

CEPAL

REVIEW



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CONTENTS

Reflections on the Latin American economy in 1982. <i>Enrique V. Iglesias</i>	7
Latin American development problems and the world economic crisis. <i>ECLA Economic Projections Centre</i>	51
Technological change in the Latin American metalworking industries. Results of a programme of case studies. <i>Jorge Katz</i>	85
The Andean peasant, water and the role of the State. <i>A. Dourojeanni and M. Molina</i>	145
Microelectronics and Latin American development. <i>Eugenio Lahera and Hugo Nochteff</i>	167
The real cost of the external debt for the creditor and for the debtor. <i>Carlos Massad</i>	183
Some ECLA publications	197

The Secretariat of the Economic Commission for Latin America prepares the *CEPAL Review*, but the views expressed in the signed articles, including the contributions of Secretariat staff members, are the personal opinions of the authors and do not necessarily reflect the views of the Organization.

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Notes and explanation of symbols

The following symbols are used in tables in the *Review*:

Three dots (...) indicate that data are not available or are not separately reported.

A dash (-) indicates that the amount is nil or negligible.

A blank space in a table means that the item in question is not applicable.

A minus sign (-) indicates a deficit or decrease, unless otherwise specified.

A point (.) is used to indicate decimals.

A slash (/) indicates a crop year or fiscal year, e.g., 1970/1971.

Use of a hyphen (-) between years, e.g., 1971-1973, indicates reference to the complete number of calendar years involved, including the beginning and end years.

References to "tons" mean metric tons, and to "dollars", United States dollars, unless otherwise stated.

Unless otherwise stated, references to annual rates of growth or variation signify compound annual rates.

Individual figures and percentages in tables may not necessarily add up to the corresponding totals, because of rounding.

Reflections on the Latin American economy in 1982

*Enrique V. Iglesias**

A review of what happened in the Latin American economies during 1982 is a particularly useful step towards understanding the nature and causes of the serious economic crisis affecting the region, knowledge of which in its turn is indispensable for proposing measures whereby to cope successfully with the situation.

In the first part of the study, the author analyses the main features of the crisis in the light of certain key phenomena such as economic growth, unemployment, inflation and external sector disequilibria, in particular the deterioration of the terms of trade, the increase in payments abroad under the head of interest and profit and the drastic reduction of the inflow of external capital.

Both the gravity of the crisis and its causes vary according to the different national situations, but among those causes emphasis is laid in the second part of the article on the incidence of external factors, especially the contraction of the developed countries' demand for imports and the rise in interest rates. The problems of external indebtedness are analysed in the third part, in which the author describes the situation towards the close of 1982 and expounds its root causes, in particular the prolonged international recession, the high cost of credit, the negative effects of development strategies based on external borrowing and the weaknesses of the international financial system.

Lastly, the fourth part maps out the path that Latin America should follow in order to cope with the crisis, stressing the point that the solution will not be found through the application of the traditional austere stabilization policies, but must spring from the impulse given by steadfast economic reactivation. This reactivation will not only necessitate a favourable policy on the part of the centres to promote international trade and facilitate payment of the Latin American countries' external debt, but will also have to be supported and spurred by renewed efforts at the level of co-operation among the countries of the region and with developing countries in other parts of the world.

* Executive Secretary of ECLA.

I Economic trends in Latin America during 1982

In 1982 Latin America found itself in the throes of the worst economic crisis that had befallen it since the Second World War and, probably, the gravest since the dark years of the Great Depression.

Caused by a complex set of external and internal factors, the crisis made itself felt in virtually all the main macroeconomic variables and affected, in different degrees, the great majority of the countries of the region. Thus, on the basis of the provisional data at ECLA's disposal, which are summarized in table 1, it is estimated that:

(i) Latin America's total gross domestic product fell by almost 1%, something that had not once occurred in the four preceding decades;

(ii) As a result of this decrease and of population growth, the per capita product, which had already slightly declined in 1981, dropped by more than 3% in the region as a whole and underwent a contraction in each and all of the 19 countries for which comparable data are available;

(iii) In consequence of the further deterioration suffered by the terms of trade in 1982, the downward trend of total income was even steeper than that of the product, and the terms-of-trade index for the non-petroleum-exporting countries sank to its lowest level in more than half a century;

(iv) In addition, the loss of economic dynamism was accompanied by a rise in urban unemployment rates in the great majority of the countries on which reliable data are to hand;

(v) Notwithstanding all this, and above all as a result of the high exchange rates introduced in many countries, there was a notable quickening of the pace of inflation. The simple average rate of increase of consumer prices exceeded 45% and the average weighted by the population was almost 80%. Thus, both far outstripped all those registered in the past;

(vi) In the external sector, the balance

of payments, which had already displayed signs of weakness in the two preceding years, closed with an unprecedented deficit of about US\$ 14 billion, with the consequent drain on international reserves;

(vii) This negative balance occurred despite the *volte-face* performed by the

merchandise trade balance, which, after showing a deficit of over US\$ 600 million in 1981, in 1982 generated a surplus of US\$ 8.8 billion;

(viii) But the impact of this change in the trade balance on the balance-of-payments current account was largely neu-

Table 1

LATIN AMERICA: MAIN ECONOMIC INDICATORS^a

	1973	1975	1977	1978	1979	1980	1981	1982 ^b
<i>Basic economic indicators</i>								
Gross domestic product at market prices (billions of 1970 dollars)	237	264	292	307	327	346	351	348
Population (millions of inhabitants)	288	303	319	327	335	343	352	361
Per capita gross domestic product (1970 dollars)	825	871	915	939	975	1 008	998	965
<i>Growth rates</i>								
<i>Short-term economic indicators</i>								
Gross domestic product	8.4	3.8	4.8	5.1	6.5	5.9	1.5	-0.9
Per capita gross domestic product	5.6	1.2	2.2	2.5	3.9	3.3	-1.0	-3.3
Consumer prices ^c	36.3	57.6	40.4	38.6	53.8	56.0	57.9	79.7
Terms of commodity trade	12.3	-11.9	6.0	-10.4	3.9	4.2	-7.1	-6.0
Current value of exports of goods	42.3	-6.7	18.8	7.8	33.6	29.9	6.5	-10.0
Current value of imports of goods	31.0	7.4	14.3	13.7	25.6	32.0	6.6	-19.0
<i>Billions of dollars</i>								
<i>External sector</i>								
Exports of goods	24.6	36.1	49.3	53.1	70.9	92.1	98.1	87.3
Imports of goods	22.8	41.6	49.3	56.1	70.4	93.0	99.1	78.4
Commodity trade balance	1.8	-5.5	0.0	-3.0	0.5	-0.9	-1.0	8.9
Net payments of profits and interest	4.4	5.7	8.4	10.7	14.3	18.4	27.4	34.4
Balance on current account	-3.6	-14.1	-11.6	-18.4	-19.8	-28.1	-38.6	-33.0
Balance-of-payments position	4.6	0.6	4.7	7.3	6.4	-1.5	0.5	-13.8
Total gross external debt ^d	42.3 ^b	69.1	107.3	136.1	169.2	207.1	255.2	274.0

Source: ECLA, on the basis of official statistics.

^a Product and population figures relate to the group formed by the 19 countries included in table 2. Price data relate to the group formed by those 19 countries plus Barbados, Guyana, Jamaica and Trinidad and Tobago. The figures for the external sector relate to those 23 countries plus Suriname, except for the year 1982, in which Jamaica and Suriname are excluded.

^b Provisional estimates subject to revision.

^c Variation from December to December.

^d Public external debt disbursed plus non-guaranteed debt to financial institutions which provide information to the Bank for International Settlements.

tralized by the sharp new upswing in net payments of profits and interest, which totalled more than US\$ 34 billion, thus almost doubling in the course of only the last two years;

(ix) In strong contrast with the increase in financial remittances abroad, the net inflow of capital into the region plummeted from US\$ 42 billion in 1981 to US\$ 19 200 million in 1982;

(x) As a result of this downward plunge, in 1982 there was a significant slackening of the growth rate of the total external debt, which, after increasing at an average rate of 24% during the four preceding years, did so by only a little over 7% in 1982, and thus came to stand at approximately US\$ 274 billion by the end of the year;

(xi) As at the same time, however, the value of exports of goods and services decreased, the relation between the amount of the debt and the value in question rose steeply, reaching a coefficient of 2.5, which easily surpassed the average of a little under 2 recorded during the five preceding years.

1. *Economic growth*

The year 1982 witnessed a pronounced intensification of the loss of dynamism which the Latin American economy had already shown in the previous year. After increasing by barely 1.5% in 1981—its lowest growth rate since 1940—the region's gross domestic product decreased by almost 1% in 1982 (see figure 1).

Moreover, this decline in overall economic activity—the first to take place in the past 43 years—was very widespread. As can be seen in table 2, the gross domestic product shrank in 11 of the 19 countries considered, remained stagnant in two others and rose very slightly in the remaining six. But even in these last, the growth rate of the economy failed to keep pace with that of the population. Consequently, in 1982 something almost unheard-of happened: the per capita product decreased in all the countries of the region (see table 3).

Economic activity contracted to a very marked extent in Argentina, Bolivia, Costa Rica and Uruguay, countries in which it had

already declined in 1981. The worst slump, however, occurred in Chile, where the recession that had begun in 1981 was severely aggravated in 1982 and resulted in the reduction of the gross domestic product by about 13%. Economic activity also slackened, although in a much more moderate degree, in all the Central American countries, except Panama, where it showed a marginal increase. The domestic product likewise decreased in Paraguay, the country which between 1975 and 1981 had attained the highest economic growth rate in Latin America. The boom in the Mexican economy which had started in 1978 also came to an abrupt halt in the course of 1982, while in Venezuela, the region's other leading petroleum exporter, economic activity remained almost completely static for the fourth year in succession. In contrast, total production in Brazil recovered a little during the year—although its expansion was not enough to offset its contraction in 1981—and the gross domestic product very slowly increased in Colombia, Peru and the Dominican Republic. In these countries too, however, the growth rate of the economy was lower than that of the population, and in all of them, therefore, the per capita product slightly decreased.

In Brazil—the largest economy in Latin America, which alone generates about one-third of the region's total domestic product—economic activity increased by approximately 0.5%, after having declined in 1981—for the first time in the last 40 years—by 2%. The main tonic influence behind this modest recovery was an expansion of about 2% in manufacturing industry, a sector which from February onwards reversed the downward trend that it had followed throughout the whole of the year 1981, with the result that the industrial product in that year had undergone a contraction of nearly 10%. Thanks in part to this recovery in industrial activity, during the first nine months of the year unemployment rates were reduced in the country's six biggest cities (see table 4 and figure 2).

As mentioned above, in 1982 there was a notable deterioration in the situation of the Mexican economy, which had been

Figure 1

LATIN AMERICA: ANNUAL GROWTH RATES OF GROSS DOMESTIC PRODUCT

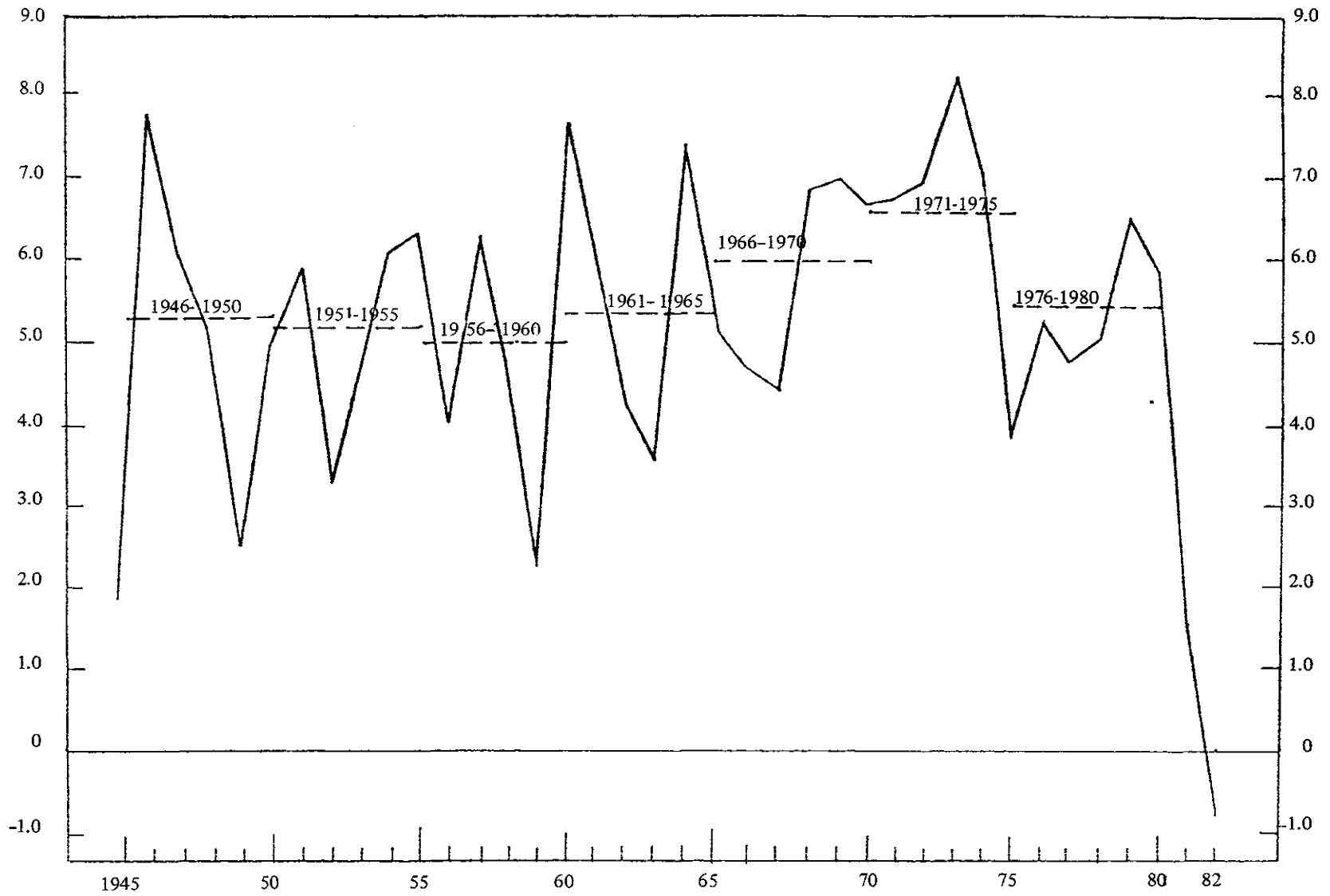


Table 2
LATIN AMERICA: EVOLUTION OF TOTAL
GROSS DOMESTIC PRODUCT

(Annual growth rates)

Country	1970- 1974	1975- 1978	1979	1980	1981	1982 ^a
Argentina	4.1	0.4	7.1	1.4	-6.1	-5.0
Bolivia	5.6	5.1	1.8	0.6	-0.6	-7.5
Brazil	11.5	6.3	6.4	8.0	-1.9	0.5
Colombia	6.7	5.5	5.1	4.0	2.5	1.5
Costa Rica	7.1	5.7	4.9	0.6	-3.6	-6.0
Chile	0.9	1.7	8.3	7.5	5.3	-13.0
Ecuador	11.4	7.0	5.1	4.8	4.3	2.0
El Salvador	4.9	5.4	-1.5	-9.6	-9.5	-4.5
Guatemala	6.4	5.5	4.7	3.5	1.0	-3.5
Haiti	4.7	3.3	4.7	5.7	-3.0	-2.0
Honduras	3.7	5.4	6.6	2.5	-0.4	-1.5
Mexico	6.8	5.3	9.2	8.3	8.1	—
Nicaragua	5.4	1.5	-25.5	10.0	8.9	-1.0
Panama	6.2	2.8	7.0	4.9	3.6	0.5
Paraguay	6.4	9.2	10.7	11.4	8.5	-2.5
Peru	4.8	1.5	4.1	3.8	4.0	1.0
Dominican Republic	10.1	4.8	4.8	5.6	3.4	1.5
Uruguay	1.3	4.5	9.6	3.7	-0.7	-9.5
Venezuela	5.4	6.1	0.9	-1.2	0.6	0.0
<i>Latin America (19 countries)</i>	7.2	4.8	6.5	5.9	1.5	-0.9

Source: ECLA, on the basis of official statistics.

^a Provisional estimates subject to revision.

expanding with exceptional vigour since 1978. In consequence of the acute external disequilibrium and of a considerable fall in international reserves, the economic authorities first decided upon a severe devaluation of the Mexican peso and then imposed a strict exchange control. These measures helped to precipitate an exceptional acceleration of the inflationary process and a drastic contraction of the volume of imports. In such circumstances, and also as a result of the cuts introduced in the public investment programme and of the uncertainty prevailing in the private sector, by half way through the year economic activity had begun to decline, and it is estimated that in the last few months unemployment and under-employment significantly increased in the main urban centres.

In Argentina—the third largest of the Latin American economies—the gross domestic product decreased by about 5%, after having fallen by 6% in 1981. This further reduction was caused mainly by the slump in the construction sector and by the contraction which, for the third consecutive year, affected manufacturing industry. Owing to the decline in these activities—particularly marked during the first two quarters of the year—and the downward trend shown by the sectors producing services, the rate of unemployment continued to rise both in Buenos Aires and in the primate cities of the interior.

There was an even more notable drop in the gross domestic product and unemployment soared yet more sharply in Chile and Uruguay, the other two economies

Table 3
LATIN AMERICA: EVOLUTION OF PER CAPITA GROSS
DOMESTIC PRODUCT^a

Country	Dollars at 1970 prices				Annual growth rates			
	1970	1975	1980	1982 ^b	1979	1980	1981	1982 ^b
Argentina	1 256	1 353	1 412	1 229	5.8	0.2	-7.2	-6.1
Bolivia	317	372	382	334	-0.8	-2.0	-3.2	-9.8
Brazil	528	777	956	900	3.9	5.5	-4.2	-1.8
Colombia	587	708	831	827	2.9	1.8	0.3	-0.8
Costa Rica	740	875	1 001	867	2.5	-1.7	-5.9	-8.0
Chile	967	794	1 045	927	6.5	5.7	3.5	-14.3
Ecuador	420	622	730	729	1.9	1.6	1.1	-1.1
El Salvador	422	476	428	349	-4.3	-12.2	-12.1	-7.2
Guatemala	439	494	560	514	1.6	0.4	-1.9	-6.3
Haiti	123	135	147	133	2.2	2.7	-5.4	-2.0
Honduras	313	296	340	311	2.9	-1.0	-3.8	-4.7
Mexico	977	1 143	1 358	1 385	6.0	5.2	5.0	-2.9
Nicaragua	431	480	345	348	-27.9	6.4	5.4	-4.4
Panama	940	1 043	1 150	1 144	4.5	2.5	1.2	-1.7
Paraguay	383	452	633	629	7.1	7.9	5.2	-5.4
Peru	646	707	677	671	1.3	1.0	1.1	-2.0
Dominican Republic	378	503	560	560	2.2	3.0	0.9	-0.9
Uruguay	1 097	1 164	1 462	1 299	8.9	3.0	-1.3	-10.0
Venezuela	1 205	1 278	1 278	1 202	-2.5	-4.5	-2.7	-3.3
<i>Latin America (19 countries)</i>	<i>720</i>	<i>871</i>	<i>1 008</i>	<i>965</i>	<i>3.9</i>	<i>3.3</i>	<i>-1.0</i>	<i>-3.3</i>

Source: ECLA, on the basis of official statistics.

^a At market prices.

^b Provisional estimates subject to revision.

in the Southern Cone which, like Argentina, had in recent years pursued economic policies of a monetarist type. The decrease in economic activity was particularly marked in Chile, where it is estimated that the gross domestic product fell by about 13%, mainly in consequence of the steep downward trend followed by industrial production and the virtual collapse of the construction sector. This drastic contraction in economic activity caused, in its turn, a dramatic upswing in the rate of overt unemployment, which towards the end of the year hovered around 25% in Greater Santiago (see table 4 and figure 2).

The evolution of the economy was sim-

ilar, although less unfavourable, in Uruguay, a country in which the gross domestic product, after decreasing slightly in 1981, shrank by approximately 9.5% in 1982. As in Chile, its contraction was accompanied by an even more marked decline in industrial activity, by a severe depression in the construction sector and by an aggravation of the unemployment situation. The rate of unemployment in Montevideo, which between 1977 and the beginning of 1981 had steadily fallen but which had begun to climb rapidly in the second quarter of that year, continued to increase in 1982 and exceeded 13% in October.

Economic activity also declined at a

Table 4
LATIN AMERICA: EVOLUTION OF URBAN UNEMPLOYMENT

(Average annual rates)

Country	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Argentina ^a	5.4	3.3	2.6	4.5	2.8	2.8	2.0	2.3	4.5	5.7
Brazil ^b	...	...	...	...	...	6.8	6.4	6.2	7.9	6.9
Colombia ^c	...	12.7	10.6	10.2	9.3	8.8	8.9	9.7	8.2	9.3
Costa Rica ^d	...	...	...	5.4	5.1	5.8	4.9	6.0	9.1	10.4
Chile ^e	4.8	8.3	15.0	17.1	13.9	13.8	13.4	11.7	9.0	20.3
Mexico ^f	7.5	7.4	7.2	6.8	8.0	6.9	5.7	4.5	4.2	...
Paraguay ^g	...	...	...	...	5.4	4.1	5.9	3.9	2.2	...
Peru ^h	5.0	4.1	7.5	6.9	8.7	8.0	6.5	7.1	6.8	...
Uruguay ⁱ	8.9	8.1	...	12.8	11.8	10.1	8.3	7.4	6.7	11.4
Venezuela ^j	...	7.6	8.3	6.8	5.4	5.1	5.8	6.6	6.8	8.2

Source: ECLA and PREALC, on the basis of official statistics.

^a Federal Capital and Greater Buenos Aires. Average from April to October, 1982: April.

^b Metropolitan areas of Rio de Janeiro, Sao Paulo, Belo Horizonte, Porto Alegre, Salvador and Recife. Average for 12 months, 1980: average for June to December, 1982: average for January to September.

^c Bogotá, Barranquilla, Medellín and Cali. Average for March, June, September and December, 1974: June, 1982: average for March, June and September.

^d Urban. Average for March, July and November, 1976: Average for July and November, 1982: March.

^e Greater Santiago. Average for four quarters, 1982: Average from January to November.

^f Metropolitan area of Mexico City, Guadalajara and Monterrey. Average for four quarters.

^g Asunción, Fernando de la Mora, Lambaré and urban areas of Luque and San Lorenzo, 1981: first semester.

^h Metropolitan Lima. Averages calculated according to the data available for each year.

ⁱ Montevideo. Average for two semesters, 1973: first semester, 1974: second semester, 1982: average for January to October.

^j Urban. Average for two semesters, 1982: first semester.

very high rate (-7.5%) in Bolivia, where it had stagnated completely in the two preceding years. Although largely linked to the profound external crisis undergone by the country in 1982, and also to the explosive growth of inflation, this contraction of the gross domestic product likewise reflected the incidence of extra-economic factors.

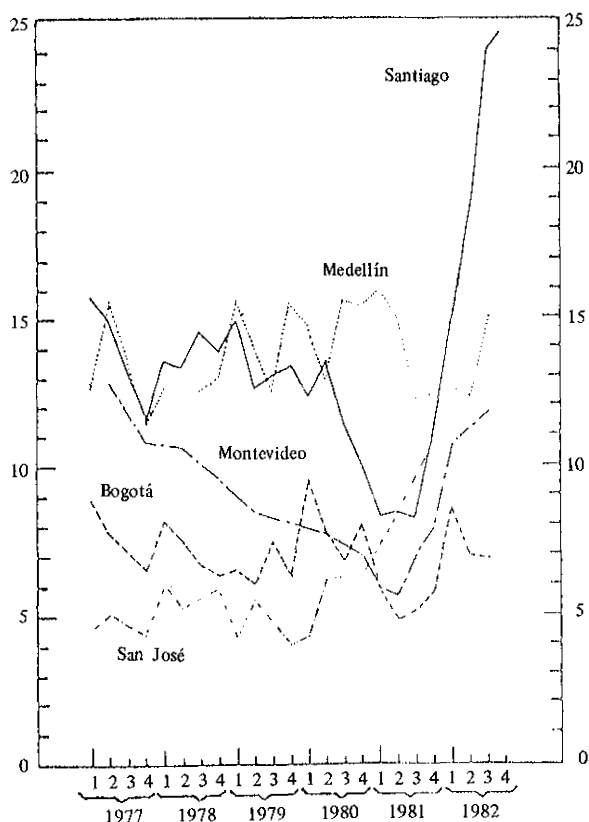
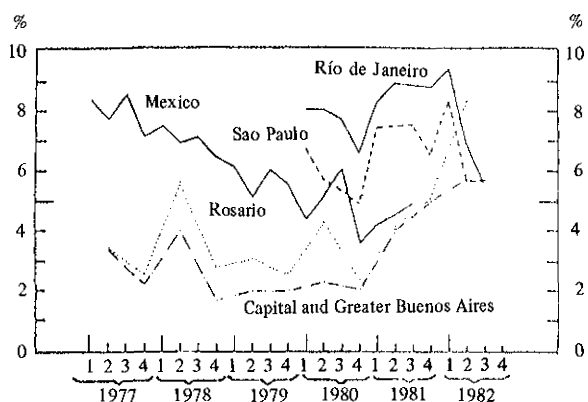
These latter also decisively influenced trends in economic activity in most of the Central American countries, in all of which, except Panama, the gross domestic product diminished in 1982. The most marked decreases took place in Costa Rica (-6%)—a country in which economic activity had already declined the year before, and which in 1982 began to adopt measures to control galloping inflation—and in El Salvador (-4.5%), where there was no respite from the bitter socio-political conflicts that had been partly responsible for a drop of about

20% in the gross domestic product during the two preceding years.

In the course of 1982 economic activity also contracted—by approximately 2.5%—in Paraguay, and thus a break occurred in the phase of exceptional dynamism which had stretched from 1973 to 1980, and during which the gross domestic product had grown at an average annual rate of something over 9%.

On the other hand, economic activity increased, although at unsatisfactory rates, in Colombia, Ecuador, Peru and the Dominican Republic. In the first of these countries, the year 1982 saw an accentuation of the systematic loss of dynamism that the economy had been showing since 1979. While the gross domestic product increased by barely 1.5%—the lowest growth rate recorded in the last 40 years—, the rise in the rate of overt unemployment averaged rather

Figure 2
LATIN AMERICA: UNEMPLOYMENT TRENDS IN PRIMATE CITIES
(Unemployment rates)



Source: ECLA, on the basis of official statistics.

more than 9% in the country's four primate cities.

The economy evolved on similar lines in Ecuador, where the increment of approxi-

mately 2% registered in the gross domestic product in 1982 represented, firstly, a continuation of the downward trend followed by the rate of economic growth since 1979, and constituted, secondly, the lowest increase in economic activity measured since 1951. In 1982 the rate of economic expansion also declined in Peru. After climbing at an average annual rate of 4% in the three preceding years, the gross domestic product rose by barely 1% in 1982.

Lastly, in 1982 the Cuban economy too made much slower headway, although, just as in 1981, its growth rate was the highest in the region. It is estimated that the material product (equivalent to the gross output of the agricultural, mining, manufacturing industry, construction and electric energy sectors) increased by 2.5%, after doing so by about 12% the year before.

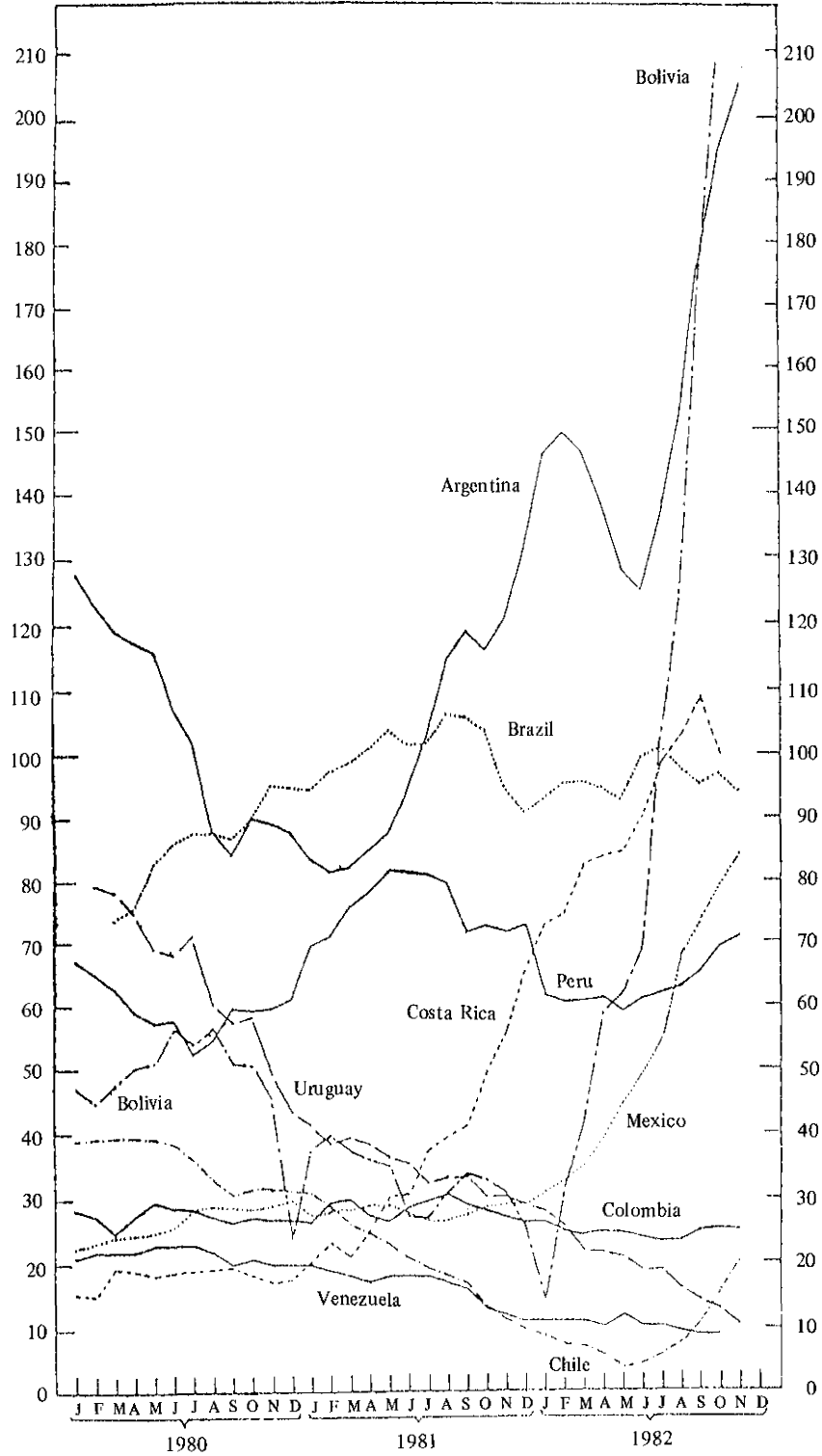
2. Inflation

Although, as has been shown, in 1982 the rate of economic growth slackened and unemployment rose, inflation soared to an unprecedented height. The weighted average rate of increase of consumer prices in the region as a whole was almost 80%, and thus far exceeded the corresponding figure for any preceding year. While inflation increased in 13 of the 21 countries for which data are available, its acceleration was especially rapid in Argentina, Bolivia, Costa Rica and Mexico (see table 5).

As can be seen in figure 3, the rate of increase of consumer prices shot up in Argentina, reaching over 200% per annum in November. This phenomenon, mainly linked to the fiscal deficit and to the sharp devaluations of the peso, meant that for the seventh time in the last 8 years inflation in Argentina rose to a three-digit figure.

The speed at which inflation advanced was even greater in Bolivia, where consumer prices, after mounting at a rate of about 25% in the two preceding years, soared by over 200% in 1982. This vertical upward trend in the rate of inflation—which can be seen particularly clearly in figure 3—was triggered by the rise of approximately 75% in the official rate of exchange decreed at

Figure 3
 SELECTED LATIN AMERICAN COUNTRIES: VARIATIONS IN
 CONSUMER PRICE INDEX OVER TWELVE MONTHS



Source: ECLA, on the basis of official statistics.

Table 5
EVOLUTION OF CONSUMER PRICES
(Variations from December to December)

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
<i>Latin America^a</i>	12.2	13.5	20.9	36.3	40.0	57.6	61.5	40.4	38.6	53.8	56.0	57.9	79.7
<i>Countries with traditionally high inflation</i>	114.4	15.6	24.1	41.5	44.9	69.3	74.8	48.4	45.9	61.9	66.3	68.3	90.7
Argentina	21.6	39.1	64.2	43.9	40.1	334.9	347.5	150.4	169.8	139.7	87.6	131.2	204.6 ^b
Brazil ^c	17.7	18.1	14.0	13.7	33.8	31.2	44.8	43.1	38.1	76.0	95.6	91.5	94.4 ^b
Colombia	3.5	14.1	14.0	25.0	26.9	17.9	25.9	29.3	17.8	29.8	26.5	27.5 ^e	24.8 ^b
Chile	34.9	22.1	163.4	508.1	375.9	340.7	174.3	63.5	30.3	38.9	31.2	9.5	20.0 ^b
Mexico	7.8	-0.8	5.6	21.3	20.6	11.3	27.2	20.7	16.2	20.0	29.8	28.6	84.6 ^b
Peru	5.7	7.7	4.3	13.8	19.2	24.0	44.7	32.4	73.7	66.7	59.7	72.7	71.0 ^b
Uruguay	19.3	35.6	94.7	77.5	107.2	66.8	39.9	57.3	46.0	83.1	42.8	29.3	10.8 ^b
<i>Countries with traditionally moderate inflation</i>	2.8	4.6	7.2	15.0	19.8	10.2	7.8	8.3	10.0	22.1	16.0	15.0	31.2
Barbados	9.2	10.1	10.4	26.0	36.6	12.3	3.9	9.9	11.3	16.8	16.1	12.3	12.5 ^f
Bolivia	3.8	3.3	23.6	34.8	39.0	6.6	5.5	10.5	13.5	45.5	23.9	25.2	207.4 ^d
Costa Rica	4.3	1.9	6.9	15.9	30.6	20.5	4.4	5.3	8.1	13.2	17.8	65.1	100.6 ^d
Ecuador	8.0	6.8	6.9	20.6	21.2	13.2	13.1	9.8	11.8	9.0	14.5	17.9	20.2 ^d
El Salvador	1.0	-0.6	5.2	7.9	21.0	15.1	5.2	14.9	14.6	14.8	18.6	11.6	12.6 ^g
Guatemala	1.0	0.3	1.1	17.5	27.5	0.8	18.9	7.4	9.1	13.7	9.1	8.7	-0.6 ^f
Guyana	2.4	1.4	7.1	15.2	11.6	5.5	9.2	9.0	20.0	19.4	8.5	29.1	14.6 ^h
Haiti	-0.7	13.3	7.3	20.8	19.5	-0.1	-1.4	5.5	5.5	15.4	15.3	16.4	14.7 ^g
Honduras	1.4	1.5	6.8	5.1	13.0	7.8	5.6	7.7	5.4	18.9	15.0	4.9	9.1 ^f
Jamaica	7.5	5.2	9.3	9.6	20.6	15.7	8.3	14.1	49.4	19.8	28.6	4.8	6.0 ⁱ
Nicaragua	...	...	...	...	...	1.9	6.2	10.2	4.3	70.3	24.8	23.2	26.0 ⁱ
Panama	2.5	1.0	6.7	9.7	16.7	1.4	4.8	4.8	5.0	10.0	14.4	4.8	3.9 ^d
Paraguay	2.3	6.3	9.5	14.1	22.0	8.7	3.4	9.4	16.8	35.7	8.9	15.0	5.2 ^b
Dominican Republic	-1.3	10.6	8.0	17.2	10.5	16.5	7.0	8.5	1.8	26.2	4.2	7.4	7.6 ^g
Trinidad and Tobago	3.3	5.0	8.0	24.4	18.6	13.4	12.0	11.4	8.8	19.5	16.6	11.6	10.3 ^d
Venezuela	3.4	3.0	3.5	5.1	11.6	8.0	6.9	8.1	7.1	20.5	19.6	10.8	8.5 ^b

Source: International Monetary Fund, *International Financial Statistics*, November 1982, and official data provided by the countries concerned.

^a Totals for Latin America and partial figures for groups of countries represent average variations by countries, weighted by the population in each year.

^b Variation between November 1982 and November 1981.

^c Up to 1979, figures correspond to the variation in the Rio de Janeiro Consumer Price Index and from 1980 onwards to the variations in the total national CPI.

^d Variation between October 1982 and October 1981.

^e Up to 1980, figures represent the variation in the Consumer Price Index for manual workers; 1981 and 1982, figures represent the variation in the total national CPI, for both manual workers and employees.

^f Variation between August 1982 and August 1981.

^g Variation between September 1982 and September 1981.

^h Variation between June 1982 and June 1981.

ⁱ Variation between July 1982 and July 1981.

the beginning of February, and constituted, together with the brusque fall in the gross domestic product and external payments difficulties, an outward and visible sign of the deep-seated crisis suffered by the Bolivian economy in 1982.

In Mexico, too, the acceleration of inflation was very marked. In this country, which up to 1972 had kept its price levels remarkably stable, the rate of inflation had subsequently hovered between 15% and 30%, and then rocketed after the devaluation of the Mexican peso in February. Thus,

by the end of November the annual rate of increase of consumer prices approached 85%, and in view of the big increases in the prices of a number of goods and services decreed at the beginning of December, it was probably even higher at the end of the year.

In Costa Rica —another country which has traditionally maintained an appreciable degree of stability, but in which the rate of inflation went up by leaps and bounds at the beginning of 1981 in consequence of the successive devaluations of the colon—, the rate of inflation continued to accelerate up

to September, when it reached the unprecedented level of almost 110%. Despite the fact that this rising trend in inflation was interrupted in October, at the end of that month the level of consumer prices was exactly twice as high as it had been a year before.

In Brazil, the rate of inflation continued to fluctuate slightly below 100% for the second year in succession. This result was decisively influenced by the complex system of indexation of the exchange rate, salaries and wages, financial assets, and other key economic variables, which bred a marked tendency towards perpetuation of the inflationary process. Inflation followed a similar course, although at a lower level, in Peru, where again a system had been consolidated in recent years which was characterized by frequent readjustment of the exchange parity and of salaries and wages, and where consumer prices rose in 1982 by more than 70%, just as in the preceding year.

Furthermore, in mid-1982 the downward trend which had been almost continuously followed by Chilean inflation since 1974 was reversed. After a fall in price levels in absolute terms during the first half of the year, there was a vigorous recrudescence of inflation as a result of the alteration of the exchange rate, which had been pegged during the three preceding years. In consequence of this devaluation and of the subsequent successive increases in the exchange parity, notwithstanding the freezing of salaries and wages and the contraction of the money supply, the annual rate of increase of consumer prices rose steadily from June onwards and reached 20% by the end of November, while that of wholesale prices exceeded 36%.

In contrast with the experience of the foregoing countries, the rate of inflation declined a little—from 27.5% in 1981 to 25% in 1982—in Colombia, a country in which annual price variations have shown a notable degree of stability during the last 10 years, fluctuating almost permanently between 25% and 30%.

Inflation also continued to slow down in Uruguay. The annual rate of increase of consumer prices, which had dropped from

83% in 1979 to 43% in 1980 and to 30% in 1981, fell to less than 11% in November 1982. It is highly likely, however, that this downward trend may have been reversed in December in consequence of the abrupt rise in the exchange rate decreed at the end of November.

Again, among countries in which the rate of inflation has traditionally been moderate and for some of which no data are available on the more recent months, the rate of increase of consumer prices rose slightly from 23% to 26% in Nicaragua and from 18% to 20% in Ecuador; declined for the third consecutive year in Trinidad and Tobago and Venezuela; remained relatively stable in Barbados, El Salvador, Jamaica, Haiti, Panama and the Dominican Republic; went up sharply, although from a very low level, in Honduras; and was markedly reduced in Guyana, Paraguay, and, above all, Guatemala (see table 5).

3. *The external sector*

Under the severe constraints imposed by the adverse evolution of the world economy (which will be discussed later) and by the adjustment policies applied in many countries of the region, in 1982 Latin America's external sector underwent a radical upheaval, of which the following were the most significant manifestations:

(i) The value of exports of goods decreased by 10% after six years of very rapid expansion;

(ii) The decline was much steeper still—19%—in the case of the value of imports, which had also been increasing at a high rate since 1975;

(iii) These changes made a very considerable difference to the merchandise trade balance, which switched from a deficit of somewhat over US\$ 600 million in 1981 to a surplus of more than US\$ 8.8 billion in 1982;

(iv) This *volte-face* in merchandise trade was achieved despite a 7% deterioration in the terms of trade;

(v) During the year 1982 net payments of profits and interest continued to rise at a dizzy speed, and reached over US\$ 34 billion, an amount equivalent to almost

40% of the value of exports of goods and nearly double that of the net financial remittances transferred only two years before;

(vi) As a result of the merchandise trade surplus, and notwithstanding the considerable increase in net payments of profits and interest, the deficit on current account, which had been growing steadily larger since 1976, was reduced from US\$ 38 billion in 1981 to US\$ 33 billion in 1982;

(vii) This decline was accompanied, however, by a much more drastic decrease in the net movement of capital, which fell by 55%, dropping from US\$ 44 billion in 1981 to only a little over US\$ 19 billion in 1982 – the lowest figure in the last five years;

(viii) In consequence of this contraction, despite the reduction of the imbalance on current account, the balance-of-payments position underwent a radical change, a surplus of nearly US\$ 4 billion in 1981 giving place to a deficit of about US\$ 14 billion in 1982 (see table 6).

(a) *Foreign trade and terms of trade*

In 1981 there was a break in the prolonged and rapid expansion of Latin America's exports which had been going on since the beginning of the previous decade. After increasing at an average annual rate of 19% between 1970 and 1981, the value of external sales of goods dropped by 10% in 1982.

This diminution, however was caused exclusively by the reduction in the unit value of exports, which not only decreased by 10% in the region as a whole but declined in all the Latin American countries (see table 7).

So generalized a downward movement reflected, in its turn, the impact of the fall in world market prices for the great majority of the primary commodities exported by the region, which were adversely affected not only by the contraction of demand due to the recession in the industrialized economies and the rise in interest rates, but also by the appreciation of the dollar on international exchange markets.

Although during 1982 reductions

occurred in the world market prices of virtually all the principal primary commodities exported by Latin America, they were particularly heavy in the prices of sugar (which dropped by over 40% for a second consecutive year), in those of fish meal, lead and maize (which decreased by between 20% and 25%) and in those of copper, cocoa, soya and zinc (which fell by between 10% and 15%). In fact, bananas, coffee and iron ore were the only products whose prices rose in 1982, but these increases were minimal, and both in the case of coffee and in that of iron were far from offsetting the sharp decline in the preceding years (see table 8 and figure 4).

The sluggishness of international trade also exerted an unfavourable influence on the volume of Latin American exports. The latter had steadily kept up an exceptionally high average annual rate of expansion –8.7%– between 1976 and 1981, but in 1982 remained completely static. However, in contrast with the decline in unit value which, as has been seen, reflected to a greater or lesser degree the decreases in all countries' export prices, stability in the quantum of exports was the net result of the opposing trends it showed in the various economies of the region. Thus, while the volume of exports shrank by about 10% in Brazil, Panama, Trinidad and Tobago and Uruguay, and contracted even more notably in Venezuela (–17%) and Guyana (–24%), it expanded by approximately 14% in Peru, Barbados and Chile, by over 20% in Mexico and by about 30% in Paraguay.

The change in relation to the trends prevailing in previous years was yet more marked in the case of imports, whose value dropped by 19%, after a spell of vigorous and uninterrupted growth between 1980 and 1981. As can be seen in table 9, this downward movement affected alike both the group formed by the petroleum-exporting countries and that constituted by the other economies of the region.

Moreover, contrary to what happened in the case of exports, the decline in the value of external purchases was caused mainly by the reduction of their quantum. This shrank by 16% in the region as a whole

Table 6
LATIN AMERICA: BALANCE OF PAYMENTS^a

(Millions of dollars)

Country	Exports of goods FOB		Imports of goods FOB		Balance of trade (goods)		Net service payments ^b		Net payments of profits and interest		Balance on current account ^c		Net movement of capital ^d		Total balance ^e	
	1981	1982	1981	1982	1981	1982	1981	1982	1981	1982	1981	1982	1981	1982	1981	1982
<i>Latin America</i>	96 603	87 255	97 242	78 440	-639	8 815	10 993	7 860	26 903	34 395	-38 122	-33 045	42 092	19 200	3 970	-13 845
<i>Petroleum-exporting countries</i>	48 878	45 410	43 966	35 455	4 912	9 955	5 829	3 220	10 135	14 675	-11 336	-8 255	16 222	1 660	4 886	-6 595
Bolivia	909	820	680	440	229	380	215	180	341	425	-314	-210	141	100	-173	-110
Ecuador	2 544	2 400	2 362	2 310	182	90	487	490	722	810	-1 027	-1 210	731	890	-296	-320
México	19 837	20 800	23 166	13 900	-3 329	6 900	1 093	-2 000	8 700	12 000	-12 997	-3 000	14 755	-500	1 758	-3 500
Peru	3 256	3 200	3 803	3 635	-547	-435	247	270	885	970	-1 680	-1 675	1 176	1 760	-504	85
Trinidad and Tobago	2 473	2 190	1 577	1 770	896	420	-84	-20	304	370	637	40	182	210	819	250
Venezuela	19 859	16 000	12 378	13 400	7 481	2 600	3 871	4 300	-817	100	4 045	-2 200	-763	-800	3 282	-3 000
<i>Non-petroleum-exporting countries</i>	47 725	41 845	53 276	42 985	-5 551	-1 140	5 164	4 640	16 768	19 720	-26 786	-24 790	25 870	17 540	-916	-7 250
Argentina	9 145	7 700	8 232	4 600	913	3 100	1 667	200	3 302	4 800	-4 057	-1 900	1 025	1 900	-3 032	-
Barbados	175	170	520	560	-345	-390	-250	-250	10	15	-84	-130	108	110	24	-20
Brazil	23 276	20 000	22 080	19 500	1 196	500	2 839	3 800	10 290	10 700	-11 739	-14 000	12 982	10 000	1 243	-4 000
Colombia	3 127	3 200	4 789	5 100	-1 662	-1 900	63	100	333	490	-1 969	-2 400	2 594	1 600	625	-800
Costa Rica	1 030	1 010	1 092	820	-62	190	38	5	300	395	-371	-180	309	80	-62	-100
Chile	3 960	3 800	6 558	3 650	-2 598	150	888	600	1 428	2 140	-4 869	-2 540	5 300	1 400	431	-1 140
El Salvador	792	735	858	875	-66	-140	103	105	86	85	-239	-190	203	230	-36	40
Guatemala	1 299	1 200	1 540	1 290	-241	-90	311	320	103	90	-567	-350	304	325	-263	-25
Guyana	346	250	400	290	-54	-40	76	60	54	50	-179	-150	163	145	-16	-5
Haití	150	150	356	330	-206	-180	69	50	13	15	-215	-165	185	170	-30	5
Honduras	784	710	899	830	-115	-120	62	35	153	190	-321	-330	263	230	-58	-100
Nicaragua	500	430	897	675	-397	-245	82	50	93	100	-571	-395	686	220	115	-175
Panama	339	280	1 374	1 455	-1 035	-1 175	-857	-755	181	150	-422	-630	363	540	-59	-90
Paraguay	399	440	772	810	-373	-370	-22	-30	29	30	-378	-370	514	290	136	-80
Dominican Republic	1 188	770	1 439	1 200	-251	-430	21	50	295	200	-378	-490	409	320	31	-170
Uruguay	1 215	1 000	1 470	1 000	-255	-	74	300	98	270	-427	-570	462	-20	35	-590

Source: 1981: International Monetary Fund; the figures for Barbados, El Salvador, Nicaragua, Dominican Republic and Uruguay are ECLA estimates. 1982: ECLA, provisional estimates subject to revision.

^a Additions and subtractions do not exactly fit the totals owing to rounding of the original figures.

^b Excluding net payments of profits and interest.

^c Including net unilateral private transfers.

^d Including long- and short-term capital, unilateral official transfers, counterpart entries and errors and omissions.

^e Corresponds to the variation in international reserves.

Table 7
LATIN AMERICA: EXPORTS OF GOODS
(Indexes: 1970=100, and growth rates)

Country	Value			Unit value			Quantum		
	1981	1982	1982/ 1981	1981	1982	1982/ 1981	1981	1982	1982/ 1981
<i>Latin America</i>	672	607	-10	370	332	-10	182	183	-
<i>Petroleum-exporting countries</i>	867	806	-8	646	544	-15	134	148	10
Bolivia	478	430	-10	400	340	-15	120	126	5
Ecuador	1 083	1 022	-6	546	524	-4	198	195	-2
Mexico	1 472	1 543	5	466	406	-13	316	380	21
Peru	315	309	-2	313	266	-15	101	116	15
Trinidad and Tobago	1 098	972	-11	1 621	1 571	-3	68	62	-9
Venezuela	763	615	-19	1 396	1 354	-3	55	45	-17
<i>Non-petroleum-exporting countries</i>	570	500	-12	257	233	-9	222	215	-3
Argentina	516	434	-16	299	266	-11	173	163	-6
Barbados	489	475	-3	285	242	-15	172	196	14
Brazil	850	730	-14	257	239	-7	331	306	-8
Colombia	397	406	2	298	295	-1	133	138	4
Costa Rica	446	437	-2	260	249	-4	172	176	2
Chile	356	341	-4	162	138	-15	219	247	13
El Salvador	336	312	-7	279	276	-1	120	113	-6
Guatemala	437	404	-8	233	221	-5	188	183	-3
Guyana	269	194	-28	410	386	-6	66	50	-24
Haiti	385	384	-	245	240	-2	157	160	2
Honduras	440	398	-10	292	284	-3	151	141	-7
Nicaragua	280	240	-14	270	245	-9	104	98	-6
Panama	260	215	-17	258	240	-7	101	90	-11
Paraguay	610	674	10	320	279	-13	191	242	27
Dominican Republic	555	360	-35	339	237	-30	164	152	-7
Uruguay	542	446	-18	271	246	-9	201	181	-10

Source: ECLA. Provisional estimates.

and decreased in 12 of the 22 countries for which data are available. The slump in the volume of imports was exceptionally pronounced in Argentina (-50%), Chile (-39%), Mexico (-38%) and Bolivia (-31%), all of them countries which heavily devalued their currencies in the course of 1982 and in which economic activity underwent a marked decline or lapsed almost completely into stagnation. The quantum of imports likewise fell by more than 20% in

Uruguay, Costa Rica, Guyana and Nicaragua, owing to the measures adopted to reduce the external imbalance and to the contraction of the domestic product. On the other hand, in Trinidad and Tobago, Venezuela, Barbados and Colombia imports of goods increased rapidly in real terms.

As in the case of exports, in 1982 the unit value of imports decreased; nevertheless, this downturn was much more moderate than that of the average price of exports.

Table 8

LATIN AMERICA: PRICES OF STAPLE EXPORT PRODUCTS

(Dollars at current prices)

	Annual averages						Growth rates					
	1977	1978	1979	1980	1981	1982 ^a	1977	1978	1979	1980	1981	1982 ^a
Unrefined sugar ^b	8.1	7.8	9.7	28.7	16.9	9.1	-30.2	-3.7	24.4	195.9	-41.1	-46.2
Coffee (mild) ^b	240.2	185.2	183.4	178.8	145.3	148.8	52.3	-22.9	-1.0	-2.5	-18.7	2.4
Cocoa ^b	172.0	154.4	149.4	118.1	94.2	81.0	85.3	-10.2	-3.2	-21.0	-20.2	-14.0
Bananas ^b	14.0	13.7	15.6	18.9	19.2	19.3	12.9	-2.1	13.9	21.2	1.6	0.5
Wheat ^c	105.6	131.9	164.4	177.4	178.5	164.4	-22.1	24.9	24.6	7.9	0.6	-7.9
Maize ^c	114.4	132.5	154.8	210.3	181.0	144.4	-17.6	15.8	16.8	35.9	-13.9	-20.2
Beef ^b	68.4	97.1	130.9	125.9	112.2	107.0	-4.6	42.0	34.8	-3.8	-10.9	-4.6
Fish meal ^c	454.0	410.0	395.0	504.0	468.0	351.0	20.7	-9.7	-3.7	27.6	-7.1	-25.0
Soya ^c	280.0	268.0	298.0	296.0	288.0	251.0	21.2	-4.3	11.2	-0.7	-2.7	-12.8
Cotton ^b	73.9	72.9	77.4	94.2	85.8	74.4	-6.8	-1.4	6.2	21.7	-8.9	-13.3
Wool ^b	153.6	157.4	190.5	194.5	178.2	158.7	5.7	2.5	21.0	2.1	-8.4	-10.9
Copper ^b	59.3	61.9	90.0	98.6	79.0	67.5	-6.6	4.4	45.4	9.6	-19.9	-14.6
Tin ^d	4.9	5.8	7.0	7.6	6.4	5.9	44.1	18.4	20.7	8.6	-15.8	-7.8
Iron ore ^c	20.2	19.7	24.0	28.9	25.9	27.2	—	-2.5	21.8	20.4	-10.4	5.0
Lead ^b	28.0	29.9	54.6	41.1	33.0	25.9	37.9	6.8	82.6	-24.7	-19.7	-21.5
Zinc ^b	26.7	26.9	33.6	34.6	38.4	34.3	17.3	0.7	24.9	3.0	11.0	-10.7
Bauxite ^c	134.8	138.4	152.6	212.5	216.3	213.8	14.9	2.7	10.3	39.3	1.8	-1.2

Source: UNCTAD, Monthly Commodity Price Bulletin, Supplements 1960-1980 and November 1982; International Monetary Fund, *International Financial Statistics*, Yearbooks 1981 and November 1982.

- ^a January to September.
^b U.S. cents.
^c Dollars per ton.
^d Dollars per pound.

Accordingly, the terms of trade, which had already deteriorated by 7% in 1981, underwent a further decline of 6% in 1982.

This reduction, moreover, was widespread. In 1982 the terms of trade deteriorated in all the countries of the region with the exception only of Colombia, El Salvador, Haiti, Honduras, Panama, Trinidad and Tobago and Venezuela, where they slightly improved (see table 10).

In striking contrast with what had occurred in previous years, in 1982 the decline in the terms of trade was more marked (-12%) in the petroleum-exporting countries than in the other economies of the region (-4%) (see table 10 and figure 5). Even so, the negative effects of the deterioration were worse in the latter, since in these countries the terms of trade had already been continuously following a steep downward trend

during the four preceding years. Accordingly, the terms-of-trade index for the non-petroleum-exporting countries sank in 1982 to its lowest level in more than half a century and its average value over the three-year period 1980-1982 was considerably less than it had been in the years 1931-1933, i.e., during the most critical phase of the Great Depression.

(b) *The balance of payments*

Since a much greater reduction took place in the value of imports than in that of exports, the merchandise trade balance underwent a radical change in 1982. In the region as a whole a surplus of US\$ 8.8 billion replaced the deficit of over US\$ 600 million shown in the preceding year.

This right-about turn was particularly

Figure 4

LATIN AMERICA: VARIATIONS OVER 12 MONTHS IN INTERNATIONAL PRICES OF MAIN COMMODITIES EXPORTED, 1980 - 1982

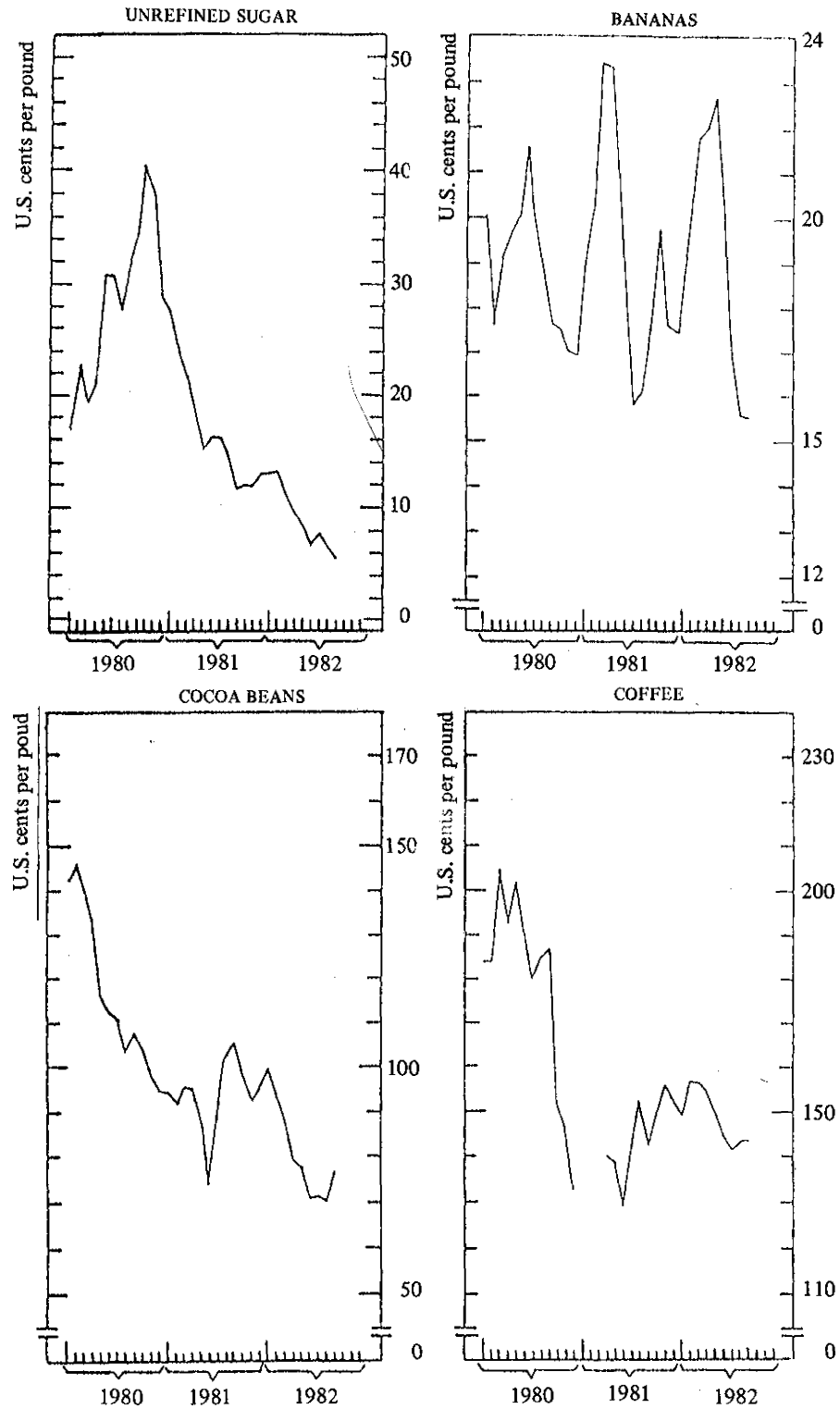


Figure 4 (continued)

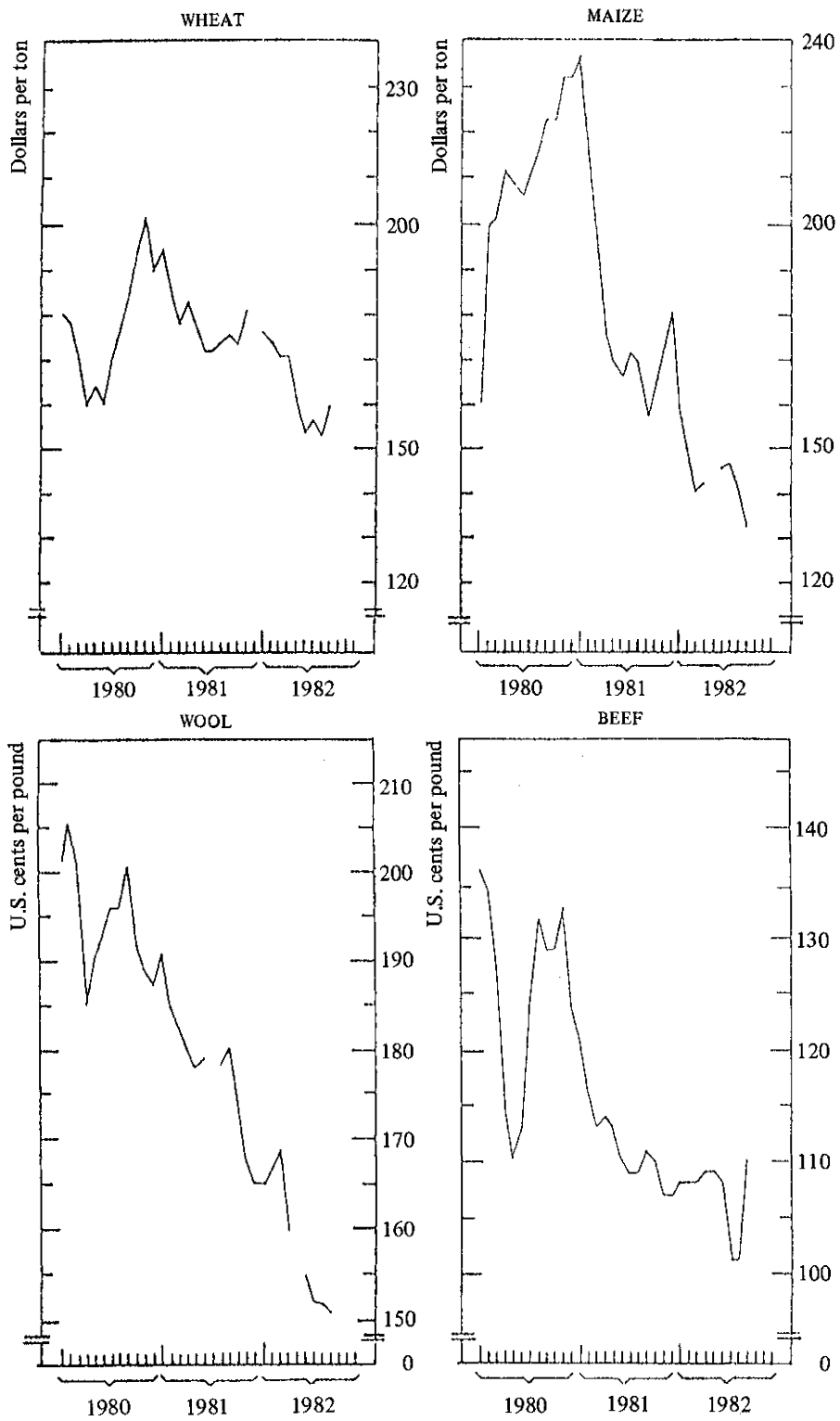


Figure 4 (continued)

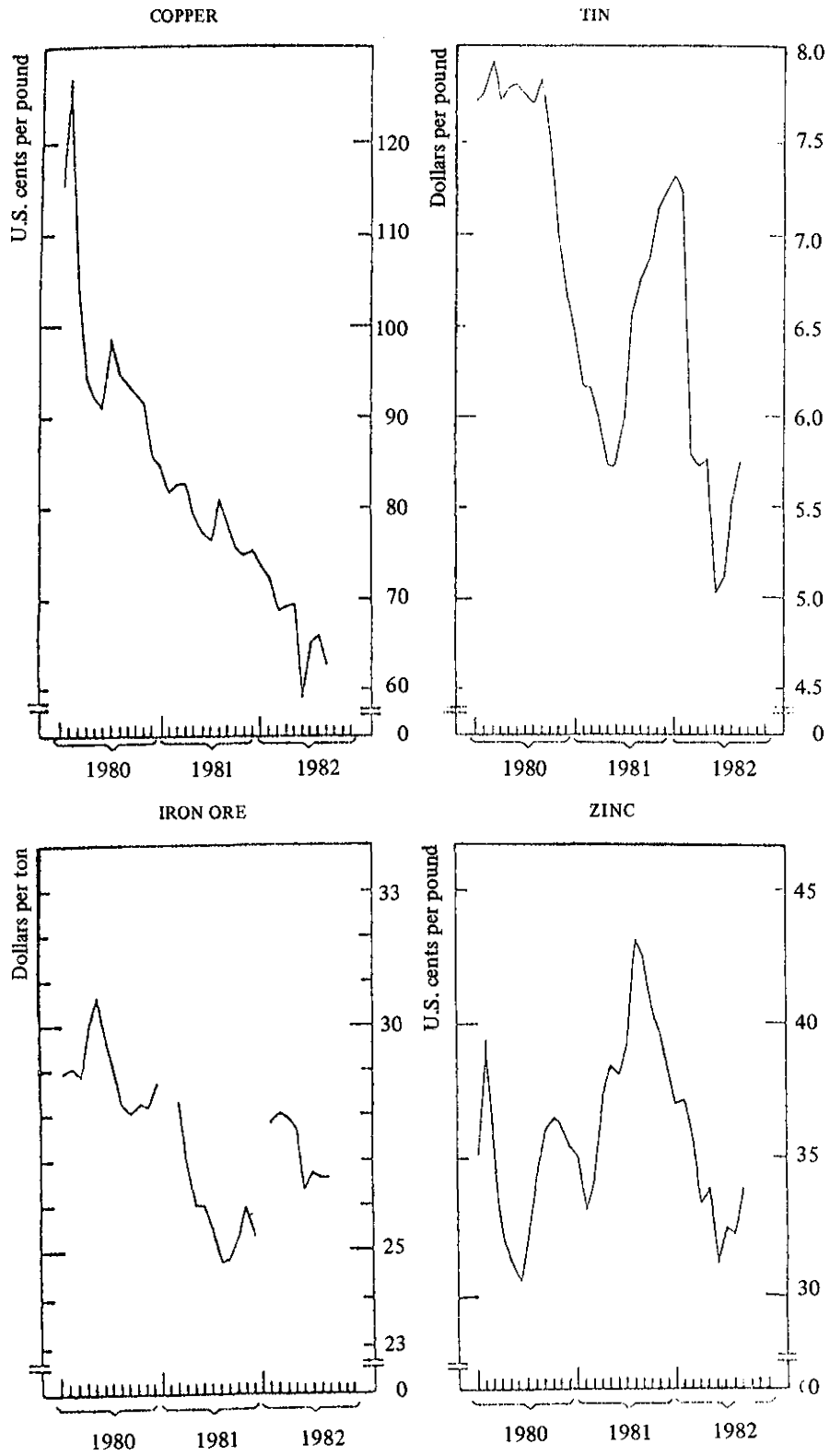
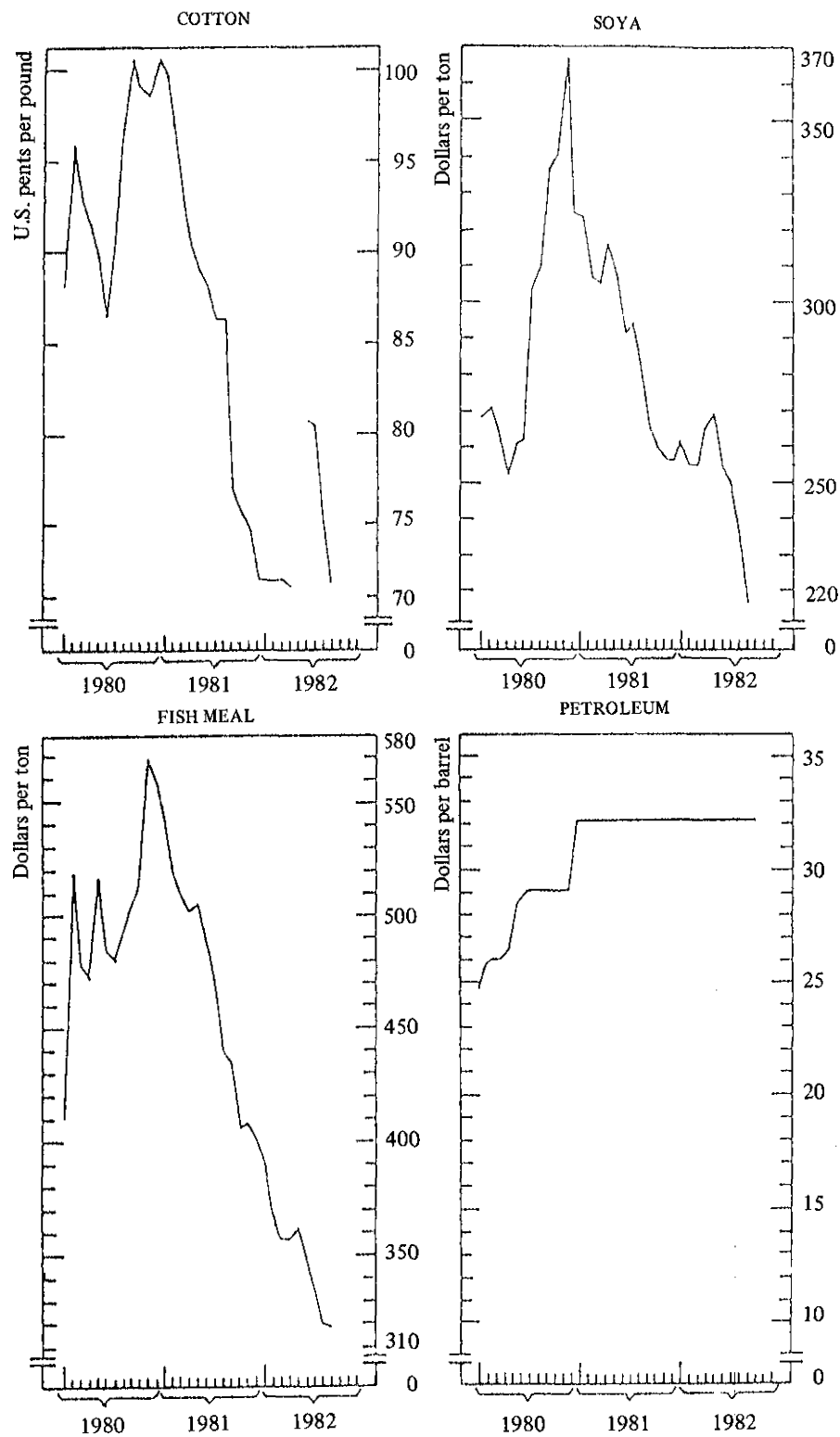


Figure 4 (concluded)



Source: UNCTAD, *Monthly Commodity Price Bulletin*, November 1982. Petroleum: IMF, *International Financial Statistics*, December 1982.

Table 9
LATIN AMERICA: IMPORTS OF GOODS
(Indexes: 1970 = 100, and growth rates)

Country	Value			Unit Value			Quantum		
	1981	1982	1982/ 1981	1981	1982	1982/ 1981	1981	1982	1982/ 1981
<i>Latin America</i>	732	591	-19	320	306	-4	229	193	-16
<i>Petroleum-exporting countries</i>	828	668	-19	268	258	-4	308	259	-16
Bolivia	503	325	-35	309	296	-4	159	110	-31
Ecuador	946	926	-2	249	242	-3	383	383	—
Mexico	1 036	622	-40	268	257	-4	387	242	-38
Peru	544	520	-4	273	257	-6	199	203	2
Trinidad and Tobago	571	641	12	272	261	-4	211	246	17
Venezuela	723	782	8	272	261	-4	266	300	13
<i>Non petroleum-exporting countries</i>	662	534	-19	381	361	-5	176	150	-15
Argentina	549	307	-44	335	322	-4	162	81	-50
Barbados	486	524	8	294	282	-4	165	186	13
Brazil	881	778	-12	457	443	-3	190	175	-8
Colombia	597	637	7	279	268	-4	213	237	11
Costa Rica	381	286	-25	316	306	-3	119	93	-22
Chile	757	421	-44	398	374	-6	185	113	-39
El Salvador	441	449	2	307	298	-3	142	151	6
Guatemala	578	484	-16	313	303	-3	183	160	-13
Guyana	333	242	-27	347	333	-4	93	73	-22
Haití	745	690	-7	299	281	-6	246	246	—
Honduras	442	407	-8	309	296	-4	142	137	-3
Nicaragua	502	377	-25	322	309	-4	155	122	-21
Panamá	415	440	6	387	371	-4	101	117	16
Paraguay	1 008	1 057	5	317	317	—	313	334	7
Dominican Republic	518	432	-17	313	301	-4	163	142	-13
Uruguay	724	493	-32	373	347	-7	190	142	-25

Source: ECLA. Provisional estimates.

influenced by the considerable changes occurring in the merchandise trade balances of Mexico (which after having a deficit of US\$ 3.3 billion in 1981 obtained a surplus of US\$ 6.9 billion in 1982), Chile (where a small surplus of US\$ 150 million replaced the negative balance of US\$ 2.6 billion recorded the year before), and Argentina (which increased the positive balance it had achieved in 1981 by US\$ 2.2 billion). In contrast, in 1982 the trade balance surplus

that Venezuela had secured in 1981 was reduced by US\$ 4.9 billion and that of Brazil decreased by US\$ 700 million (see table 6).

The effects on the balance on current account of this reversal in merchandise trade and of the US\$ 3 billion decrease in net service payments in 1982 were neutralized, however, to a considerable extent, by the new and substantial increase in net remittances of profits and interest. Although the

Table 10
 LATIN AMERICA: TERMS OF TRADE AND PURCHASING POWER
 OF EXPORTS OF GOODS

(Indexes: 1970 = 100, and growth rates)

Country	Terms of trade in goods			Purchasing power of exports of goods		
	1981	1982	1982/ 1981	1981	1982	1982/ 1981
<i>Latin America</i>	116	109	-6	212	199	-6
<i>Petroleum-exporting countries</i>	241	211	-12	323	312	-3
Bolivia	129	115	-11	155	145	-6
Ecuador	219	217	-1	434	423	-3
Mexico	174	158	-9	550	600	9
Peru	115	104	-10	116	121	4
Trinidad and Tobago	598	603	1	407	373	-8
Venezuela	514	519	1	283	236	-17
<i>Non-petroleum-exporting countries</i>	68	65	-4	152	139	-8
Argentina	89	83	-7	154	135	-12
Barbados	96	86	-11	165	168	2
Brazil	56	54	-4	185	165	-11
Colombia	107	110	3	142	151	6
Costa Rica	82	81	-1	141	143	1
Chile	41	37	-10	90	91	1
El Salvador	91	93	2	109	105	-4
Guatemala	74	73	-2	139	133	-4
Guyana	118	116	-2	78	58	-26
Haiti	82	85	4	129	137	6
Honduras	95	96	1	143	134	-6
Nicaragua	83	79	-4	86	78	-9
Panama	63	65	3	64	58	-9
Paraguay	101	88	-13	193	213	10
Dominican Republic	107	79	-26	175	120	-31
Uruguay	73	71	-2	147	129	-12

Source: ECLA. Provisional estimates.

contraction in domestic economic activity helped to limit remittances of profits, and notwithstanding the decline in nominal interest rates on the international financial markets, payments of profits and interest rose from a little less than US\$ 27 billion in 1981 to over US\$ 34 billion in 1982. As these remittances had already been increasing exceptionally fast since 1977, the amount they represented in 1982 more than

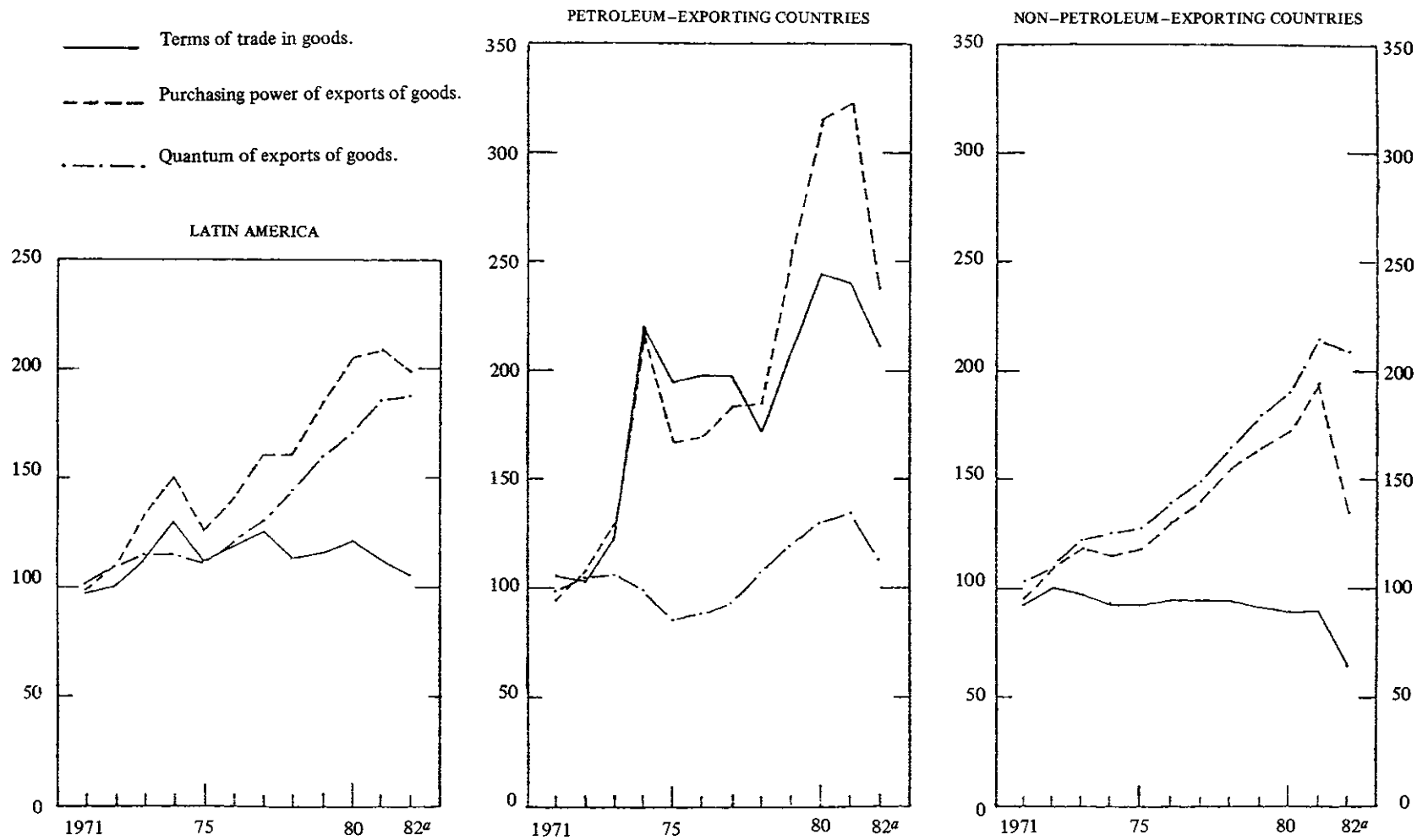
quadrupled the corresponding figure shown barely five years before.

The net result of these changes was a reduction of US\$ 5 billion in Latin America's deficit on current account. Although this decrease was the first that had occurred since 1976, the negative balance on current account in 1982 easily exceeded all those recorded up to 1980.

In consonance with the changes in mer-

Figure 5
LATIN AMERICA: TRENDS OF SOME FOREIGN TRADE INDICATORS

(Indexes: 1970 = 100)



Source: ECLA, on the basis of official data.

^a Provisional estimates.

chandise trade and in the net inflow of capital, the large negative balances with which the current account had closed the preceding year in Mexico, Chile and Argentina were drastically reduced in 1982, while there was a marked increase in the deficits shown by Brazil and Colombia and a radical reversal took place in Venezuela's current account, which, after generating a surplus of US\$ 4 billion in 1981, recorded a deficit of US\$ 2.2 billion in 1982.

Furthermore, as a result of the unfavourable economic trends observable in the great majority of the countries of the region, of the very high level of external indebtedness reached by many of them, and of the changes in the world economy,¹ in 1982 there was a brusque contraction in net movements of capital into Latin America. Net receipts of external resources decreased, in fact, by 55%, falling from US\$ 42 billion

in 1981 to only a little over US\$ 19 billion in 1982.

This decline in net movements of loans and investment was, moreover, much more pronounced than the decrease in the deficit on current account. Consequently, during 1982 a sweeping change occurred in the final balance-of-payments position. In 1981 the balance of payments had generated a surplus of nearly US\$ 4 billion; in 1982 it showed a deficit of about US\$ 14 billion. Although this result was especially due to the very substantial deficits which Brazil, Mexico and Venezuela recorded in 1982, and to the smaller, but still appreciable, negative balances shown by Chile, Colombia and Uruguay, all the countries of the region also contributed to it, the only exceptions being Trinidad and Tobago, Peru and El Salvador, which obtained small surpluses.

II

The incidence of external factors

More than at any other time since the Second World War, the growth of the periphery in general and of Latin America in particular was heavily conditioned in 1982 by constraints deriving from the poor economic evolution of the centre. It is true that, as already shown, causes of internal origin—such as those linked to the unsatisfactory management of fiscal and exchange policies and to problems of an extra-economic character—account for most of the big decreases in the product in the countries of the Southern Cone, for its decline in several Central American economies or for the stagnation of economic activity in countries such as Mexico. Nevertheless, the major external constraints stemming from the recession in the industrialized economies constituted a brake which had a generalized

handicapping effect on the economic growth of the entire region.

Although the anti-inflation campaign waged in many of the member countries of the Organization for Economic Co-operation and Development (OECD) succeeded in significantly lowering the rate of inflation in 1982, it did so only at the cost of a new rise in the rate of unemployment and an almost total stagnation of economic activity. According to provisional estimates, the gross domestic product of the OECD economies as a whole would seem to have shown an increase of barely 0.1%, whereby they completed three successive years of extremely low growth rates (see table 11). This had a negative effect on the centre's demand for imports, the value of which decreased by nearly 4% in 1982. Moreover, although in that same year the nominal interest rate fell by three percentage points, inflation in the OECD countries was reduced on a similar scale, so that the real rate of interest con-

¹ These last two factors are discussed in greater detail in the next two sections.

Table 11

SOME BASIC INTERNATIONAL INDICATORS

	1976-1979 (1970-1973)	1980-1981 (1974-1975)	1982 ^a (1976)
<i>OECD countries</i>			
Annual growth rate of GDP	4.2 (5.0)	1.3 (-0.5)	0.1 (4.9)
Annual inflation ^b	8.3 (5.8)	11.0 (12.2)	8.0 (8.3)
Average rate of unemployment	5.2 (3.5)	6.1 (4.6)	8.5 (5.2)
Rate of interest (LIBOR) ^c			
Nominal	8.2 (7.5)	14.7 (9.4)	14.3 (6.1)
Real ^d	-0.1 (1.6)	3.3 (-2.5)	6.0 (-2.0)
<i>Developing countries</i>			
Annual growth rate of GDP			
All developing countries	5.1 (6.2)	1.7 (4.7)	-0.1 (6.0)
Latin America	5.5 (7.2)	4.6 (5.4)	-0.9 (5.4)

Source: United Nations Department of International Economic and Social Affairs; IMF, *International Financial Statistics* (several issues); OECD, *Main Economic Indicators*, September 1982; and ECLA estimates, on the basis of official statistics.

^a Provisional estimates.

^b Consumer price index.

^c LIBOR at 6 months.

^d LIBOR at 6 months deflated by the rate of inflation of the OECD countries.

tinued to stand at approximately 6%, its highest level since the Great Depression.² This, of course, played a contributory part in limiting the expansion of demand and deferring the first steps towards a recovery of the central economies.

The most serious feature of the year 1982, however, was not so much the recession in the centre, nor the decline in world trade, nor the high real rates of interest—for in the past there had been pe-

riods of similar or even worse contractions—but the coincidence of all these negative phenomena in a single year and, above all, their prolonged duration.

While the recession in the industrialized economies in 1974-1975 was more critical than its counterpart today—the gross domestic product of the OECD countries fell by 1% in that period—it lasted only two years. Thus, as can be seen in table 11, in 1976 there was already a vigorous recovery of production (4.9%), so that in the three-year period 1974-1976 the cumulative growth rate of the central economies was almost 4%. On the other hand, while in the course of the period 1980-1982 production never decreased in the OECD countries as a

² As will be seen later, the real rate of interest on the Latin American countries' external debt was much higher still, since in 1982 the unit value of Latin America's exports sharply declined.

Table 12
SOME BASIC EXTERNAL SECTOR INDICATORS

(Percentage variations during the period)

	1976-1979 (1970-1973)	1980-1981 (1974-1975)	1982 (1976)
Value of OECD imports	94.4 (110.0)	13.5 (42.0)	-3.8 (15.5)
Volume of OECD imports	34.1 (42.2)	-4.5 (-7.7)	1.5 (14.5)
Value of the dollar (+: appreciation; -: depreciation)	6.3 (-17.0)	12.8 (1.2)	11.0 (5.2)
Commodity prices ^a	51.7 (71.1)	-6.5 (4.7)	-15.0 (13.2)
Terms of trade of non-petroleum-exporting developing countries	6.5 (-1.0)	-15.0 (2.0)	-7.0 (4.0)

Source: IMF, *International Financial Statistics* (several issues); and ECLA estimates, on the basis of official statistics.

^a Excluding petroleum.

whole, its total increase was only 2.7%, that is, less than in the period 1974-1976.

In short, 1982 was the third consecutive year of meagre growth in the centre; the second year in which real interest rates fluctuated around 6%; and the third successive year in which OECD's volume of imports decreased or only marginally expanded. Consequently, 1982 was also a year in which the prices of the primary commodities produced by the periphery fell, and the fifth consecutive year in which the terms of trade deteriorated for the non-petroleum-exporting developing countries (see table 12).

To this set of unfavourable circumstances was added yet another of particular significance, i.e., the marked reduction in absolute terms of the net flow of capital into the periphery. This decline was especially severe in the case of the non-petroleum-exporting countries of Latin America, whose net receipts of capital dropped by 35% in 1982 (see table 13).

This contraction in net capital inflows was crucial, since it is the capital account, of

course, which can be used as a buffer against abrupt deteriorations of the trade balance without bringing down the product and income. In fact, it was thanks to these capital inflows, which in 1974-1975 acted as a countercyclical factor, that Latin America was able to maintain a by no means negligible economic growth rate throughout that period, despite the severe recession which was affecting the central economies at the time. But in lively contrast with what occurred during the 1974-1975 crisis, in 1982 the capital movements in question played a procyclical role.

This situation was linked, in turn, to the unexpected duration of the recession in the centre. Its prolongation, and the repeated postponement of the first signs of recovery beyond the looked-for date, brought about a liquidity crisis in the industrialized economies which made itself felt in an upsurge of demand for credit, which was no longer due to the prevalence of inflationary expectations—since, as already shown, the rate of inflation had decreased—but stemmed from the need to supplement the low cash

Table 13
 FLOWS OF CAPITAL AND VOLUME OF EXPORTS OF NON-PETROLEUM-
 EXPORTING DEVELOPING COUNTRIES

	Indexes (1973 = 100)							Growth rates	
	1974	1975	1976	1979	1980	1981	1982	1974-1975	1980-1982
1. Net real capital flows ^a to:									
All NPEDC ^b	151	158	153	184	203	208	177	58	-4
Latin America	130	128	172	201	206	224	145	28	-28
2. Volume of exports of									
All NPEDC ^b	100	99	111	139	140	141	144	-1	4
Latin America	101	101	111	146	154	174	169	1	16
3. Ratio between flows of capital and volume of exports (1:2)									
All NPEDC ^b	151	160	138	132	145	148	123	60	-7
Latin America	129	127	155	138	134	129	86	27	-38

Source: IMF, *International Financial Statistics* (several issues), and *Annual Report 1982*; and ECLA estimates.

^a Net flow of capital in current dollars deflated by the United States CPI.

^b Non-petroleum-exporting developing countries.

flows caused by the continuous and unexpected reduction of sales. As this heavy demand for credit coincided with stabilization policies centering on monetary restrictions, it generated unprecedented real interest rates and led to declines in production, particularly in the sectors most sensitive to the rate of interest (such as those producing capital goods and durable consumer goods), and to reductions in inventories.

Unfortunately, primary commodities—which constitute the periphery's staple exports—are among the goods in whose case adjustment to a contraction in demand is made mainly through a fall in prices, or else they constitute inputs for industries that are particularly hard hit by a recession in the centre (for example, metal products for the motor vehicle and construction industries), or again their inventories are liable to be drastically reduced when the rate of interest rises. It is not surprising, therefore, that in

the last two years they have suffered a price decline of 30%.

Viewed from this angle, the persistence of deflationary policies in the centre has especially affected the periphery's export prices but only partly hit domestic prices in the centre itself. Consequently, downward price rigidity as regards the goods produced in the industrialized countries has aggravated the deterioration of the periphery's terms of trade.

Of course, there is nothing new about the fact that stabilization policies applied in the central economies are more prone to bring down the periphery's terms of trade than to reduce inflation in the centre. What is new is that because of the unexpected prolongation of the recession a liquidity crisis occurred which kept real interest rates exceptionally high—in contrast with what happened in 1974-1975, when the real interest rate was negative—and which also made for restriction of the net flow of cap-

ital into the periphery, a circumstance that likewise implied a significant difference from what had occurred during the 1974-1978 crisis and again in 1980.

Indeed, in the latter year the flow of capital into the non-petroleum-exporting countries of the periphery increased by over 10% and helped to neutralize the impact of the deterioration in the terms of trade deriving from the second petroleum crisis and the recession in the centre. With the persistence of this situation in 1981, the net flow of capital again increased, although by barely more than 2%. In 1982, on the other hand, the net flow of capital to the non-petroleum-exporting countries of the periphery not only failed to rise but decreased in absolute terms (see table 13).

This decline was partly due to the high levels of indebtedness reached by the developing countries and to the slower expansion of bank capital, and partly too to the reluctance of the international banking system to increase its loans to the periphery at a time when the value of the latter's exports was diminishing.

The perverse irony of this change lies in the fact that the reduction in the value of the periphery's exports was due not to a contraction in their volume—which in fact expanded—but to the very marked fall in export prices. Thus, since the banking system took as the index of the periphery's capacity of payment the current value of its exports—and not their future value, which would incorporate more normal terms of trade—, capital movements tended to aggravate rather than to alleviate the external crisis.

Consequently, in the period 1980-1982 the net inflow of capital into Latin America seriously decreased (-28%), while the volume of the region's exports expanded by 16% (see table 13).

Thus, in contrast to what happened in the two-year period 1974-1975—when the inflow of capital increased much more than the volume of exports, thus allowing the periphery time to weather the petroleum shock and the international recession without suffering a contraction of its own—, after 1979 the flow of capital remained

static in relation to exports or abruptly declined, compelling the non-petroleum-exporting peripheral countries to reduce the balance-of-payments deficit through the current account rather than through the capital account.

As has already been shown, a large number of the countries of the region tried to improve their trade balance in 1982 through severe devaluations of their currencies, which helped to boost the volume of their exports; but much of this effort came to nothing on account of the fall in prices. And this was so because the capacity to absorb new imports both on the part of the centre and on that of non-traditional purchasers such as the petroleum-exporting countries and the socialist countries, decreased or grew far more slowly during that same year.

Consequently, given, in the first place, the limited capacity of the rest of the world to absorb the bigger volume of exports of the periphery as a whole without its implying a fall in the export prices concerned; given, in the second place, the increase in debt services; and given, lastly, the procyclical character of the net flow of capital in 1982, the necessary adjustment on current account had to be effected by a reduction of the peripheral countries' imports, which, in turn, entailed a decline or a pronounced deceleration in the growth rate of their production.

Thus the vicious circle of the liquidity crisis was completed. The year 1982 saw a deterioration of all those mechanisms of adjustment to a recession in the centre which do not oblige the periphery to curtail its production, such as an expansion of the volume of its exports to countries other than those of the centre which might be growing rapidly (as were the OPEC economies in the mid-1970s); a fall in international rates of interest (with the consequent reduction of debt service payments and an increase in commodity export volumes so as to replace and expand inventories); or a larger flow of capital into the periphery.

In these circumstances, there was no way open but the least desired and desirable form of adjustment: a curtailment of

production. In face of this situation, which was sometimes aggravated yet further by the neo-protectionist trends in the centre, it is not surprising that in 1982 several developing countries fell into arrears in their external payments and that many of them applied for renegotiation of their external debt. For if the value of their exports de-

creases because of the recession in the centre and if capital flows are reduced because export values decline, then the whole of the adjustment must be absorbed either by reduction of imports (largely induced by a contraction in domestic economic activity) and/or by the negotiation of new conditions of payment of the external debt.

III

The problems of external indebtedness

1. *The situation in 1982*

As already stated, provisional estimates suggest that the total external indebtedness of Latin America increased by somewhat more than 7% in 1982, thus amounting to US\$ 274 billion (see table 14). This expansion represented a marked deceleration by comparison with the previous growth rates, which had been well over 20% a year since 1977.

The reduction in the rate of debt accumulation was much more notable in the region's net petroleum-exporting countries than in the petroleum-importing countries, since in the former the rate fell from 32% in 1981 to 5% in 1982, while the comparable rates in the latter case were 17% and 10% for those two years.

This slowing-down of debt accumulation in 1982 cannot of course be considered to have been brought about on purpose. It was undoubtedly due to the more burdensome loan terms, the uncertainty with regard to the exchange rate in many countries and unfavourable changes in interest rates. However, the decisive factor in the deceleration in 1982 was the same that had helped to create much of the dynamism of external financing in the 1970s — the availability of funds from international private commercial banks.

The share of the banks in the region's external indebtedness has of course increased notably: in the 1960s it was relatively insignificant, while in the 1980s it was over 50%, and in some countries (Argentina,

Brazil, Chile, Mexico, Venezuela) it amounted to more than two-thirds of the total debt.

Obviously, debts with private banks reached these proportions because of the willingness of the banks in question to finance most of the region's deficit on current account from 1974 on. In actual fact, bank loans have been available in abundance, except during a short recession in the mid-1970s. Recently, however, the banks have become much more cautious about making new commitments in general and particularly in respect of granting loans to the developing countries.

Many factors are responsible for this tighter attitude on the part of the commercial external credit institutions. In the first place, the cyclical decline in the industrial economies has weakened the bank markets in their countries of origin, causing national clients to meet with payments difficulties or to go bankrupt, while at the same time increasing the demand for credit; moreover, many of the banks' clients in developing countries have experienced payments problems. Other factors accounting for the banks' lack of interest in granting loans to developing countries include a more generalized attitude of circumspection concerning the diversification of their portfolios and disequilibria in the relation between their capital and their assets.

The payments problems of the developing countries with regard to the private banks have been especially apparent in Latin America. In 1982 there were serious payments crises in Mexico and Argentina

Table 14
LATIN AMERICA: GROSS EXTERNAL DEBT DISBURSED^a

(End-of-year balance, in millions of dollars)

Country	1977	1978	1979	1980	1981	1982 ^b
<i>Latin America</i>	107 280	136 060	169 186	207 102	255 188	274 000
<i>Petroleum-exporting countries</i>	47 716	59 373	74 804	92 496	121 721	127 780
Bolivia	1 633	2 097	2 585	2 442	2 851	2 910
Ecuador	2 153	3 268	3 754	4 798	6 823	7 700
Mexico	26 583	30 084	37 746	50 216	73 737	78 000
Peru	6 260	7 135	7 116	7 901	8 502	10 100
Trinidad and Tobago	275	404	525	645	860	970
Venezuela	10 812	16 385	23 078	26 494	28 948	28 100
<i>Non-petroleum-exporting countries</i>	59 564	76 687	94 382	114 606	133 467	146 220
Argentina	8 210	11 193	18 299	24 543	30 794	32 100
Bahamas ^c	48	41	38	38	40	50
Barbados ^c	70	82	89	121	150	250
Brazil	32 758	42 945	48 991	57 262	63 067	71 000
Colombia	3 892	4 454	5 935	7 310	8 229	9 600
Costa Rica	1 030	1 289	1 690	2 124	2 577	2 600
Chile	4 899	6 120	7 491	9 544	12 447	13 600
El Salvador	539	791	798	846	1 010	1 200
Guatemala	603	780	983	1 120	1 159	1 350
Guyana	429	522	527	565	664	800
Haiti	158	191	226	269	321	470
Honduras	726	958	1 130	1 303	1 426	1 650
Jamaica	1 220	1 317	1 320	1 388	1 558	...
Nicaragua	1 300	1 426	1 453	1 660	2 173	2 400
Panama ^c	1 501	2 190	2 378	2 701	3 000	3 500
Paraguay	329	503	727	919	1 152	1 350
Dominican Republic	862	992	1 170	1 548	1 780	2 100
Suriname	17	70	110	34	40	...
Uruguay	973	823	1 027	1 311	1 880	2 200

Source: ECLA, on basis of the following publications: IBRD, *World Debt Tables. External Public Debt of Developing Countries and Territories*, December 1981, provisional figures; IBRD, *Economic Memorandum on Suriname, Report N° 2851*, 30 May 1980; IDB: *External Public Debt of the Latin American Countries*, July 1981; BIS, *The Maturity Distribution of International Bank Lending*, July 1978, July 1979, July 1980, July 1981 and July 1982; IMF, *International Financial Statistics*, vol. XXXIV, August 1981; OECD: *Development Co-operation, 1977 Review, 1978 Review*; OECD: *Geographical Distribution of Financial Flows to Developing Countries*, Paris, 1980.

^a Including, in addition to the officially guaranteed public and private external debt, the non-guaranteed long and short-term debt to financial institutions which provide information to the Bank for International Settlements, and credits from the International Monetary Fund. The guaranteed and non-guaranteed debt to other commercial banks is not included, and neither are suppliers' credits not officially guaranteed.

^b Provisional ECLA estimates, based on the estimated movement of the pertinent balance-of-payments items. For this reason, they may not coincide with the estimates presented respecting the amount of some countries' total external debt.

^c In the case of financial centre, the non-publicly-guaranteed short-term debt to financial institutions is not included.

—which are among the leading bank debtors— and also in Bolivia, Ecuador, and Costa Rica. In addition, other countries, such as Cuba and Venezuela, have announced that they will try to reschedule their next payments; and although some

Table 15
LATIN AMERICA: EXTERNAL PUBLIC DEBT INDICATORS^a

	1971	1973	1975	1976	1977	1978	1979	1980	1981 ^a	1982 ^a
Thousands of millions of dollars										
Disbursements ^b	3.8	7.9	12.2	17.1	20.8	31.3	34.1	28.2	43.6	...
Debt servicing	2.7	4.3	6.6	8.2	11.4	18.3	25.0	26.8	35.4	...
Amortization	1.8	2.9	3.8	4.8	7.3	12.3	16.0	13.8	16.9	...
Interest	0.9	1.4	2.8	3.4	4.1	6.0	9.0	13.0	18.5	...
Debt coefficients (percentages)										
$\frac{DS}{EXP}$	14	14	15	16	20	28	29	24	30	...
$\frac{DS}{DIS}$	71	55	54	48	55	59	73	95	81	...
$\frac{Public\ DBT}{EXP}$	...	...	...	...	124	147	131	113	128	...
$\frac{Total\ DBT}{EXP}$	...	...	...	...	182	210	197	186	210	250

Source: Public debt: World Bank, *World Debt Tables*.
Total debt: table 14.

Note: DS = debt service
EXP = exports of goods and services
DIS = disbursements
DBT = debt

^a ECLA, provisional estimates.

^b Medium and long-term or State-guaranteed loans.

countries, including Brazil, Chile and Peru, have declared that they will abide by their present payment schedules, the likelihood is that they can do so only by making a significant sacrifice in terms of their economic growth and relying on contingency agreements with IMF.

The payments difficulties of Latin America are to some extent reflected in table 15, which presents some indicators of the external public debt burden in the region. Of course, these indicators do not accurately reflect the total amount of the debt since, for want of sufficient statistics, the private debt, which is considerable in some countries, has not been included. In any case, the traditional debt servicing coefficient, i.e., the ratio between amortization and interest payments and export

earnings, rose from 20% in 1977 to nearly 30% in 1981; in addition, given the decrease in the value of exports shown in 1982, this coefficient is bound to have experienced another increase—and a substantial one—in this latter year.

The debt servicing coefficient may, however, be misleading inasmuch as it suggests that the debt is paid with exports, when in practice it is almost always paid by incurring new debts. Accordingly, the ratio between debt servicing and new loans may be of use in suggesting how likely a country or region is to suffer an indebtedness crisis. This indicator has also deteriorated seriously in recent years in that, as may be seen in table 15, it climbed from 48% in 1976 to over 80% in 1980-1981, and, furthermore, another significant rise is predicted for 1982.

This means that Latin America is obtaining progressively fewer resources for investment and accumulation of reserves per dollar it receives on loan; in other words, the region is trapped in a vicious circle of indebtedness and is forced to plunge deeper and deeper into debt just in order to stay where it is.

The third and fourth indicators of the external debt burden—public debt and global debt as a percentage of exports—have also shown a tendency to increase. Normally these indicators would not be of much use for the analysis, since an increase in the coefficient would not necessarily mean that the situation was any worse if loan repayment periods were also extended. However, the information available suggests that on average repayment periods have tended to be shorter, so that the rise in these coefficients also points to potential external indebtedness problems.

One last indicator of indebtedness difficulties and of the balance-of-payments situation in general is the large number of countries in the region which have managed to obtain financing from IMF (see table 16). This circumstance is attributable to two factors. First, the commercial banks have been unwilling to reschedule debts or to grant new credit to countries with payments difficulties unless they have previously reached a financing agreement with IMF; secondly, IMF may have become more attractive as a source of credit owing to the recent modifications in the terms of its loans and to the expansion of its financing programmes outside the sphere of the terms in question.

2. The origins of the problem

(a) *The international recession*

One of the origins of the problem is to be found in the international recession, which, as noted above, has been unusually long drawn-out. In practice, the recession in the industrial countries has reduced the aggregate demand of the central countries and, consequently, has brought down the price of Latin American exports; and to make matters worse, the developing coun-

tries have sought to offset the drop in prices by exporting larger volumes, a move which produces an even greater glut on the market and lowers prices in its turn. Here again, the countries as a whole must step up their efforts simply to remain *in statu quo*. In any case, the recession has an eroding effect on what looks like a means of paying off the debt (i.e., exports) and affects the banks' opinion of the solvency of countries, to the detriment of the real source of payment, i.e., loans granted on reasonable terms.

(b) *The high cost of credit*

All the indicators suggest that the terms on which Latin America contracts its debts have reached a point where new loans barely provide minimum relief from the burden of indebtedness.

Thus figure 6 shows that interest rates have become very positive in real terms in the past two years, after having been negative, also in real terms, ever since the mid-1970s. The Bank for International Settlements, for example, has reported that in the period March-June 1982 interest rates in the United States were over 7%, in contrast with the more normal real rates of 2% which prevailed in the 1960s.

However, from the point of view of the debtor countries, the high interest rates must primarily be considered in relation to the prices of the region's exports. It can then be seen that the real cost of credit for Latin America increased spectacularly between 1981 and 1982, since the LIBOR rate rose unusually high while, at the same time, there was a sharp drop in export prices (see figure 6). This clearly shows the extent of the deterioration in the region's external debt-servicing capacity due to exogenous factors.

The available data also show that the effect of the high basic interest rates in 1982 has been even further aggravated by the rise in the variable component of interest on loans in Eurocurrencies to developing countries, which, in turn, reflects the greater risk run by the banks in lending money to the countries in question.

The negative effect of the high basic

Table 16

**LATIN AMERICA: MAIN FINANCIAL RESOURCES PROVIDED
BY THE INTERNATIONAL MONETARY FUND DURING 1982**

(Millions of dollars)^a

Country	Compensatory Financing Facility during 1982		Stand-by arrangements approved during 1982			Extended Fund Facility (3 years) in force in November 1982		Total
	Month	Amount	Month	Duration (No of months)	Amount	Month of approval	Amount	
A. Credits approved								
Barbados	Oct.	14	Oct.	20	35			49
Costa Rica		-			-	June 1981	304	304
Dominica		-			-	Feb. 1981	9	9
El Salvador	July	36	July	12	47		-	83
Guatemala		-	Nov. ^b	12	21		-	21
Guyana	Nov.	7			-		-	7
Haiti		-	Aug.	14	38		-	38
Honduras	Nov.	26	Nov.	12	84		-	110
Jamaica	Aug.	21			-	June 1981	525	546
Panama		-	April	12	33		-	33
Peru	June	220			-	June 1982	715	935
Dominican Republic	may	20			-		-	52 ^c
Uruguay	Aug.	61			-		-	61
B. Credits applied for ^d								
Argentina								2 100 ^e
Bolivia								...
Brazil								5 500 ^e
Chile								850 ^e
Ecuador								60
Mexico								3 840-4 450 ^e
Uruguay								400

Source: Part A: International Monetary Fund, *IMF Bulletin*, several issues.
Part B: ECLA, on the basis of data provided by its Information Service.

Note: **Compensatory Financing Facility:** by means of this facility, IMF provides immediate financing to countries whose balance of payments has deteriorated as a result of declines in the prices of their staple export products.
Stand-by arrangements: under these arrangements, IMF supports government economic adjustment programmes during a period of 1 to 2 years.
Extended Fund Facility: this is an agreement under which IMF provides assistance to member countries which have to make structural adjustments in their economies in order to attain a viable balance-of-payments position over the medium term. This agreement is implemented over a period of three years.

^a IMF grants financing in Special Drawing Rights (SDR). In this table SDR are expressed in terms of United States dollars (1 SDR = 1.1 dollars).

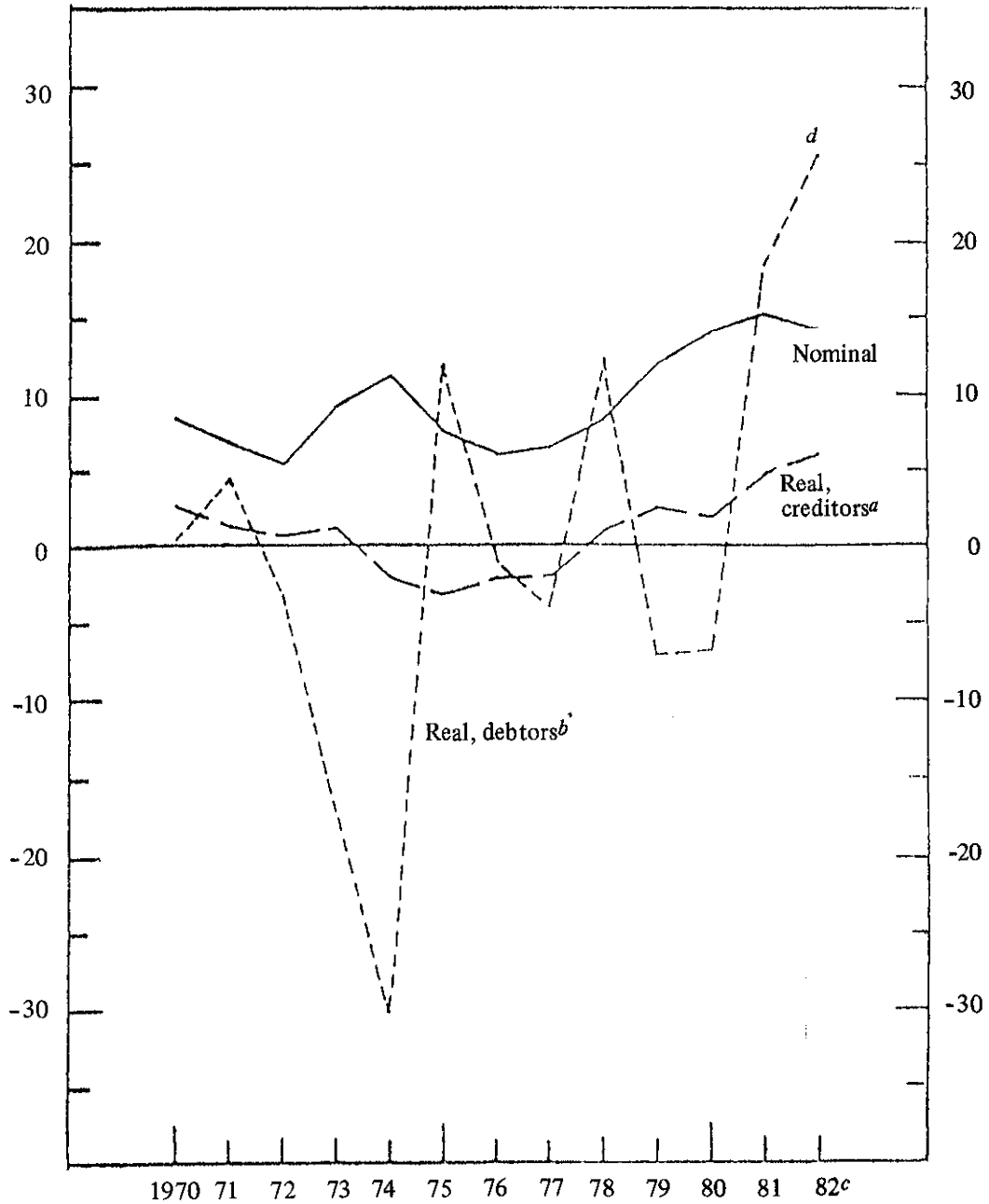
^b November 1981.

^c Including financing granted by IMF under the Buffer Stock Financing Facility.

^d Provisional information.

^e In the final stage of approval.

Figure 6
EVOLUTION OF LONDON INTERBANK OFFER
RATES (LIBOR), NOMINAL AND REAL



Source: LIBOR, Morgan Guaranty Trust Co., *World Financial Markets* (several issues); Consumer Prices: IMF, *International Financial Statistics*, Yearbook, 1981 and December 1982.

Unit value of exports: ECLA, on the basis of official data.

^a Nominal LIBOR for 6 months, deflated by industrialized countries' consumer prices.

^b Nominal LIBOR for 6 months, deflated by the unit value of Latin America's exports.

^c Up to September.

^d Provisional estimates.

interest rates is, moreover, two-fold in that they increase not only the cost of new loans but also that of loans previously contracted at variable interest, which have increased notably in Latin America since the beginning of the 1970s.

The recent interest-rate trends have thus given rise to a new phenomenon — that of interest rates being a debt burden in themselves. Thus, it is estimated that in 1982 interest payments amounted to the equivalent of about 50% of export earnings in Argentina, Brazil and Chile, while the corresponding figure for Mexico was 44%.

The second cause of the increase in the cost of indebtedness has to do with the evolution of the average time in which the loans mature. Even in the absence of complete data on debt repayment periods for 1982, it seems likely, to judge by trends in the preceding year, that they were shorter, thus accelerating debt servicing payments and putting pressure on the countries' capacity to pay.

It is interesting to observe that Brazil has opted for longer payment periods at the cost of accepting much bigger margins of interest. Because of this, its interest payments have increased to such an extent that they have given rise to balance-of-payments problems. Mexico, on the other hand, has accepted shorter payment periods but smaller margins of interest in recent years; consequently, the main feature of its indebtedness crisis has been the maturing of a large number of loans within very short spaces of time. Thus, both Brazil and Mexico have experienced severe debt-servicing difficulties, although the pressure point has been different in each case.

The fact of having contracted short-term debts is usually symptomatic of payments difficulties: debtors need new loans in order to serve their debt, while the entities granting the credits, in consideration of the greater risks involved, are unwilling to grant long-term loans. This increases short-term lending and means that there is a greater accumulation of debts which have fallen due.

Even though it is still difficult to obtain accurate data concerning short-term

indebtedness, provisional estimates suggest that it amounted to 30% of Latin America's total debt in 1981, a figure which probably rose in 1982.

The increase in short-term indebtedness, combined with the shorter maturities of medium-term instruments, means that it is necessary to refinance progressively larger proportions of the debt each year. Thus, it was estimated that in 1982 Mexico, Argentina and Colombia would amortize close to 50% of their indebtedness with commercial banks, while the comparable figure for Peru and Venezuela was 60%. As for Brazil, its explicit policy of extending the payment periods meant that in 1982 it had to amortize only 35% of its bank debt. However, as has already been stated, the burden in terms of interest payments has already reached serious proportions. In addition, the traditional rescheduling of amortization payments would scarcely relieve the country in these circumstances. Moreover, the greater the share of the debt to be paid to the banks, the greater their risk, which makes it even more difficult to obtain new loans on reasonable terms.

(c) *Development strategy based on indebtedness*

During the 1970s, Latin America opted for a development strategy based on indebtedness.

For a number of years the result was positive. Although from 1974 on the expansion of the world economy was feeble, the economic growth of Latin America was relatively brisk and considerably greater than that of the OECD economies. In addition, this strategy seemed eminently reasonable since indebtedness was 'cheap', with very low or negative real interest rates, lengthy payment periods and servicing payable in dollars, whose real value was being eroded.

However, those who argued in favour of rapid entry into international capital markets and the concomitant strategy of growth based on indebtedness may have underestimated the real cost of credit; during the period nominal costs did not reflect the implicit risks of debt-servicing

problems should a conflict arise between the increase in liabilities with commercial banks and the limits set by those institutions in respect of their commitments. These implicit risks obviously became greater owing to the fact that the structural problems of the OECD countries caused their economic growth rates to fall during the 1970s (by comparison with those recorded in the preceding decade), which meant that Latin America had to contract even more debts in order to maintain its high growth rates at a time when general economic conditions were not propitious for creating the capacity to cope with the accumulation of the bank debt.

From another point of view, the inflation unleashed in the mid-1970s was unexpected, so that the low real cost of loans was a temporary and artificial phenomenon; once the creditors' expectations became more realistic, the cost of credit more than recovered.

Another factor related to the strategy of growth based on indebtedness was that some countries obviously obtained more credit than they could use productively, i.e., external loans took the place of domestic saving and facilitated an increase in consumption, speculation and the purchase of weapons.

Although much of this state of affairs may be attributed to erroneous indebtedness strategies, there can be no doubt that the structure of the international banking market also helped to create the problem. In the initial phase of the loan cycle, the banks granted a large number of loans, with the aim of rapidly investing their surplus on account of competition and excess liquidity. However, there was often some asymmetry between what the banks were able to loan

and the capacity of the countries to absorb the funds obtained efficiently. Thus, the combination of low interest rates, the prestige gained by attracting international credit and the ease of obtaining bank loans when a large dollar reserve existed persuaded some countries to borrow more than their possibilities for investment warranted and to postpone the making of internal adjustments.

(d) *The weaknesses of the international financial system*

In 1974 the international banking system became, *de facto*, a kind of central bank for the world economy.

However, it was not in a position to perform this function and, at best, was able to assume it only for a very short time. Its operation was relatively satisfactory between 1974 and 1975, when its net initial commitments with the developing countries were still very low; today, on the other hand, in view of the high level of its commitments in the Third World, considerations attaching to loan risks and the need for banks to obtain profits stand in the way of efficient recirculation of liquidity.

Moreover, in practice the banks do much to accentuate the cyclical movements of economic activities at both the national and the international level. In addition, although in the 1970s those cycles were not closely synchronized in the Third World, they are so now, owing not only to the prolonged OECD recession but also, and largely, to the lack of interest shown by the banks in granting new loans, the latter being a factor which, as has been seen, was at one time decisive in stimulating the economic growth of the region.

IV

Summary and conclusions

1. *The disquieting and confused international scene*

As has already been pointed out, in the

period 1980-1981 the international economy suffered from the greatest depression since the 1930s. Unlike past recessions, the present one has distinctive traits which dif-

ferentiate it clearly from anything else in post-war experience. In the first place, it is a widespread crisis which affects all the countries in the world, whether capitalist or socialist, developed or developing. Secondly, it has lasted longer, and has proved recalcitrant to traditional therapy, which for a long time encouraged the supposition that appropriate and definitive remedies had at last been found to avoid, or at least to soften, the downturns in the economic cycle.

The diagnosticians of the causes of the recession differ considerably, ranging from those who base their thinking on theories of long-term cycles and announce the advent of a new trough of long duration, to those who lay the blame on the differences between the large centres in respect of the growth rate of productivity or on the inflationary upheavals in the key economies of the industrial world. In any case the general tone is one of great confusion as to how to interpret the existing problems and of mounting insecurity as to the future.

The dominant traits of this profound recession in the industrialized economies are very familiar. In the OECD countries the product remains stagnant or goes on falling; the extensive unemployment which already affects close to 32 million people persists, and there is not the faintest sign of its decreasing significantly in the medium term; idleness of installed capacity has increased, providing a disincentive for new investment; profits are exceptionally low, while bankruptcies of enterprises are on the rise. As a corollary of all this, international trade declined in the 1981-1982 biennium for the first time since 1958. In addition, the fluctuations in the main currencies have added a new factor of instability and are responsible for abrupt changes in international competitiveness among the various central countries and between them and the developing economies.

In addition, the recession in the centres has spread to the entire periphery, as it was bound to do, in consequence of the action of three factors: the negative terms of trade, the high real interest rates and the sudden decline in the availability of new financial resources. The terms of trade have deteriorated

mainly because of the drop in demand for commodities in the industrial centres, while the real interest rates, which are still at their highest level in 50 years, are attributable to the stabilization programmes which have promoted restrictive monetary policies at a time of substantial and persistent fiscal deficits and abrupt maladjustments in the exchange rates of the currencies of the leading industrial countries. As for new credit, it has grown much harder to come by as a consequence of the decision on the part of the private international banks not to grant new loans, of the high levels of indebtedness of the Third World countries and of their precarious balance-of-payments positions. Recently this situation has been compounded by the deterioration in the quality of the bank portfolios of both national and international entities.

Meanwhile, even when forecasts predict that good progress will be made in the control of inflation and the reduction of the nominal interest rates, they are especially cautious with regard to the possibilities of reactivating the economic sector to a significant degree in the short run. In particular, stress is laid on the asymmetry in the possibilities and rates of recovery in the different centres and doubts are expressed as to the time it would take for this recovery to have an appreciable impact on the prices of raw materials or on the flow of capital towards the developing economies (two key factors in the solution of the immediate problems of the periphery).

For this reason, and also in consideration of the high level of indebtedness of the majority of the Latin American countries, it seems wise to be prepared for a time of difficulties which can be got round only by strengthening international and regional cooperation and by implementing domestic adjustment programmes in each country in the region.

2. *A regional economy in crisis*

As indicated above, in 1982 the Latin American economy became very much weaker and suffered its worst crisis in the past 50 years. This crisis can certainly not be dissoci-

ated from the profound repercussions of the international cycle which had some impact on all the countries of the region. Commensurately with the extent to which domestic policies have been mistaken in recent years, especially policies relating to the attraction and use of external credit and exchange, fiscal, monetary and balance-of-payments policies, these international repercussions have also shaken the countries in varying degrees.

For these reasons, the regional gross domestic product fell by nearly 1%, and the per capita product decreased in all the countries of the region, while inflation markedly accelerated. In the external sector, the deficit on current account amounted to US\$ 33 billion, and the balance of payments closed with a negative balance of nearly 14 billion. These results were produced in spite of the fact that the trade balance closed with a surplus of about US\$ 6 billion, by virtue of a painful reduction in imports. At the same time, there have been numerous cases of devaluation and international reserves declined in the majority of the countries of the region.

As we have already indicated, during 1982 Latin America was very hard hit by the action of external factors. Real interest rates, measured by the prices of the region's exports, reached an unprecedented level of close to 25%. In addition to these unfavourable factors, there was a contraction in the net inflow of capital, which accentuated the effects of the cyclical drop in exports and the deterioration in the terms of trade.

These phenomena have in turn had severe social repercussions. Thus, in the majority of the countries, the fall in real wages has been compounded by a sharp increase in unemployment. Moreover, the contraction in external and domestic demand and the high interest rates—both national and international—have had a marked impact on the economy at enterprise level, increasing the number of bankruptcies and, more recently, also making inroads into the economy of the banking institutions.

3. *Trade problems*

Among the root causes of the difficulties now faced by both the world economy and the economy of Latin America are the problems of international trade, upon whose evolution a lasting and stable solution to the present recession will largely depend. In recent years not only has there been a sharp decline in the region's export earnings as a result of the drop in the terms of trade, but the protectionist trends which affect both the manufactures and the commodities exported by Latin America have intensified.

The protectionism prevailing in the developed countries, which began to manifest itself in new and concrete ways in the past decade, has not only been directly responsible for limiting the expansion and diversification of the exports of the developing countries but, owing to the increasingly broad application of protectionist measures, has also brought the principles and standards which sustain international trade into serious conflict with the practical realities by which that trade is governed. Thus, trade under multilateral agreements is decreasing steadily, and that carried out under bilateral agreements contracted outside the multilateral agreements or simply on the basis of unilateral decisions taken by the importing countries without regard for international regulations is increasing. As is easily understandable, therefore, the uncertainty to which this situation gives rise is in itself an important limiting factor for the normal development of international trade relations and, especially, for the resolution of the present problems with regard to the recession.

With good reason, the recent meeting of GATT, which for the first time in nine years was held at the ministerial level and was attended by representatives of nearly 100 countries from all parts of the world, gave rise to hopes that, at the highest level and in accordance with the gravity of the world economic situation, ways would be found to open the gates of international trade and to effect a substantial improvement in the prevailing trade system.

Unfortunately, these hopes were not realized. It was not possible to reach concrete agreements which would assure the developing countries that in the future the commitments made in their favour would be respected and that the practices of conditional application of the most-favoured-nation clause, discrimination, selectivity, unilateral compensatory measures, 'controlled trade' and graduation would be progressively eliminated from international trade.

It is also important to point out that at the Ministerial Meeting it was agreed to initiate studies in the services field, which has vast ramifications and is of special importance for the development strategies of the developing countries. As specified in the relevant decision, the developing countries and competent international organizations must be alert and attentive to the studies recommended, with a view to acquiring detailed knowledge of the situation with regard to the extensive and complex activities which come under the heading of services, so as to be able to adopt informed positions and ward off negative impacts on their balance of payments or on the autonomy of their national development.

4. The imperative need for global solutions

To the extent that all countries feel the effects of the international recession, especially those which, like the Latin American countries, have in recent years been more open to international trade and financial currents, the problem ceases to be an individual or regional one and becomes a global problem, which also requires global solutions.

The indicators referred to in this review of the regional economies show that the Latin American countries are already engaged in painful processes of internal adjustment. To ensure that these adjustments do not reach dangerous limits of social and political tolerance, with additional negative effects on the rest of the economy and on international finances, appropriate economic policies on the part of the big centres are

needed, as well as an imaginative policy of international co-operation in keeping with the deep-seated and widespread character of the problems.

In this connection, it is appropriate to point out that some of the recent reactions of the monetary authorities of the industrialized countries to the payments crises of the developing economies seem to indicate that they are becoming better aware of the need to act promptly and with flexibility and imagination, especially in matters relating to finance and payments. In contrast, however, as has just been remarked, there has been no similar reaction in the commercial field.

In the following paragraphs, in our interpretation of what in our view are the most urgent needs of the countries of the region, we shall make some observations of a general nature on a few of the global measures which would be desirable in the field of international co-operation as means for coping adequately with the present emergencies, particularly in the fields of finance and trade.

(a) International reactivation

A policy for adjusting international imbalances based on the principle that all countries must reduce their imports and expand their exports does not appear to be realistic. It would in fact make sense only in so far as some countries were to initiate a reactivation policy which would make it possible to absorb the greater volume of exports of the other countries. Obviously the ability to do this rests first and foremost with the industrial countries. It is for that reason that a recovery of the OECD countries would provide the relief needed for the countries with liquidity problems and would by the same token facilitate the evolution of those countries with structural difficulties in their external payments.

In the present circumstances it is of primary importance for the big centres to come up with concrete policies for reactivating their economies without it running into new inflationary excesses. It might be argued in this respect that single-minded, unswerving pursuit of the objective of avoiding inflation

might aggravate the trends towards recession and unemployment, which would constitute a serious threat to the political and financial stability of the world system. Moreover, the lesson learned from the Great Depression was that if deflation, as a measure taken prior to the reactivation of the economies, is prolonged in time, it can give rise to uncontrollable cumulative effects which resist indirect incentives. Thus, the greater advances made in reducing the inflation might be fully outweighed by the social and political costs of a depression on a national and international scale.

(b) *Substantially increased mobilization of new financial resources*

The fact that many countries of the region find it necessary to devote an excessively high percentage of their exports to servicing their debt clearly shows that they will not be able to repay the principal and will even have serious difficulties in making the interest payments so long as the international prices of exportable commodities remain low and high real interest rates persist. It follows that in order to overcome this problem there is need for international co-operation (on the part of both public and private sources) of a magnitude in keeping with present circumstances.

Ever since the middle of the past decade, of course, private banks have been acting as the main agents in the extensive recycling of funds which was necessary in order to cope with the balance-of-payments disequilibria resulting from the increase in the prices of fuels. In present circumstances, however, private banking cannot serve effectively as the moneylender of last resort. Considerations both of risk and of profitability usually turn the banks into 'procyclical agents', rendered incapable of handling the problems of the developing countries on their own. Hence an increase in public financial resources would seem to be essential.

In this connection, the measures aimed at extending the present operational facilities of the International Monetary Fund (by increasing the ordinary quotas or by ex-

tending the terms of the General Arrangements to Borrow) or providing it with the proposed new resources (an emergency fund and a fund in support of interest payments) take on particular urgency. Nor should consideration fail to be given to the idea of *ad hoc* creation of Special Drawing Rights, as a way of independently creating liquidity on the part of IMF for the purpose of coping with the drop in international liquidity and channelling new resources to alleviate a payments situation as tight as the present one.

This is why it is of particular importance to think, as was recently advocated by some international monetary authorities, of convening a large-scale international conference to update the principles underlying the system of international economic relations established at the Bretton Woods Conference and to lay the foundations for a new international trade and finance organization.

Not only is it necessary to lay claim to greater international resources to provide emergency support for countries with liquidity problems, but also the flow of long-term public capital to the developing countries should be activated in a markedly anti-cyclical direction. Latin America has been repeatedly criticising the error of drastically reducing the flow of public funds from the World Bank or IDB to the region on grounds that it has attracted a large volume of private capital in recent years. Experience shows that this reasoning has not held good for long and that today more than ever the region needs additional long-term resources, precisely to compensate for the sharp cutbacks in external private resources and the decline in foreign investment.

Moreover, it would be particularly inappropriate for the private banks, in the wake of the broad financial permissiveness which prevailed in the second half of the past decade, to initiate a very restrictive policy. In this connection, the cautionary observations made by the Managing Director of IMF to the private banking sector at the Toronto meeting, when he asked it to be prudent with regard to possible cutbacks in the resources loaned to developing regions,

seem to us to have been particularly relevant. The policy that IMF agreements should be accompanied by private bank support is indispensable, not only for the viability of the adjustment programmes but also in the interests of the private system itself.

It should be pointed out that in spite of the fact that a significant percentage of the debts contracted with international banks had no public guarantee, many governments readily agreed to recognize the responsibility of the State in the fulfilment of the external commitments of the private sector. If account is also taken of the heavy profits obtained by the banks on their loans to developing countries in recent years and it is borne in mind that in their past experience, international private banks have suffered only minor losses in recovering their portfolios in the region, these institutions might well be expected to take up positive attitudes towards supporting the programmes designed to channel new resources to the Latin American countries in the present conjuncture.

(c) *International machinery for re-scheduling the debt*

It also seems obvious to us that in the present circumstances some international arrangements should be provided for supplying organic and systematic relief to the developing countries in their debt servicing. The key to these arrangements is that they must be tied to development criteria and not just to repayment criteria.

In so far as these agreements involve extensions to the payment of the principal and new credits to cope with the payment of interest, they do not necessarily imply a loss for the banks, and in many cases would only mean that practices agreed to by the banks in their own national markets would be reproduced at the international level.

These arrangements are being provided for under the system of special agreements with international institutions such as the International Monetary Fund and the World Bank. Thus, the problem of the terms under which such agreements are entered into and the need for adapting the traditional criteria in that respect to the magnitude and general

prevalence of the world recession once again comes to the fore. In this connection, it should be borne in mind that traditional adjustments on the expenditure side, devaluations, reduction of fiscal deficits and liberalization of prices and interest rates, etc., have seldom met with success, since, in addition to the fact that some of the theoretical assumptions on which they are based are weak, their practical application has come up against economic and social obstacles which are not always easily surmounted.

It is for this reason that in the midst of a world recession, in which the large majority of the developing countries are experiencing serious pressures in their domestic sectors, these adjustment policies should take into account the severity and general prevalence of the difficulties of the moment by trying to bring structural adjustments in the balance of payments and the gradual reduction of inflationary pressures into line with the maintenance of adequate rates of development.

(d) *Trade reform*

The stagnation of international trade and the deterioration of the body of rules and principles which should govern the international trade system represent great challenges to the developing countries and to their export expansion and diversification policies, and place serious limitations on the efforts to solve the region's payment problems. In connection with those problems, the loss of dynamism and the openness of world markets in the past decade is a fact of major significance which should be duly considered in the short- and even the medium-term development strategies of the Latin American countries.

As we have repeatedly remarked, the problems of the past have been greatly aggravated in recent years by the burden of servicing Latin America's external debt, which eats up an increasingly large share of the income realized from exports. To embark on a solution to these problems there must be an improvement in trade, in which context importance again attaches to

such matters as the free access of Latin American manufactures to the markets of the developed countries, higher and more stable commodity prices and a greater degree of processing of primary commodities in the producer countries. The Latin American and other developing countries must pursue their efforts to negotiate these questions satisfactorily with the industrialized centres.

In the short term, the developing countries, and those of Latin America in particular, are faced with an imperative need to organize their bargaining capacity in such a way as to keep the protectionist tendencies of the industrialized countries from making headway and embark on an effort to secure their elimination. Moreover, they must ensure that the steady deterioration in the standards laid down in the international trade system is halted, since it is harmful to the developing countries, and they must join forces with a view to moving ahead to a more efficient and equitable world trade system.

The next session of the United Nations Conference on Trade and Development (UNCTAD VI) will provide the international community with a significant opportunity to muster the consensus needed as a point of departure in surmounting the obstacles in the way of the international trade system. Now is the time to define important issues in this regard, since in April of the current year it will be necessary to begin negotiations for the establishment of a global system of trade preferences among developing countries, which, in accordance with the guidelines already adopted by the Group of 77, should lead to the creation of a real economic system for the developing countries. The establishment of this system will be a new venture, opening up vast prospects for the future of the developing countries in the concert of international economic relations.

Furthermore, these obstacles highlight the need for co-operation among the developing countries and, in particular, inter-Latin American co-operation and integration, a matter to which reference is made below.

5. Domestic policy options and the role of regional co-operation

(a) The margin for manoeuvre and the basic orientations of domestic policy

The foregoing comments have made manifest the depth of the external upheavals which are affecting the region and the consequent need to introduce changes into the environment in question — a responsibility which is primarily incumbent upon the central economies and the basic institutions of the world system.

The predominant importance of these factors, however, by no means implies that Latin America is completely subject to their influence and can therefore do nothing on its own account to counteract them. On the contrary, we believe that much can and must be done in this direction; not only to 'manage' the crisis but also to palliate it and to create conditions which will contribute to the recovery of the Latin American economies.

The present author dwelt on this subject at some length last year, drawing attention to two circumstances which are of vital importance.

In the first place, the history of the Great Depression of the 1930s — over and above irrelevant analogies — bears witness to the fact that many countries were able to react energetically to its traumatic effects and to discover appropriate means and policies whereby to give impetus to a recovery that in certain cases was actually steadier and more significant than that achieved in some of the industrialized countries.

Secondly, it will not come amiss to repeat that the region now facing the present crucial situation has undergone substantial changes in the past half century, which have implied the expansion and diversification of its structures of production, the improvement of the technical calibre of its professional élite, both in the public and in the private sector, and the establishment of institutional machinery of considerable power and efficacy. In a word — to repeat a

conception that may still be considered valid and pertinent— there has been an increase in our countries' 'capacity for defence' against external contingencies.

But these remarks should not be interpreted as an exercise in ritual optimism. Even if the foregoing propositions are upheld with full conviction, it is impossible to overlook the fact that in the scenario of today new and singularly complex situations can be distinguished. Cases in point are those already referred to in connection with the external debt, and those discernible because of the greater dependence of internal dynamism on the available supply of imports. And to these are added others, no less specific and original in relation to past scenarios, such as the disruptions of the production apparatus that have been caused by mistaken policies in some countries, and, above all, the encumbrance of a generalized inflationary pressure which indubitably militates against the possibilities of any reactivation programme.

In view of the diversity of national situations in these and other respects, it is too hazardous to make any attempt to sketch out positive and universally meaningful guidelines. Nevertheless, there are some courses of action which—in different versions—are taking shape in the region.

The first seems to be the decision in favour of an explicit reactivation policy, founded on two cornerstones. One of these is encouragement of production for the home and regional markets, combined with resolute export promotion to supplement this effort and help to maintain the level of imports as far as is viable. The other is the adoption of all the necessary and possible provisions to ensure that these endeavours are not frustrated by upsurges of inflation. A third requisite is that overall strategy should concede top priority to the relief and resolution of the serious social problems, in particular the scourge of unemployment.

Each and all of these lines of action present formidable challenges, but this does not lessen the supreme importance of establishing a basic frame of reference for the policies of defence and reaction to be adopted.

(b) *The revitalization of regional co-operation*

Furthermore, in the present circumstances it is imperatively necessary to take a fresh and imaginative look at the possibilities of regional co-operation. The opportunities afforded by a regional market of a million million dollars, the steady expansion of intra-regional trade during the last few years, the manifold institutional channels existing, and all the methods of informal co-operation explored in the recent past, offer grounds on which to base a concentrated effort in that direction.

The first step should be the urgent adoption of measures designed to stop the deterioration of the region's current terms of trade. Acute balance-of-payments difficulties often give rise to the danger of raising internal barriers to regional trade. But it is indispensable that medium- and long-term considerations and interests should prevail over any immediate temptation. Defence of regional trade is, in our view, a *sine qua non* in present circumstances.

Secondly, attention should be turned to the possibility of expanding regional trade on the basis of the idle capacity which is on the increase in the region, particularly in industry. This might be achieved through government agreements concluded with the active participation of the private sector, which knows and has access to flexible and varied channels of interconnection.

In this context, it becomes especially important to consider innovative and flexible financial machinery to facilitate the mobilization of the real resources that are lying idle in the region. On other occasions mention has been made of the need to forge ahead with the study of reciprocal balance and credit compensation facilities and with the analysis of mechanisms conducive to the creation of a financial safety net for the region, and today it seems desirable to lay further stress on the importance which in the writer's view attaches to these measures.

Furthermore, the member countries of the Asociación Latinoamericana de Integración (ALADI) (Latin American Integration Association, ex-ALALC) must in the near

future apply a margin of preference in respect of their reciprocal trade. Maximum efforts should be made to ensure that this margin is really meaningful, for it must not be forgotten that the present conjuncture and future prospects call for more intensive and efficacious utilization of the regional market, and likewise that the eleven member countries have been trying for two decades to construct a preferential trade area. In addition, consideration should be given to the possibility that this preference might be applicable to all the countries of the region. Such a measure would undoubtedly constitute a major incentive not only to the expansion and diversification of reciprocal trade, but also to regional co-operation in every guise.

But the need to reassess the intrinsic merits of regional co-operation and integration is not confined to the field of trade. There are many areas and activities in the region to which a collective and concerted approach has been and can be adopted. In this connection, new and creative patterns of co-operation can be promoted through the SELA Action Committees and the mechanisms of partial or multilateral scope for which provision is made in the 1980 Montevideo Treaty by which ALADI was created. The vulnerability of the region which has been evidenced in this crisis of the world economy has led the Latin American countries to reach agreement, within the framework of SELA, on a regional economic safety device. The steps recently taken to study the specific measures that would set it in motion are deserving of special support and attention. A regional economic safety net should comprise specific action in the areas of financing and payments, food and agriculture, energy and trade.

Final considerations

A review of the economic evolution of the region in 1982 and the recent trends in the world economy suggests two considerations.

The first is the conviction that to surmount the present crisis a new vision of

the future will be required and a new system of international economic relations which will be responsive to the radical economic changes occurring in the world scenario, and which, besides making it possible to cope with the present emergency, will formulate new trade and monetary rules to facilitate the sustained growth of the world economy. Because of the indissoluble linkage between the region's current problems and global solutions, it is imperative that Latin America should bring the nature of its problems before the appropriate forums and should express coherent views on the global solutions to which the whole world must feel itself committed.

The second reflection relates to the medium-term view of our problems. In this terrain, it seems worth while to recall that the region faces problems of liquidity, but not of insolvency. The dynamism shown by the Latin American economy in the past decade, the transformation and diversification of its production capacity and the abundance of its human and natural resources leave no room for stultifying pessimism. Rather must it be considered that alongside their costs, crises always open up opportunities for making structural adjustments and devising growth strategies which, thanks to the lessons of past experience, aim at achieving an economic and social development consonant with the expectations that the region may legitimately hope to see fulfilled.

Lastly, as always ECLA will shoulder its full share of responsibility as regards contributing to the study and solution of the serious problems besetting the region today. To this end—and in pursuit of a practice which has borne valuable fruit at other crucial junctures in the past—the ECLA Secretariat has decided to convene a select group of Latin American personalities with a view to learning their views and proposals on the subject under discussion, which will have an enlightening influence on the institution's activities and will be of help in discovering the solutions for which our countries are clamouring today.

Latin American development problems and the world economic crisis

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This article is a summary of the document submitted by the ECLA Secretariat to the Committee of High-Level Government Experts (CEGAN) at the latter's meeting in New York in December 1982. Its main aim is to outline the nature and causes of the crisis through which the region is passing and to suggest some lines of action which could be followed in order to tackle the problem at both the domestic and external levels.

Part I of the article considers the instability of the economic process, the sharp decline in the growth rate, the main economic problems, and the social tensions which the heightening of the latter is causing. Part II sets forth the main relationships between external factors and national economic processes, both from a global viewpoint and through analysis of the specific cases of Brazil, Costa Rica, Mexico and Peru. Finally, Part III contains reflections on Latin America's future prospects and the main lines of action which could be followed in the light of the goals and objectives established in the Regional Programme of Action.

In order to shed more light on these prospects, the article presents two preliminary exercises which give an idea of the effects that would be produced on the main domestic and external macroeconomic indicators by a recovery in the economic growth rate, these two exercises being differentiated by their respectively more and less optimistic assumptions regarding the economic progress of the developed countries and world trade. Whatever the possible growth hypothesis adopted, however, there seems no doubt that regional co-operation and integration must play an important role in the years to come, and the article therefore concludes with a rapid examination of the priority areas in which such efforts should be made.

I

The slackening of economic growth and the intensification of social problems

A. THE ECONOMIC PROCESS: ITS INSTABILITY AND THE SHARP DECLINE IN THE RATE OF GROWTH

The International Development Strategy (IDS) approved by the General Assembly of the United Nations and the Regional Programme of Action adopted by ECLA at its nineteenth session within the framework of that strategy were designed to provide guidelines for the action that should be taken at the national, regional and international levels in order to promote during the 1980s the development of the peripheral countries in general and of Latin America in particular. The implementation of the IDS depended upon concerted action in the international, regional and national fields conducive to the adoption of decisions intended to eliminate or mitigate structural situations in the world economy—particularly in the industrial countries—which represent obstacles to the practical application of the Strategy. Unfortunately, the developments that took place and spread as a result of the world economic crisis generated new political and economic situations which drove events along a course essentially different from the basic premises and guiding principles propounded by the IDS and ECLA's Regional Programme of Action.

No progress whatever has been made in concerting the global negotiations that had been envisaged for the structuring of a new international economic order, and the first years of the present decade so far display in the international sphere a panorama of profound economic recession, with high indexes of unemployment and inflation, while at the regional level, in our own countries, there has been a severe deterioration in economic and social conditions. Considering the region as a whole, it can be seen that in 1981 the per capita domestic product failed to maintain its 1980 levels,

real per capita income has declined, and the 1982 results are even more unfavourable.

International events and this deterioration of economic and social conditions are helping to propagate a dangerous climate of instability and confusion in the context of which substantial changes in national policies are often brought about in many countries, in an endeavour to control almost unmanageable situations.

These processes have indubitably been influenced by factors of different kinds, both internal and external, which differ from one country to another. Among the former may be mentioned policies of greater or lesser openness; the scale and terms of the use of external financial resources; the protection or non-protection of national economic activities; the placing of emphasis on certain economic and political objectives to the detriment of others of a socio-economic character which are of special significance; the *modus operandi* and degree of efficacy in the administration of reserves and of the external debt; and over-estimation of the soundness of specific policies in the light of experiences which were apparently satisfactory over the short term, but were really—at least in part—the result of the favourable evolution of other factors. Generally speaking, it seems that in many cases the domestic policies adopted were based on a diagnosis of the situation and an evaluation of international trends which with the passage of time became more and more widely divorced from reality.

Obviously, however, it has been the changes and unfavourable trends in external variables stemming from the policies pursued and the stagnation and inflation faced by the industrial countries, as well as from the world economic recession, that have made for a severe restriction of the economic growth of the great majority of the countries of the region and for an atmosphere of uncertainty as regards their subsequent development. The factors in question can be controlled by the developing countries only in part and in certain respects, and their influence determines a high degree of economic and technological dependence upon the industrial countries.

Many Latin American countries contracted debts on the assumption that the crisis in the developed world was basically of a conjunctural nature. During the second half of the 1970s they managed, by means of borrowing and a rapid expansion of exports, to maintain what seemed—in the prevailing world economic circumstances—to be a relatively high rate of economic growth, until the persistence and aggravation of the external crisis made their economic policy models untenable.

The problems of external indebtedness and financing besetting most of the Latin American countries and their effects on the decline in growth are not of recent origin: they are really the result of institutional changes and of a cumulative process that began midway through the 1970s. To shed light on these aspects of the question and gain a more precise idea of the nature of the prevailing economic and financial situations it is desirable to review, if only succinctly and in broad outline, the various phases that have taken place.

With this end in view, and for the sake of simplicity, the evolution of the region's economy, from the beginning of the past decade up to the present time, could be divided into four periods or phases which reflect changes and trends of a general character, though they are not always exactly applicable or significant for each and every country. These phases correspond to the following periods: (i) the period of intense dynamism recorded in the early 1970s; last decade; (ii) the period 1974-1975, marked by trends towards an economic depression which became more pronounced in the latter year; (iii) the moderate and costly recovery extending from 1976 to 1980; and, lastly, (iv) the economic and financial crisis of 1981 which dragged on into 1982 and which, unfortunately, may likewise last through 1983. Thus, the period is one of sharp contrasts, in which the optimism of the early 1970s seems to have influenced the maintenance—if not the accentuation—of patterns of external trade and financing whose non-viability had become evident by the dawn of the 1980s, when the hard facts have finally spread an attitude of pessimism.

The early 1970s (up to 1974 in certain aspects) witnessed the culmination of a phase of rapid economic growth which had started in the second half of the 1960s, although with notable differences from one country to another.

Up to 1973, there was a boom in exports of goods and services in the great majority of the countries of the region, and for many of them the external terms of trade followed a favourable trend, thus strengthening the purchasing power of their exports. Accordingly, imports expanded appreciably, on a scale exceeding the increment in the domestic product, without thereby causing any significant increase in balance-of-payments deficits on current account, at any rate for the region as a whole.

The year 1974 marked a phase of transition from the boom of the preceding years to a definite depression in 1975. This transition had one noteworthy feature. The growth rate of the product remained relatively high and the petroleum-exporting countries increased their real income by virtue of the rise in the price of their exports. Imports, in turn, expanded considerably in almost all countries; but at the same time, in an important group of countries exports remained static or decreased and the external terms of trade deteriorated in almost all the non-oil-exporting countries, so that the real value of their exports of goods and services contracted. In 1975 the economic recession became general; for the non-oil-exporting countries as a whole exports continued to stagnate, and their terms of trade deteriorated considerably, the result being a pronounced reduction in the real value of exports which affected the oil-exporting countries as well. In these circumstances the rate of economic growth dropped to only 3.5%, and imports dwindled, except in the case of the petroleum-exporting countries.

Against this background, in 1974 the non-oil-exporting countries as a whole appreciably enlarged their balance-of-payments deficit on current account, which, in the case of a group of 20 countries,¹ climbed from approximately US\$ 4 500 million in

1973 to US\$ 13 500 million in 1974. The main causes were the expansion of imports and the decrease in the real value of exports. This swollen deficit was partly financed by the use of reserves, but principally by an increase in external borrowing. In 1975 the increment in the deficit was still bigger; for the same group of countries it reached a figure of approximately US\$ 16 200 million, at current prices, which seems to have been determined by the contraction again recorded in the real value of exports, notwithstanding the decrease in the value of imports and the decline in the rate of economic growth. Thus, in a brief period net external financing rose from the equivalent of 19% to 51% of the value of exports. International reserves were again reduced, but the magnitude of the financing contributed to the accumulation of a huge external debt which—since it was not possible to restore conditions of economic dynamism and regain terms of trade similar to those of the early 1970s—had subsequent effects on the rate of economic growth and on national economic policy measures.

The phase covered by the years 1976-1979 may be described as one of merely moderate recovery, especially if it is taken into account that the average annual growth rate of the domestic product came to only a little over 5%.

Noteworthy features of this phase were the vigorous expansion of exports and the maintenance of a considerable flow of external financing, notwithstanding the high levels of previous borrowing. This facilitated an increase in imports, which, nevertheless, was less than the rise in the real value of exports. Although for the group of 20 countries under consideration the balance-of-payments deficit on current account decreased in relation to the peak figure of 1975, the imbalance remained at relatively high levels, and throughout this period the external indebtedness of the countries of the region continued to increase. What is more,

¹ Comprising all the countries of Latin America and the Caribbean, with the exclusion of Bolivia, Cuba, Ecuador, Trinidad and Tobago and Venezuela.

in 1979 there was a further rise in the deficit, which, for the same group of countries, increased from approximately US\$ 11 600 million in 1978 to US\$ 19 100 million in 1979.²

The economic performance in 1980 differed considerably from one country to another. Thus, for example, Mexico increased the economic weight it carried among the countries of the region, while at the same time acquiring special characteristics, as a result of the growing importance of its production and exports of petroleum. Broadly speaking, the economic growth rate for the countries as a whole may be described as similar to or slightly greater than the average for the period 1975-1979; although in many countries the high rate of increase in the volume of exports was maintained, signs of deterioration began to appear, and downswings occurred in some countries, while the terms of trade worsened in most cases, except for the petroleum-exporting countries. The reduction in imports observed in a few instances was more than offset by the sizeable increments in others. Furthermore, the effects of previous external borrowing began to make themselves felt. Profits and interest payments on foreign capital and the external debt increased considerably, and the net figures reached some US\$ 13 300 million in 1979, rising to US\$ 18 100 million in 1980. These figures were influenced not only by the increase in the debt but also by the rise in rates of interest.

Accordingly, the balance-of-payments deficit on current account for the 20 countries under discussion soared from US\$ 19 100 million in 1979 to US\$ 32 400 million in 1980, and even the countries in the petroleum-exporting group witnessed an increase in the current deficit on their external accounts.

² All these figures are expressed in current values. If they were adjusted in terms of constant prices of some previous year, the absolute increase would be less, because of the rise in the prices of the goods and services marketed.

In 1981, despite a renewed expansion of the volume of exports of the group of non-oil-exporting countries, the signs of deterioration that had appeared in 1980 spread more widely, sales abroad contracted in a larger number of countries, and there was a tendency for the deterioration in the external terms of trade to be generalized. Thus the real value of exports increased only slightly, and still less if Mexico (where a markedly favourable trend was observable) is excluded from the group of petroleum-exporting countries. In real terms this country's exports increased by more than 15%, a fact which highlights the importance that petroleum exports were acquiring in Mexico's total external sales. Imports decreased in many countries and the region's gross domestic product rose by only 1.1%, a much smaller increase than that of its population.

In this situation, the group of 20 countries in question once again showed a significant upswing in their external current account deficit, which rose from US\$ 32 400 million in 1980 to US\$ 41 900 million in 1981. This increase of somewhat over US\$ 9 000 million was due mainly to the net flows of profits and interest on foreign investment and debt, which climbed from US\$ 18 100 million to US\$ 27 100 million. This meant that during 1981 the deficit on the trade balance was contained, and the increase in external financing was absorbed by payments of profits and interest. At any rate, this is the interpretation that can be inferred from the aggregate figures, since the situation may vary as regards the individual evolution of each of the countries of the region.

The nature of this evolution does not change if we look instead at the entire group of 24 countries of the region for which balance-of-payments information is available. In this case, the total balance on current account rose from US\$ 28 100 million to US\$ 38 600 million, while net profits and interest paid abroad increased from US\$ 18 900 million to US\$ 27 800 million.

B. SOME SALIENT ASPECTS OF THE DEVELOPMENT PROBLEMS FACING THE REGION

The brief review presented in the previous section may usefully be followed by a synthesis, still on the macroeconomic level, of the most salient internal and external aspects of the problems facing the region in the present conditions. These aspects relate to economic dynamism, the problems of the external bottleneck and the intensification of social problems and pressures.

The moderate economic dynamism which the region had been displaying since 1976, to some extent as a recovery from the 1975 recession, broke down in 1981 and the economy sank into a severe depression which spread and got worse in 1982. In 1981 the rate of increase of the domestic product was little more than 1%, markedly below the growth rate of the population, and thus the per capita product of the region as a whole diminished for the first time in the whole of the period since the war.

This deterioration was influenced by both internal and external factors. The former are linked to national policies which in some situations have proved inadequate and in others have actually intensified the negative effects of the present conjuncture and the world economic recession. Nevertheless, it is evident that in the context of the current functioning of the national economies, it is the external factors that appear as the most conspicuous determinants, in one way or another, of the essential features characterizing the evolution of the Latin American countries.

Stagnation and inflation in the industrial countries and the world economic recession have engendered simultaneous negative effects on trade and external financing, thus disrupting the trends followed in the 1970s, when trade crises were less acute and could be weathered by making extensive use of external financing. The Latin American countries are facing at one and the same time a contraction in the volumes of demand, a deterioration of the terms of trade, a rise in real interest rates, a drop in the supply of external financing, and a

notable increase in protectionism. Since the end of 1981 and the beginning of 1982 a conjuncture may be discerned in which the following facts coincide:

(a) The external demand of the industrial countries has slackened in consequence of the stagnation and contraction of their rate of growth, although many Latin American countries did manage, except in the years of out-and-out recession, to secure an appreciable increase in the volume of their exports through the operation of other factors and the diversification of markets, as is discussed later;

(b) Primary commodity prices fell, in nominal or real terms, owing to the above-mentioned slackening of international demand and in some cases to the liquidation of stocks because of the high rates of interest;

(c) The persistent inflation observable in the industrial countries (even though it is going down in some of them) has brought about a deterioration in the terms of trade between the countries of the region and these countries. Simultaneously, in some cases, there has been a decrease in the foreign currency prices of certain Latin American export items, due to devaluations and other measures taken to gain a footing and favourable competitive conditions in the industrial countries' markets. This trend towards a deterioration in the terms of trade has sharpened with the rise of petroleum prices for the petroleum-importing countries, especially in the years in which these price changes have taken place;

(d) The rise in interest rates has considerably increased the cost of the external debt that has been accumulating as a result of the heavy balance-of-payments deficits. In this respect a stage has now been reached at which the increments in balance-of-payments current account deficits are being determined by the exceptional increases registered in net payments of profits and interest on external investment and indebtedness. These results are observable both in some individu-

al countries and in the movement of the figures for the region as a whole;

(e) The restrictive policies prevailing in the industrial countries have helped to accentuate these countries' postulates to the effect that international co-operation and external aid should be granted in accordance with a principle of graduality or of discrimination between the developing countries. The same approach is advocated as regards special or preferential treatment in respect of trade and other matters. Thus, almost all the Latin American countries would be excluded from treatment of this kind, which would be reserved for the lower-income countries;

(f) There is a recrudescence of proposals and concrete decisions relating to the adoption of protectionist measures in industrial countries with the aim of preventing or limiting the access of Latin American countries to the markets for manufactures or semi-manufactures which are of particular interest to Latin America.

Despite the decline in the economic growth rate and the measures adopted in many Latin American countries to contain or reduce the volume of imports, balance-of-payments deficits on current account have risen considerably, especially in the last few years, thus giving rise to an accumulative process which is bringing external indebtedness to dangerous levels and situations. This state of affairs creates a veritable bottleneck which is preventing the recovery and acceleration of economic dynamism and the achievement of more stable evolution than that registered in recent years. Thus:

(a) The balance-of-payments current account deficit of the region as a whole, which—as stated above—had been increasing significantly, rose from US\$ 19 800 million in 1979 to US\$ 38 600 million in 1981. In relation to the domestic product, these deficits showed the highest indexes since the end of the war in almost all countries. Thus, for example, in the majority of countries the balance-of-payments current account deficit came to represent between 6.0% and 12.0% of the gross domestic product at 1975 prices. Prior to the depression, at the beginning of the

past decade, the corresponding figures ranged from only 0.5% to 6.0%;

(b) The relation between net external financing and earnings from exports of goods and services has appreciably increased, reaching between 25% and 88% in most countries in 1981;

(c) A feature which has been gaining in importance since the mid-1970s relates to the fact that external financing funds are increasingly provided by the international private banking system, on burdensome terms and conditions, particularly as regards loan repayment periods and high rates of interest;

(d) There has been a surprising increase in total payments of profits and interest on external investment and debt is surprising; In the majority of countries these payments represented between 3.5% and 7.0% of the domestic product in the year 1981, whereas in the early 1970s the corresponding index was only 1.6%;

(e) This is due to the stepping-up of interest rates and the persistent increase in the external debt. The latter reached a sum of about US\$ 250 000 million at the end of 1981, whereas only two years before, at the end of 1979, it had amounted to US\$ 170 000 million. This debt is concentrated in a small number of large and medium-sized countries, but the indebtedness accumulated by other medium-sized and small countries is also of particular relative importance;

(f) Another specially significant aspect of the problem is the effect of the deterioration in the terms of trade of the Latin American countries. Even if the benchmark adopted is the year 1975, by which time the increases in petroleum prices registered in 1973-1974 had already been incorporated, the effect of this deterioration nevertheless came to represent by 1981 a loss of 1.9% of the gross domestic product in many non-petroleum-exporting countries;

(g) In these circumstances, the purchasing power or real value of exports of goods and services has gone down considerably. This would seem to indicate that, for some countries at least, the impact of the deterioration in the terms of trade and the growing external payments of profits and

interest were factors carrying special weight in the balance-of-payments problems and the decline in the rate of growth.

The fall in the economic growth rate and the crisis which is affecting most of the countries of the region have immediate consequences in the shape of a worsening of social conditions for a great mass of the population. This is evidenced in the increase in unemployment and underemployment, the decrease in real wages, the persistence and accentuation of extreme inequality in income distribution, and the maintenance of situations of extreme poverty and indigence affecting a high proportion of the popula-

tion. It should be borne in mind that in boom periods, or in times of greater economic dynamism, income or the fruits of economic growth are distributed very unequally and employment levels do not rise to the extent desirable. In contrast, in phases of slow growth or economic crisis it is the lower-income sectors that are hardest hit by the adverse effects of this trend in the national economies. It is easily understandable, therefore, that in the framework of extremely inequitable societies like those of Latin America, social pressures are intensified and the factors making for instability increase.

C. THE INTENSIFICATION OF SOCIAL PROBLEMS AND TENSIONS

In the report prepared by the Secretariat for the meeting of CEGAN held in Quito in 1981, at which the Regional Programme of Action for the implementation of the International Development Strategy was prepared, consideration was given to various aspects of economic growth, social change, social distribution of income, the scale and extent of poverty and the problems of unemployment.³

It was stated in the report that Latin America had obviously undergone a very important and meaningful process of economic growth and social change since the war; but it was no less true, the report went on to add, that the nature of that process had led and still was leading to the shaping of inequitable societies. The most salient features of the development process prevailing in the region are reflected in the socio-economic structure, which is characterized by a very high degree of concentration of national wealth and income in small segments of the population, a great mass of the population living in conditions of extreme poverty, and a frequently rapid expansion of the middle social strata.

The factors determining these structures

or inherent therein are related in essence with the concentrative forces of the prevailing economic system, with private appropriation of the surplus, with the degree to which the latter is used to boost non-essential consumption in a process of incessant diversification, and with investment serving only to promote consumption.

At the beginning of the 1980s the Latin American governments stressed in the Regional Programme of Action the imbalance between economic and social progress. "Latin America has undergone a significant process of economic growth and social change since the war, but the nature of that process has led and still leads to the shaping of highly inequitable societies."⁴ The rise in unemployment and the fall in real wages which are more and more in evidence in the Latin American countries give grounds for fearing a deterioration in the situation of the more disadvantaged groups. In these circumstances, it becomes necessary to reaffirm the guiding principles of social development contained in the Regional Programme of

³ See *Latin American Development in the 1980s*, E/CEPAL/G. 1150; E/CEPAL/CEGAN 5/L.3; April 1981.

⁴ See "Regional Programme of Action for Latin America in the 1980s", in *Economic and Social Council Official Records, 1981, Supplement No. 16*, Report of the nineteenth session of CEPAL (E/1981/56; E/CEPAL/G. 1176), May 1981, p. 206, paragraph 12.

Action and to adopt measures intended to redistribute the cost of the crisis and to strengthen strategies designed to "increase production capacity, so that the structures

of production and consumption can be transformed in order to meet the basic aspirations of the majorities for a better life".⁵

II

The economic process, indebtedness and changes in external economic relations

A. INTERRELATIONS BETWEEN EXTERNAL FACTORS AND THE NATIONAL ECONOMIC PROCESS

Industrial development, progress in the field of training, the expansion of production capacity, and the changes in production and technology that have taken place in most of the Latin American countries since the Second World War might have been expected to reduce, at least in the large countries and in some of those of medium size, the degree of sensitiveness, vulnerability and dependence of national economies in relation to the action of external factors, particularly as regards the unfavourable effects and repercussions of the world economic recession and economic and technological trends in the industrial countries with which Latin America maintains the bulk of its economic and financial relations. This could be expected, above all, in view of the significant progress that has been made in the development of the productive forces of the national economies.

It is obviously true that, to a greater or lesser degree, the countries of the region possess greater capacity and a broader radius of government action than in the past; as well as sounder infrastructure and support bases to defend themselves against the unfavourable impact of external factors. Most of the countries are clearly in a better position than at earlier stages, when specialization in primary production predominated in domestic activities and in exports; and better, too, than in the early phases of their industrialization processes.

It is no less obvious, however, that in

the context of the Latin American countries' present insertion in the world economy and, in particular, of their relations with the economic and technological evolution of the industrial countries, the national economies are markedly sensitive, in one way or another, to external events, and display a high degree of vulnerability and structural dependence. Moreover, the area of the favourable or unfavourable effects and repercussions of external variables has been expanded by the application of more liberal policies, characterized by the increasing external openness which the countries have been promoting, although with great differences from one country to another in respect of the nature and scale of such openness and of government attitudes and initiatives *vis-à-vis* external events.

As already noted, the growth and the far-reaching economic, social and technological changes which have taken place since the Second World War have appreciably strengthened the economic capacity of the countries of the region and have broadened the area of action of governments: advances that might be regarded as the conquest of a measure of autonomy. But there is no getting away from the conclusion that a new vulnerability and a new dependence, more complex and diversified than in the past, have also been shaped and in some

⁵ *Ibid.*, p. 215, paragraph 60.

respects may be considered to produce wider and profounder relative effects. Let us give a little thought, for example, to the risk and possible consequences of the financial situations of indebtedness and balance-of-payments deficits, as regards the vulnerability and dependence of the Latin American economies *vis-à-vis* the power now exercised by the international private banking system and world financial institutions.

One global aspect worthy of mention is the marked parallelism observed during the 1970s between the evolution of the economic growth rates of the industrial countries and of the Latin American countries as a whole. In contrast, the two-year period 1981-1982 witnessed the disruption of that parallelism, which had been characterized by the higher levels of Latin America's growth rates, and it is therefore especially important to describe these phenomena in greater depth. The growth rates of the gross domestic product of the seven largest industrial countries show a movement through time whose periods or phases are distinctly similar to those identified in the preceding chapter, when we looked at the evolution of the annual growth rates of the gross domestic product for Latin America as a whole. Thus, in broad outline, the following points may be stressed: (a) the industrial countries reached the culmination of a long period of rapid economic growth in the year 1973, when the product increased by more than 6% in relation to the preceding year, whereas Latin America prolonged its intense economic dynamism until 1974, in which year the gross domestic product rose by approximately 7%, with a heavy balance-of-payments current account deficit; (b) the crisis showed up in Latin America in 1975, when the growth rate was a little over 3.5%, while the industrial countries lapsed into a state of stagnation or economic recession in 1974 and 1975; (c) in the period 1976-1980 a moderate recovery took place, with an average growth rate of 5.5% in Latin America. In the industrial countries too there was a recovery in economic growth, whose quantitative evolution is expressed, however, in an increase of 5.2% in 1976 followed by

an uninterrupted slide-down to 3.7% in 1979; (d) in the biennium 1980-1981 this decline sharpened in the industrial countries, whose average annual growth rate was only a little more than 1%, while in Latin America the downward movement took place in 1981 with a variation in the region's gross domestic product very similar in scale to that recorded in the industrial countries; and (e) in 1982 there was a significant contraction in the domestic product of the region as a whole, and stagnation in the industrial countries.

In the context of these trends in the economic growth rates of Latin America and of the industrial countries it is useful to point out three clearly discernible aspects. One is the fact that during the 1970s the economic growth of the region as a whole always kept at higher average levels than that of the industrial countries, and only in 1981 was the increase in the two areas of very similar magnitude and of slight relative significance. In 1982 there was a contraction in Latin America's gross domestic product, whereas in the industrial countries as a whole the economy remained virtually stagnant. Another feature is that the periods of stagnation or depression or of scanty economic growth were previously of longer duration (one or two years) in the industrial countries than in Latin America. Now, however, the region has completed over two years of stagnation. The third and last general observation to be made is that both in the 1970s and today the years of scanty growth or contraction occur in the context of a fall or decline of the real value of the region's exports, resulting from a combination of constant prices for exports, contrasting with variations in the terms of trade. In the latter period, however, there has also been a considerable increase in the relative importance of debt servicing.

No claim is made that these comparisons make possible a precise definition of the quantitative relation between the economic growth rates of our region and the evolution of the industrial countries, and still less is it claimed that they explain the inverse relation. This is not only because of

the heterogeneity of the two aggregates, but, essentially, because economic and financial relations are more complex and diversified than could be inferred from such a comparison between the global growth rates, since the economic strategies and policies which have prevailed in the industrial countries and in Latin America largely determine the nature and magnitude of the effects and repercussions on trends in Latin America that may be produced by the functioning of the industrial economies and the world economic recession.

Nevertheless, this global comparative analysis—the results of which have been synthesized in the foregoing paragraphs—sheds a great deal of light on the position of the two areas in the dynamic context of the world economy and poses several questions as to the vulnerability and pronounced sensitiveness to external variables displayed by the Latin American economic process. The following paragraphs will pursue this topic farther.

In order to make faster headway in the present study, a selection has been made of the principal macroeconomic variables that are generally incorporated in global economic projection models, and their historical evolution since 1950 has been examined, with special and more detailed attention, in the more recent period, to the years of the last decade up to the present time. These variables are the following: (a) the gross domestic product; (b) real national income; (c) effects of the variation in the terms of trade; (d) net external financing, which is conventionally considered equivalent to the balance-of-payments deficit on current account; (e) exports of goods and services; (f) imports of goods and services; (g) profits and interest on external investment and indebtedness; (h) public and private consumption; (i) gross domestic investment, including changes in stocks; (j) ex-post domestic saving, which, according to the conventional definitions, is equivalent to the surplus of real national income over total public and private consumption.

Obviously, an analysis of the interrelationships between these variables and those

corresponding to external factors must be based on each individual country's experience: national economic policies have not been uniform, and the evolution of the variables in question has also differed from one country to another, as has the operation of the respective national economies. Moreover, considerable influence is exerted by other well-known factors, such as economic and demographic size and the stage of development through which the various countries are passing. In this analysis, even more than in others, the aggregation of countries incurs the risk of concealing precisely what one wants to know, that is to say, the specific experience stemming from the different economic policies that countries have adopted.

Consequently, in this part of the document general observations will be formulated, while in the following section comments will be made with respect to specific countries which have been selected with a view to the desirability of taking into account dissimilar national experiences. The essential aim of these country analyses is solely to describe the course followed by the process, not to evaluate the policy pursued in each of the countries in question. For that purpose further information and other background material would be required.

The information and background material supplied by the research conducted bears on various essential aspects of the operation of the national economies in relation to external variables. The following are among the features to which allusion should be made: (i) relations between the domestic product and real national income; (ii) the degree of sensitivity, vulnerability and dependence of national economies with respect to external factors; (iii) the borrowing process and trends in total domestic investment and consumption; (iv) the nature of the external bottleneck. This part of the analysis suffers from certain limitations inasmuch as it does not take into consideration other aspects of special importance, such as those relating to the countries' economic policies and in particular their trade policies; to living conditions; to the displace-

ment of production technologies; and to the participation of transnational enterprises.

The decline in the growth rate of the domestic product during recent years has been accompanied by a considerable increase in payments of profits and interest on external investment and debt, and in many cases by declines in the purchasing power of exports attributable to the deterioration of the terms of trade. The substantial rise in external profits and interest payments is due to two factors: one is the greater indebtedness and the other is the marked upswing in interest rates. In this connection it is illustrative to point out that in a group of sixteen countries, which does not include Ecuador, Bolivia and Venezuela, net payments of profits and interest represented in 1981 3.6% of the gross domestic product, whereas in the 1950s and 1960s the corresponding percentage was not even 1.5%.

The significance of the amount of such payments becomes more clearly apparent if it is taken into account that the proportion of gross domestic investment they represent was as high as 15%. In many individual countries the relative importance of these transfers was still greater than for the sixteen countries as a whole. These relations, because of the substantial changes that have taken place in them, are in marked contrast to those prevailing in the early 1970s. If, moreover, the effect of the deterioration in the terms of trade is added to this, an even higher figure would be reached which may be interpreted as a major erosion of the gross domestic product of many non-petroleum-exporting countries, since to determine real national income both these concepts must be deducted from the domestic product. According to one estimate, the terms-of-trade effect plus payments of profits and interest signified in 1981 a decrease of 5.5% in the gross domestic product of a group of 15 non-petroleum-exporting countries, excluding Mexico and taking 1975 as the base year for the terms of trade. This reduction represents one-fourth of the amount of those countries' gross domestic investment.

In chapter I a description was given of

the evolution of the economic growth rate of the countries of the region and the course simultaneously followed by some external variables, and in the preceding paragraphs of this chapter an attempt was made to outline the similarity between the evolution of the annual economic growth rate of the region as whole and the growth rates of the domestic product of the group constituted by the seven largest industrial countries. With respect to this latter piece of research, it is very important to recall that while throughout the whole of the 1970s the average level of Latin America's economic growth rate stood higher than the annual growth rates of the domestic product of the industrial countries, in 1981, for the first time, Latin America showed a negligible growth rate which virtually coincided with that of the industrial countries, while in 1982 a contraction in the absolute levels of Latin America's domestic product took place, just when those of the industrial countries, taken as a whole, stagnated. These recent trends are yet another indication of the depth of the crisis that is affecting the region.

Generally speaking, and with particular reference to the non-petroleum-exporting countries of Latin America, the interrelationships between external factors and the rate of economic growth might be synthesized in line with the same periods used in describing the global evolution of the economy in chapter I.

(a) In the early 1970s the marked dynamism of economic growth was spurred by a deliberate national policy of growth which was reinforced by an expansion of exports and a simultaneous improvement in the terms of trade.

(b) In the biennium 1974-1975 exports of goods and services remained static and the terms of trade considerably deteriorated. These unfavourable factors made their influence felt in 1975, and the economic growth rate was relatively low in comparison with that corresponding to the preceding period. The countries tried to keep their growth rates up to a certain level and resorted to external borrowing (and also to their reserves) to cope with the balance-of-

payments deficit. A policy was thus initiated which attempted to maintain a fairly dynamic economic process on the basis of external loans, access to which was relatively easy because of the expansion of available international resources generated by the balance-of-payments surpluses of the petroleum-exporting countries.

(c) During the period of moderate recovery which extended up to the end of the 1970s, the economic scene was characterized by the following features:

(i) a deliberate export promotion policy was pursued, and export growth rates were high, but at the same time external borrowing to finance the balance-of-payments deficits continued to increase, especially in the later years of the period;

(ii) the servicing of this debt ultimately proved to be very difficult to absorb, especially in view of the rise in interest rates;

(iii) the deterioration of the terms of trade did considerable harm to many countries of the region; and

(iv) payments of interest and profits increased and represented growing proportions of the domestic product in almost all the countries of the region.

(d) In 1981 and 1982 this economic and financial process reached a crisis, the most characteristic features of the situation being essentially the following:

(i) difficulties in continuing to step up external borrowing;

(ii) a considerable increase in debt servicing, which represents a very high proportion of current export earnings; and

(iii) unfavourable prospects for export expansion owing to the prolongation of the crisis in the industrial countries and at the world level.

These aspects of the interrelationships between external factors and the national economic process might be considered, in part at least, of a conjunctural character. The key question of the vulnerability and dependence of the rate of economic growth, however, is essentially a matter of the asymmetry in the economic and technological structure of domestic production and in the trade flows between developing and industrial countries.

Thus, the Latin American countries, despite the progress made in the economic and technological diversification of their domestic production and of their sales abroad, are exporters of primary commodities with differing degrees of processing and of manufactures with a low technological content, whereas their imports from the industrial countries comprise intermediate products that are essential for economic activity and capital goods required for the establishment of basic infrastructure and for capital accumulation to increase production capacity and make headway in the incorporation of technological innovations. In these circumstances, when the capacity to import is reduced—and taking into account the policy applied in relation to external financing and the terms for its use—national economic policy is confronted with several independent or complementary options, namely: (a) promotion of a decline in domestic demand in order to reduce imports, which, as is common knowledge, has a high social cost in terms of employment and income distribution, apart from the fact that such a policy may take a long time to produce the results hoped for; (b) containment or selective control of imports to limit purchases of non-essential goods from outside, to which end the adoption of specific policies and measures is necessary; (c) deliberate policies to promote greater expansion and diversification of exports, although they may have no immediate effect of much significance; and lastly, (d) promotion of an efficient industrialization policy, which, of course, goes beyond short-term conjunctural problems and is identified with the basic and essential aspects of the national economy's development strategy and economic and technological transformation.

Over the short term, and especially when there is no significant margin of compressible imports, economic policy generally tries to avoid a contraction in the supply of imported intermediate products in order not to affect the level of economic activity and employment, since this would mean restrictions on imports of capital goods, which, in their turn, would affect the formation of production capacity for the immediate future.

Another topic of special relevance for conceptual propositions on development strategy and for the praxis of economic policy is that of the relative changes that might take place in the course followed by domestic investment and total consumption when variations occur in external financing, which in these analyses may be considered as the contribution of external resources to the formation of the total mass of available goods and services.

In this connection, it is worth noting that the amounts of external financing tend to be absorbed, at least to a large extent, by remittances of external profits and interest (although this situation varies from one country to another), and that in these circumstances external transactions, despite the big balance-of-payments deficits, do not make any real contribution to the total supply of available goods and services, especially in cases where the amount of financing is only equivalent to the payments of profits and interest.

In the more general case in which external saving really does contribute with an inflow of real resources to the total supply

of goods and services, there is nothing to guarantee that in the economic process this contribution will be reflected in an increase in the relative participation of domestic investment in total goods and services, and a decrease in the share of total consumption. As a matter of fact, the research carried out shows that several situations may arise in different countries, as well as within one and the same country at different times. Thus, while numerous cases are to be found, particularly among countries with a high degree of economic dynamism, in which the growth of net external financing is accompanied by an expansion of imports and an increase in the participation of domestic investment in total goods and services, there are also many instances in which this does not happen. Hence it would seem that while in the experience of a number of countries external indebtedness has gone hand-in-hand with an increase in production capacity, elsewhere it has been accompanied by a process through which, to some extent, there has been an increase in the share of total consumption, or else the pre-existing relative distribution has been maintained.

B. SOME SALIENT FEATURES OF THE INTERRELATIONS BETWEEN THE EXTERNAL SECTOR AND THE NATIONAL ECONOMIC PROCESS IN A GROUP OF COUNTRIES

1. *The case of Brazil*

Brazil's experience clearly shows the interrelations between the economic process and external variables in the context of different stages of development and of the strategies and policies adopted in each of these. In the course followed by economic development since the Second World War three phases can be identified:

(a) The so-called 'import substitution' phase, which extended up to the mid-1960s, and during which imports and exports grew much less than the gross domestic product, which rose during the period in question at an average annual rate of a little over 6%.

(b) From the mid-1960s up to 1974, the Brazilian economy attained peak indexes

of economic development. So dynamic was it that the gross domestic product increased at an annual rate of approximately 8.5%. In the framework of this intense dynamism the economy underwent sweeping changes in production and technology and exports and imports expanded even faster than the domestic product.

(c) From the mid-1970s up to the present time, the rate of economic growth has declined, and although its average level remained relatively high during the period 1975-1980 (an average annual rate of 6.5%), it dropped in absolute terms in 1981 (-1.9%). The data available indicate that the gross domestic product virtually stagnated in 1982 (0.5%). The factors that have most conspicuously influenced this evolution in

recent years are undoubtedly the high balance-of-payments deficit on current account, which led to a substantial increase in the external debt; the heavy financial servicing of this debt, augmented by the rise in interest rates; and the negative effect of the deterioration in the terms of trade.

The action of these various factors has created a typical external bottleneck in Brazil's economic development process. And the most significant aspect of this situation is the fact that the external constraint does not originate in a slackening of exports, since the growth of these was speeded up and diversified; nor does it lie in an expansion of imports, which, on average, remained static or increased only slowly as from 1975; rather has it been determined by the servicing of the heavy external debt and the unfavourable evolution of the terms of trade. The figures bear eloquent witness to this situation. In 1981, payments of external profits and interest alone represented 3.2% of the product, whereas in the 1950s and 1960s the corresponding proportion did not exceed 1%. Moreover, the effect of the deterioration in the terms of trade (on the basis of 1975 prices) was equivalent to 3.7% of the product in the year in question. As for net external financing in 1981, it amounted to 3.7% of the product: a similar proportion to that of payments of profits and interest. This exposes the vicious circle into which the flow of external financing is sinking: payments of profits and interest and a further increase in debt.

Another aspect of special interest is the evolution of gross domestic investment, domestic saving and total public and private consumption in the context of the various phases of Brazil's economic development. From this evolution some essential conclusions may be drawn: (a) the coefficient representing the relation between gross domestic investment and the product tended, as was to be expected, to rise with the speeding-up of the growth rate of the domestic product, and to diminish in the second half of the 1970s when the rate of economic growth declined. This trend sharpened in 1981 with the contraction of the product and investment in absolute

terms. In brief, the gross domestic investment coefficient, which had been 24% in the early 1970s, climbed to 30% in 1974 and fell back to approximately 22% in 1981; (b) as a general rule, increases in this investment coefficient occurred in the context of an economic process which stepped up the use of external financing and increased the product-elasticity of imports; (c) in these circumstances, during the first half of the 1970s the coefficient of domestic saving tended to rise, revealing a marked dynamism in the mobilization of national resources. In contrast, in the second half of the decade this coefficient gradually declined, along with the investment coefficient, while the coefficient of net external financing remained relatively high. The gross domestic saving coefficient was 21% at the beginning of the decade, rose to approximately 24% in the mid-1970s and dropped to 18% in 1981; imports of goods and services, for their part, have expanded very slowly since the mid-1970s or even decreased in absolute terms, as happened in 1981. This is another typical element in the bottleneck that is affecting the Brazilian economy.

2. The case of Costa Rica

The economy of Costa Rica is characterized by a relatively high degree of openness as regards its external trade flows. In 1981 the value of exports amounted to over 30% of the gross domestic product, with a similar figure for imports. Another important feature is the relatively large scale of external financing, which since the 1970s has come to represent about 10% of the gross domestic product (at 1975 prices); this means, in comparative terms, half of the gross domestic investment coefficient.

The rate of economic growth tended to accelerate in the 1960s and up to 1974. During the period 1964 to 1974 the gross domestic product showed an average annual growth rate of 7.2%. This trend took a drastic turn for the worse in the second half of the last decade, when the annual growth rate was only a little over 5%; it remained static in 1980, and in 1981 contracted in absolute terms by 3%.

During its period of greatest dynamism, Costa Rica's economic process was characterized by a very high growth rate of imports (an annual average of 9%), and by an even more rapid expansion of exports (an annual average rate of 11%). In contrast, as from the mid-1970s exports slackened appreciably, although with very irregular fluctuations, as was also true of import flows. In any event, the indexes of external financing in relation to the product reached very significant relative figures, which implies a substantial increase in the external debt.

The other factor which had a powerful influence on the balance-of-payments deficit was the sum represented by payments of profits on foreign investment and interest on the increasing external debt. These remittances, as a whole, rose from a little over 2% of the gross domestic product in the early 1970s to almost 7% in 1981.

The investment coefficient increased over the long term and remained at relatively high levels throughout the second half of the 1970s, despite the decrease in the rate of economic growth. In 1981, however, it underwent a drastic contraction, dropping from the average of roughly 25% for the decade to only 18%, while domestic saving accounted for only about 50% of total gross investment.

3. The case of Mexico

Throughout the years following the Second World War the Mexican economy showed a long-term economic growth trend reflected in an average annual rate of a little over 6.5%. Naturally, in the course of time, the dynamism of the economy underwent spells of decline and faster growth. Thus, in the biennium 1976-1977 the annual rate of economic growth fell short of 4%, while in the subsequent four years it exceeded 8%. This dynamism was largely due to the production and export of petroleum, and was accompanied by massive increases in gross domestic saving. The productive and technological transformation of the Mexican economy, for its part, developed in the context of a pattern of profound changes in

the nature and structures of the country's external relations.

During a first phase, up to the mid-1960s, imports and exports increased less than the domestic product, reflecting the familiar pattern of 'import substitution'; during the 1970s, in contrast, external relations broadened out considerably. This was largely due to the growing importance of petroleum exports and the consequent improvement in the terms of trade. At the same time, an expansionary policy, promoted by the inflow of capital and the liberal use of external financing, led to a considerable increase in imports during the second half of the decade, to such an extreme that their annual percentage growth was 2, 3 and even 4 times as high as the growth rate of the domestic product, particularly in the years 1980 and 1981.

Gross domestic investment (including changes in stocks) increased considerably during the 1970s. Its coefficient in relation to the gross product rose from 20.8% in the early years of the decade to 28.6% in 1981. At the same time, the relation between net external financing and the domestic product increased from 2.3% to 6.4% over the period mentioned. Thus, in 1981 the balance-of-payments deficit showed the highest absolute and relative figure in the whole of the period since the Second World War.

In these circumstances, gross domestic saving also rose, from 18.5% to 22.3%. Thus, the participation of gross domestic investment in the total supply of goods tended to increase, while the use of external financing showed an upward trend too.

The growth of the balance-of-payments deficit on current account led to the gradual accumulation of a considerable external debt. External profits and interest alone represented in 1981 4.2% of the gross domestic product, whereas in the early 1970s the corresponding figure had been only 1.4%. Furthermore, total servicing of the external debt, together with profits on foreign investment, absorbed 54.3% of current export earnings in that year. This indicates an extremely inflexible situation with respect to Mexico's external accounts,

particularly because of the relations that have to be maintained between the evolution of external debt servicing and the growth rate of exports.

4. *The case of Peru*

To judge by estimates of the gross domestic product at constant 1975 prices, over the long term the Peruvian economy attained an average annual growth rate of 5% throughout the two decades 1950-1970. This rate declined during the 1970s to an annual average of 3.5%, which improved somewhat in 1981 (4.4%).

In the 1970s imports—which in the past had increased faster than the product, especially during the 1960s—fluctuated very irregularly in one direction or the other: during the second half of the decade they declined in some years and in others increased considerably, particularly in the three-year period 1979-1981.

Exports also showed a marked instability, which up to a point is inherent in the nature and trade structure of the country's principal export products, especially fish meal. This instability, which results in signifi-

cantly wide fluctuations over the short term, detracts from the meaningfulness of comparisons between extreme years. Even so, the figures at constant 1975 prices indicate that net external financing increased appreciably during the 1970s, and also in 1981. It is estimated that on average the financing in question represented over 3% of the gross domestic product in the 1970s and approximately 7% in 1981.

This instability of the external variables affecting the Peruvian economy is also reflected in sharp fluctuations in the gross domestic investment coefficient. Generally speaking, historically this coefficient has tended to decline, and there are signs of the same trend in the second half of the 1970s. A similar behaviour pattern is to be seen in the coefficient of domestic saving in relation to the gross domestic product.

The rising trend of the balance-of-payments deficit has resulted in a considerable increase in the external debt, so that payments of profits and interest on foreign investment and the external debt came to represent 3.2% of the domestic product in 1981, whereas at the beginning of the decade this relation had been 1.8%.

III

The economic prospects of Latin American regional co-operation and some aspects of international co-operation

A. THE ECONOMIC PROSPECTS OF LATIN AMERICA

The regional Programme of Action for the 1980s, adopted at Montevideo, expresses the region's main aspirations in respect of socio-economic development. The attainment of the objectives and targets which the governments have set themselves is based on a strategy of economic and social transformation which envisages significant changes in Latin America's position in the international economy, in economic relations between the countries of the region and with other de-

veloping areas and in the socio-economic structure of the Latin American countries.

Now that the first years covered by the Regional Programme of Action have elapsed, it can be seen that the international situation, far from changing in a direction favourable to economic dynamism accompanied by better-balanced external accounts, has swung the opposite way, and its evolution has come to be a very significant element in the recession affecting the Latin American

countries. In these circumstances, the importance of many of the proposals of a regional character contained in the Programme has been heightened. Thus, in so far as the signs of international co-operation continue to be discouraging, the Latin American countries will obviously have to channel increasing proportions of their production and trade towards the markets of the region and of the rest of the developing countries, as well as towards their own domestic markets. A recovery in the developed countries' production and in world trade would undoubtedly facilitate the tasks in hand, but it clearly cannot become the *sine qua non* for the Latin American countries to regain their economic dynamism.

In the earlier chapters of this article the repercussions of the world recession on the Latin American countries were discussed. The data for 1981 and the provisional information available for 1982 show that external disequilibria have seriously weakened economic growth and have had serious effects on the social situation. In these circumstances, changes in policy have come about which, with greater or lesser degrees of emphasis, are switching the possibilities of reactivation to the domestic and regional markets. A process of negotiation on external financing transactions is also under way, its aim being to make the balance-of-payments situation manageable. But even if progress is achieved in the fields of trade and finance, it seems hardly likely that the general recessive effects transmitted from the developed world can be significantly counteracted in 1983. Accordingly, the following review of prospects is based on the assumption of a more important recovery as from the biennium 1984-1985, as a step towards greater acceleration of economic dynamism in the second half of the 1980s.

The normative objectives and targets pursued by the region were clearly established in the Regional Programme of Action, and there is no intention here of preparing new projections of that kind. It has been thought useful, however, to present two exercises of a preliminary nature whose sole purpose is to offer provisional orders of

magnitude as regards the effects that a recovery of economic dynamism would have on the main internal and external macroeconomic factors of equilibrium. Basically, the exercises differ from each other in their assumptions as to the economic evolution of the developed countries and of world trade. Obviously, the more vigorous the reactivation of the developed economies, the better are the chances that the second half of the 1980s will usher in a level of dynamism more in line with that contemplated in the International Development Strategy for the Third United Nations Development Decade.

In the period 1983-1985 a moderate reactivation is expected, enabling the region to attain average growth rates somewhat below 4% for the period 1981-1985. If this recovery were to be combined with a growth rate of about 6% during the second quinquennium, the average rate for the whole decade would approach 5%. If, as already stated, the growth rate achieved in the second quinquennium were slightly higher than 7%, the decade would end with an average of approximately 5.6% (see table 1).

The mere study of these aggregate figures reveals how deeply the region would be affected by the crisis. There can be no doubt that the reduction of the average economic growth rate for the decade will have profound repercussions on the economic and social situation.

In the economic field, it will be necessary to cope with a state of indebtedness that will weigh heavily on the external accounts for a lengthy period, which will unquestionably be prolonged in so far as external demand and the terms of trade fail to recover. Similarly, the producer sectors will have to readapt themselves to new demand and supply conditions.

As regards the social aspects of the situation, setbacks in terms of employment and distribution have occurred in the first years of the decade which will be far from easy to reverse. An accentuation of the social orientation of policies thus becomes indispensable, both for reasons of equity, and as an indispensable requisite for the reactivation of the domestic markets.

Table 1
LATIN AMERICA (19 countries):^a DISTRIBUTION OF GROSS DOMESTIC PRODUCT
AND EVOLUTION OF THE EXTERNAL SECTOR

(Percentage annual growth rates)^b

Year	Gross domestic product	Gross domestic investment	Total consumption	Exports of goods and services	Imports of goods and services	Terms-of-trade effect	Net payments of profits and interest	Net external financing ^c
1970-1980	5.9	7.4	6.3	4.2	8.6	--	8.2	12.1
1981	1.1	-1.2	0.6	7.8	1.7	--	41.2	29.5
A								
1981-1985	3.8	4.7	3.1	4.6	2.5	--	6.1	-0.5
1985-1990	6.0	4.9	6.2	7.1	6.2	--	3.7	0.7
A 1								
1981-1985	3.8	4.7	3.1	4.6	2.5	--	1.3	-4.4
1985-1990	6.0	4.9	6.2	7.1	6.2	--	2.5	-1.2
B								
1981-1985	3.8	4.7	3.1	4.6	2.5	--	6.1	-0.5
1985-1990	7.1	8.9	6.3	8.5	7.8	--	4.1	3.1

Source: CEPAL, on the basis of official data.

Note: "A" exercise assumes recovery of the growth rate of the gross domestic product of the 1970s in the second half of the 1980s.
"A 1" exercise corresponds to exercise "A" plus the hypothesis of a decrease in average interest rates from 12% to 10% in the decade, with maintenance of export requirements.
"B" exercise assumes recovery and acceleration of the growth rate of the gross domestic product during the second half of the 1980s.

^a Not including Cuba or the English-speaking Caribbean countries.

^b Of values at 1975 prices.

^c Including net private donations.

At the opening of the 1980s, the Secretariat drew attention to the nature and magnitude of employment problems. To these difficulties, significant in themselves, must now be added the consequences of the virtual absence of economic growth in 1981-1982. It is estimated that in this biennium the labour force increased by about 5.5%, and for the mere reason that there has been no increase in job opportunity a rise of about 5 points should be expected in the percentage of overt unemployment. Moreover, the crisis has compelled some enterprises to step up their productivity and others to declare themselves bankrupt and close down altogether. Thus, even if as from 1983 a level of activity were regained similar to the 7% which

Secretariat studies assumed necessary in order to absorb the growth of the labour force and gradually reduce underemployment, the period 1983-1990 would start with a backlog of overt unemployment amounting to more than 10%. Given the present style of development, many years of rapid economic growth will be needed for the productive absorption of this contingent of human beings that has been cut off from job opportunities. Although part of this group may possibly find forms of underemployment which are not reflected in overt unemployment statistics, it is indispensable to reinforce the employment policies contained in the Regional Programme of Action in order to tackle so serious a problem.

Table 2
LATIN AMERICA (19 countries):^a DISTRIBUTION OF GROSS DOMESTIC PRODUCT
AND EVOLUTION OF THE EXTERNAL SECTOR

(Percentages with respect to gross domestic product)^b

Year	Gross domestic product	Gross domestic investment	Total consumption	Exports of: goods and services	Imports of goods and services	Terms-of-trade effect	Net payments of profits and interest	Net external financing ^c
1970	100.0	21.7	75.5	15.6	12.8	-3.0	1.9	2.2
1980	100.0	24.9	78.3	13.3	16.5	1.7	2.4	3.9
1981	100.0	24.3	78.1	14.2	16.6	0.8	3.4	5.0
A								
1990	100.0	23.9	76.6	15.4	15.9	0.5	3.3	3.3
A 1								
1990	100.0	23.9	76.6	15.4	15.9	0.5	2.6	2.5
B								
1990	100.0	27.4	73.3	15.6	16.3	0.6	3.2	3.5

Source: CEPAL, on the basis of official data.

Note: "A" exercise assumes recovery of the growth rate of the gross domestic product of the 1970s in the second half of the 1980s.
"A 1" exercise corresponds to exercise "A" plus the hypothesis of a decrease in average interest rates from 12% to 10% in the decade, with maintenance of export requirements.
"B" exercise assumes recovery and acceleration of the growth rate of the gross domestic product during the second half of the 1980s.

^a Not including Cuba or the English-speaking Caribbean countries.

^b On the basis of values at 1975 prices.

^c Including net private donations.

The fall in real wages is another source of profound concern. Postulating such a reduction as a condition for an increase in employment and domestic saving might have adverse effects on the role that it is desired to assign to the domestic market in economic recovery, and on the social objectives sought-for in the development process. What seems essential in this respect is a simultaneous revision of policies relating to the consumption and saving of the upper income strata and of the government. The consolidation of a domestic market, in which the participation of the broad masses and the process of capital accumulation acquire increasing importance and require a high degree of permanence, will be a decisive

factor in the definition of policies concerning real wages, saving and investment.

The degree of dynamism postulated in the exercises will call for growth rates of saving and investment, similar to or somewhat greater than those recorded over the long term. Of course, to reach investment percentages ranging from 24% in 1990 (according to the first exercise) to 27% (according to the second exercise) will require an extra effort in view of the deterioration shown by the initial situation today (see table 2).

These amounts of investment represent, moreover, a demand component of the greatest importance for development strategies in which regional integration will play

Table 3
LATIN AMERICA (19 countries):^a DISTRIBUTION OF GROSS DOMESTIC PRODUCT
AND EVOLUTION OF THE EXTERNAL SECTOR

(Millions of dollars at 1975 prices)

Year	Gross domestic product	Gross domestic investment	Total consumption	Exports of goods and services	Imports of goods and services	Terms-of-trade effect	Net payments of profits and interest	Net external financing ^b
1970	253 930.7	55 206.7	191 704.9	39 547.4	32 528.3	-7 692.3	4 941.3	5 615.1
1980	451 011.7	112 423.5	352 982.3	59 902.3	74 296.4	7 740.4	10 894.6	17 549.0
1981	456 127.2	111 031.6	356 124.5	64 555.4	75 584.3	3 688.2	15 385.8	22 724.9
A								
1985	529 143.6	133 280.6	401 976.4	77 176.0	83 289.8	3 134.9	19 473.9	22 286.6
1990	707 776.3	169 129.4	542 111.7	108 894.2	112 358.7	3 790.5	23 408.4	23 034.3
A-1								
1985	529 143.6	133 280.6	401 976.0	77 176.0	83 289.8	3 134.9	16 179.6	18 992.5
1990	707 776.3	169 129.4	542 111.7	108 894.1	112 358.7	3 790.5	18 349.2	17 855.8
B								
1985	529 143.6	133 280.6	401 976.4	77 176.0	83 289.8	3 134.9	19 473.9	22 286.6
1990	745 015.0	203 871.9	546 215.0	116 138.7	121 210.2	4 524.1	23 759.0	25 918.5

Source: CEPAL, on the basis of official data.

Note: "A" exercise assumes recovery of the growth rate of the gross domestic product of the 1970s in the second half of the 1980s.
"A 1" exercise corresponds to exercise "A" plus the hypothesis of a decrease in average interest rates from 12% to 10% in the decade, with maintenance of export requirements.
"B" exercise assumes recovery and acceleration of the growth rate of the gross domestic product during the second half of the 1980s.

^a Not including Cuba or the English-speaking Caribbean countries.
^b Including net private donations.

a more important role than in the past. The investment required in 1990 for the 19 countries under consideration to attain the growth rate for the gross domestic product envisaged in the first exercise (5.0%) would be about US\$ 170 000 million at 1975 prices, while this figure would rise to US\$ 204 000 million if the targets established in the second exercise were to be reached (see table 3). The size of the investment requirements reflects a significant potential demand which would have to be taken into account in drawing up any industrial complementarity or intra-regional co-operation programme.

Similarly, the speeding-up of the growth rate will necessitate appreciable in-

creases in domestic saving. By the end of the decade the coefficient of this in relation to the domestic product would exceed 20% and 23% in the two exercises, and this would require annual growth rates of 5.8% and 8.1%, respectively, as from 1981. It should be noted that this increment in domestic saving is indispensable if, as will be presently explained, the relative importance of the external debt is to be appreciably reduced.

One of the central problems with which the Latin American countries have to cope in the present economic conjuncture is the critical balance-of-payments situation, whose characteristics have already been discussed in some detail. In this context, it is useful to explore some policy lines which may facili-

tate placing the region on a new footing in the international economy, reducing the impact of external pressures, and undertaking joint action at the regional level whereby Latin America will be enabled to meet the challenge of the existing situation.

In external relations, three broad areas of action are generally distinguished in which measures could be adopted to further an appreciable improvement in the delicate situation of the Latin American external sector: international trade; external financing, and international co-operation. In the field of international trade, it is clearly necessary that measures should be directed towards a decisive increase in export earnings, either through expansion of the volumes exported or through an improvement in prices, or through both these things at once; attention should also be devoted to the region's possibilities of itself supplying increasing percentages of imports with a satisfactory degree of economic efficiency. In the area of external financing, it is indispensable to seek a redefinition of the terms (loan periods and rates of interest) on which these resources have been transferred to the Latin American countries. Lastly, in the sphere of international co-operation, the region should take concerted action to obtain better conditions of access to the markets of the industrialized economies and should intensify intra-regional collaboration and co-operation with other countries of the Third World. As this last area to a certain extent overlaps the first two and possible propositions are closely linked to those put forward in respect of them, the analysis will be focused on the first two aspects in question.

Obviously, solutions based on the expansion of international trade would tend to give the region a greater degree of autonomy than those that postulate a moratorium in the servicing of the external debt, since they depend more on the countries' own decisions. They involve not only the capacity to generate increasing flows of exportable products, but also, and to a very important extent, concerted intra-regional action. The first requisite is linked to the creation and adaptation of domestic production capacity which will allow of a more vigorous and

diversified export drive; thus, an indispensable step is the strengthening of the economic structure and its readjustment in this direction. Concerted action, for its part, calls for regional integration and co-operation, which must be regarded as an essential component of the dynamism of exports, both from the standpoint of the broadening of markets through regional co-operation, and from that of united action and adoption of joint policies in trade negotiations with the industrialized countries.

These two aspects have already been underlined in the Regional Programme of Action in the context of the need to boost export earnings. In the projections prepared to that end⁶ attention was drawn to the changes in the composition and destination of exports needed to make this increase in earnings possible. Another point emphasized was that manufactures ought to become the most dynamic Latin American export item, and that efforts to boost them should be based mainly on intra-regional trade.⁷ Moreover, a significant effort would have to be made to increase exports of primary commodities and fuels, to expand trade with other developing areas and with the socialist countries, and to secure a more co-operative attitude on the part of the industrial countries.

The serious deterioration in the terms of trade which took place in 1981-1982 has placed the region in an extremely delicate situation. The greater the recovery in the prices of Latin American exports, above all those of primary commodities, the easier it will be to cope with the balance-of-payments problems. This possibility, however, is largely outside the range of the region's power of decision. In contrast, the expansion of intra-regional trade depends to a

⁶ *Latin American Development Projections for the 1980s* (E/CEPAL/G.1158/Rev. 1), United Nations publication (Santiago, Chile), April 1982.

⁷ The proportion of total exports accounted for by manufactures would have to rise from 15% at the present time to 42% in 1990, which would require annual growth rates of about 17%. Intra-regional trade, on its part, would have practically to double its participation.

great extent on internal decisions. In so far as the pertinent targets set forth in the Regional Programme of Action are attained, a change in the terms of trade should occur in consequence of the greater symmetry that foreign trade would acquire.

As regards net external financing, possible lines of action are very largely conditioned by the region's present situation of indebtedness. The high levels of the external debt and its servicing clearly reveal the impossibility of keeping up the trend which net external financing has been following in recent years. Consequently, possible measures would have to be directed towards relieving pressure on the balance of payments through a change in the terms of the existing debt and an inflow of new credits which, by virtue of the special terms on which they were extended, would not result in additional pressure.

The foregoing aspects have been taken into account in the projection exercises cited, with the aim of bringing them to the fore, establishing certain orders of magnitude in the external macroeconomic relations, and analysing their possible implications.

The projections have established the reduction of relative levels of indebtedness as an essential condition for more balanced management of the external accounts. To that end, a gradual decrease in the external financing/product ratio is assumed, so that by 1990 the percentage in question would be more or less similar to the average for the 1970s. In Latin America's case, this would mean bringing it down from 5.0% of the gross domestic product in 1981 to 3.4% in 1990. This proposition is complemented by another which postulates that debt servicing should not exceed a predetermined proportion of the value of exports. Secondly, it is assumed that the terms of trade will remain constant at their 1981 level, which constitutes a relatively pessimistic hypothesis, based on the observations made in earlier paragraphs. A final hypothesis is that the terms of the external debt as regards loan periods and rates of interest will more closely resemble those of the second half of the 1970s than those of today, which implies the assumption that the region will

have some degree of success in the negotiation of its debt.

The internal repercussions of this relative decrease in external financing would be reflected, as already pointed out, in a rise in the levels of domestic saving. In this connection, it should be noted that the participation of saving in the financing of total gross investment would climb from the level reached in 1981 (almost 80%) to 86% and 87% in 1990 in the two respective exercises.

Within the frame of reference described, in both exercises imports would grow at the very slow rate of 2.5% up to 1985. This would reflect on the one hand the effects of the recession on the countries' foreign trade, and, on the other, the restrictive policies that have been applied on account of the balance-of-payments problems already referred to. After 1985, given the speeding-up of economic growth and the improvement of lending terms that are postulated, import requirements to sustain such growth will be considerably greater. For the region as a whole, their annual rate of increase would have to be higher than that of the gross domestic product: i.e., 6.2% in the first exercise (against 6% for the product) and 7.8% in the second exercise (7.1% for the product). These rates imply, however, a decline in the long-term product-elasticity of imports (see table 1).

The exports projected are such as would correspond to the earnings required for financing the imports in question and attaining the expected level of net external financing. These amounts necessitate relatively high growth rates in both exercises. In the first they are reflected in an annual rate of 6.0% in the period 1981-1990, and in the second the rate rises to 6.7%. It is worth noting that the necessary rate of expansion of exports fits fairly easily into the export potential developed by the region in recent years; it must not be forgotten, however, that measures and decisions in international trade are of a multilateral character, which makes it indispensable to strengthen the system of international co-operation if the goals established are to be reached.

Export expansion requirements are determined not only by the relatively high

Table 4
LATIN AMERICA (19 countries):^a EVOLUTION AND PROJECTIONS OF THE EXTERNAL SECTOR
(Percentages on the basis of current prices)

Year	Percentage relations with respect to exports of goods and services					Relation between external debt and gross domestic product ^c
	Net payment of profits and interests	Net external financing ^b	Servicing of external debt			
			Capital	Interest	Total	
1970	16.1	17.8	12.8	5.5	18.3	...
1980	16.9	26.7	17.4	13.2	30.7	25.9
1981	23.2	33.5	19.8	18.8	38.6	27.9
A						
1985	24.5	28.1	24.3	19.1	43.3	26.8
1990	21.3	21.3	20.4	16.5	36.9	22.9
A 1						
1985	20.4	24.0	23.2	15.1	38.2	25.3
1990	16.6	16.6	18.0	12.2	30.2	19.5
B						
1985	24.5	28.1	24.3	19.1	43.3	26.8
1990	20.1	20.8	19.2	15.6	34.8	22.1

Source: CEPAL, on the basis of official data.

Note: "A" exercise assumes recovery of the growth rate of the gross domestic product of the 1970s in the second half of the 1980s.
"A 1" exercise corresponds to exercise "A" plus the hypothesis of a decrease in average interest rates from 12% to 10% in the decade, with maintenance of export requirements.
"B" exercise assumes recovery and acceleration of the growth rate of the gross domestic product during the second half of the 1980s.

^a Not including Cuba or the English-speaking Caribbean countries.

^b Including net private donations.

^c On the basis of values at 1975 prices. The debt balance was deflated by the implicit index of imports of goods and services.

economic growth rates which are postulated for the second quinquennium, and which are reflected in large volumes of imports, but also by the heavy external debt accumulated and the high interest rates in force. The accumulation of external indebtedness has generated servicing costs which call for abundant export earnings to meet the targets established with respect to external financing. Analysis of the period 1981-1985 makes this clear. As already noted, while imports should increase by only 2.5% a year, exports would need to do so by 4.6%. If it is taken into account that in 1981 the servicing of the external debt absorbed about 40% of current export earnings, it becomes obvious that a relation of this magnitude cannot be kept up without aggravating the already delicate balance-of-payments situation; hence the proposal that it should be reduced to about 35% by the end of the decade (see table 4).

As already noted, the restrictions imposed on net external financing in relation

to the product, and on the servicing of the external debt in relation to export earnings necessitate a major effort to increase exports. In any case, however, such an effort is inevitable if Latin America's external sector is to be placed on a sound footing and the bases are to be established for achieving a form of economic growth less vulnerable to external vicissitudes. Although it might be possible to obtain more external financing than is projected in these exercises, requirements in respect of export earnings would not appreciably decrease, because of the high percentage which is tied up in the servicing of the external debt and which is precisely what it is proposed to reduce. In this connection it should be pointed out that even with the severe restrictions imposed on external financing, the servicing of the external debt would rise by 1990 to about US\$ 175 000 million: a sum almost four times as large as that paid out in 1981 (see table 5).

Attention has previously been drawn to

Table 5
 LATIN AMERICA (19 countries):^a EVOLUTION AND PROJECTIONS OF EXTERNAL
 SECTOR FINANCIAL VARIABLES
 (Millions of dollars at current prices)

Year	Net payments of profits and interest	Net external financing ^b	External debt servicing			Exports of goods and services
			Capital	Interest	Total	
1970	2 751.1	3 046.6	2 195.9	938.9	3 134.8	17 106.8
1980	17 956.6	28 256.0	18 474.5	14 031.9	32 506.4	106 011.0
1981	26 558.0	38 369.8	22 667.2	21 599.7	44 219.9	114 676.9
A						
1985	51 222.9	58 741.2	50 682.9	39 809.7	90 492.6	208 852.6
1990	100 364.9	100 260.3	96 097.3	77 830.8	173 928.1	471 712.9
A-1						
1985	42 622.8	50 141.1	48 370.6	31 489.5	79 860.4	208 852.6
1990	78 477.4	78 372.9	85 032.0	57 620.4	142 652.4	471 712.6
B						
1985	51 222.9	58 741.2	50 682.9	39 809.7	90 492.6	208 852.6
1990	101 314.2	104 822.4	97 162.3	78 658.2	175 820.5	505 163.8

Source: CEPAL, on the basis of official data.

Note: "A" exercise assumes recovery of the growth rate of the gross domestic product of the 1970s in the second half of the 1980s.
 "A 1" exercise corresponds to exercise "A" plus the hypothesis of a decrease in average interest rates from 12% to 10% in the decade, with maintenance of export requirements.
 "B" exercise assumes recovery and acceleration of the growth rate of the gross domestic product during the second half of the 1980s.

^a Not including Cuba or the English-speaking Caribbean countries.
^b Including net private donations.

the importance attached to the high interest rates in the world financial situation in recent years. With the aim of examining the implications of lower interest rates for external-sector variables, another exercise was carried out, derived from the first, in which the average rate of interest was lowered by two points and export requirements remained the same as in the first exercise. The results show a marked reduction in 1990 of the percentages of the gross domestic product represented by net payments of profits and interest, on the one hand, and net external financing on the other; in both cases these relations fell from approximately 3.3% to 2.5%. Furthermore, the servicing of the external debt would correspond to about 30% of current export earnings and the coefficient of the external debt in relation to the gross domestic product would drop from 23% to 19% in the same year. The significance of this reduction becomes

clearer still if it is borne in mind that in this case the servicing of the debt by 1990 would amount to only US\$ 143 000 million, that is to say, US\$ 31 000 million less than in the reference example (see table 4). It is important to note that this considerable impact is closely linked to the maintenance of the export earnings assumed in the basic exercise.

To sum up, the results obtained make it possible to show not only the magnitude of the balance-of-payments problem and the principal factors that determine it, but also the considerable effort demanded by certain policies designed to bring about a more balanced external situation. In this context, orders of magnitude are presented which make it possible to evaluate the absolute and relative importance that might be attached to increased export earnings and to new terms and amounts of external financing.

Lastly, the achievement of more equi-

librium in the balance-of-payments situation will necessitate a set of measures relating to external financing and trade. In view of the importance of the subject, the other two sections of the present chapter are devoted to

the suggestion of lines of action and policy measures for regional co-operation with other developing areas and with the developed countries.

B. REGIONAL CO-OPERATION AND ECONOMIC INTEGRATION

1. *Priority areas*

Latin America has already demonstrated its ability to produce a large proportion of consumer manufactures, but it still shows considerable limitations in the manufacture of capital goods, intermediate products and certain consumer goods for which advanced technology is required. It is precisely these lines of production that need economic spaces which, as a general rule, exceed those separately offered by the national markets of the Latin American countries. Consequently, integration and co-operation are irreplaceable in their significance as basic mechanisms for complementing and accelerating these countries' industrialization processes, without, of course, detracting in any way from the importance of the role they may also play in strengthening intra-regional commodity trade.

There are naturally innumerable ways in which pooled action can make a substantial contribution to the attainment of the objectives indicated, while at the same time helping to reach other goals of interest to the Latin American countries.

In an ECLA document presented at the nineteenth session of the Commission (Montevideo, May 1981)⁸ a descriptive list was given of the possible priority areas for co-operation in the decade now beginning. This seems an appropriate opportunity for a review in somewhat greater depth of those spheres of action in which the Latin American countries should concentrate their co-operation efforts.

Thus, taking for granted the indispen-

sable and resolute support of the countries of the region for the various integration schemes existing in Latin America and the Caribbean —whose ultimate objective is essentially to create an area or subregional market which will promote an industrialization process of greater depth and scope— the following pages analyse the fields in which co-operation can do a great deal to speed up the development of the countries of the region.

2. *Joint rational development of natural resources and compensation for regional disequilibria*

Efforts should be made to initiate or continue co-operative action to bring about: (i) a greater degree of self-reliance in regional supplies of food and raw materials in general; (ii) joint use of shared resources, such as water; (iii) re-channelling of trade flows in respect of primary commodities which the region exports to third countries and at the same time imports from the countries in question; and (iv) improvement of income from commodity exports, through an increase in local processing which will raise their incorporated value added and lead to greater national participation in the distribution and marketing phases, as well as to a stronger position in international commodity negotiations. All these initiatives should be undertaken in an adequate framework of rational use of resources.

3. *Energy*

In this field there are major areas which have not yet been the subject of sufficient attention, including, *inter alia*, the development of non-traditional energy resources; the

⁸ See ECLA, *Regional integration and co-operation in the 1980s* (E/CEPAL/G.1151), April 1981.

systematization of full, rapid and accurate information, especially with regard to petroleum and petroleum products; manpower training; management of enterprises; and, in general, everything related to energy economics and technology. Lastly, it would be of interest to continue in greater depth co-operation efforts such as those made in recent years by Mexico and Venezuela with a view to relieving the situation of the Central American and Caribbean countries which are net petroleum importers.

4. Physical integration and co-operation in transport, communications facilities and other public services

In order to surmount the obstacles posed by the long geographical distances existing between the countries of the region and to promote more efficient utilization of the existing infrastructure, it is important to pursue the initiatives aimed at facilitating the movement of persons and goods and at interconnecting the various transport and communications media. It will also be necessary to promote closer collaboration—especially in respect of the technology and production of certain inputs and capital goods—in other public services such as drinking water, irrigation, urban sanitation and metropolitan urban railway systems.

5. Food and agriculture

In this sector there is much potential room for co-operation activities in such fields as technology, foreign trade and the region's ability to supply its own food requirements. Complementarity in production, in line with climatic characteristics or the type of land available, may give rise to long-term supply agreements between groups of countries. Another point to note is that limitations in the available supply of foreign exchange and in other respects make it advisable that the region should produce as much of the food it requires as possible.

6. Science and technology

Science and technology are linked with all

productive activities and with the creation, application, dissemination, control and ownership of knowledge. Among the co-operation activities of regional interest may be mentioned the strengthening of scientific and technological capacity; promotion of the adaptation or creation of technology connected with priority sectors (energy, food, capital goods, etc.); interconnection of scientific and technological networks; organization of Latin American multinational technological enterprises; financing for scientific and technological development, and the adoption of common regional positions in international negotiations on such matters as industrial property and a code of conduct in technology.

7. Co-operation in industry

Apart from moves towards the creation of a common market, whose main beneficiary would be manufacturing industry, there are other co-operation activities at the level of specific branches of industry or individual enterprises, both public and private. Complementarity or joint programming of industrial branches of high capital density and volume and with large scales of production, such as petrochemicals, the aluminium industry, shipbuilding, the iron and steel industry or the production of electronic components, may contribute to a considerable increase in their efficiency and feasibility. A similar case is that of capital goods or heavy equipment, which call for continuity of demand and substantial production orders.

8. Financing

There now exist financial mechanisms, both on a regional scale and within the integration systems, intended to facilitate trade between such systems, to support countries with balance-of-payments deficits and to finance projects relating to integration industries. Nevertheless, co-operation in seeking new sources of financing inside and outside the area and in putting into operation an export insurance system is still of great importance, especially in order to cope with

the needs for long-term credit generated by the energy disequilibria of many countries of the region, by the urgent need to create and consolidate new export flows, by the additional demand for financing which will result from increased trade in capital goods, and by the need to concert major financial arrangements in support of binational or multinational co-operation activities.

At all events, present circumstances open up the opportunity of improving the forms of regional and subregional financial co-operation in Latin America already in existence as suggested above. It would therefore be desirable:

(a) To give greater impetus to the negotiations being conducted to secure larger amounts of reciprocal credits and longer repayment periods under the ALADI system of compensation of balances and reciprocal credits. The success of this system, which has been in operation for more than 15 years, warrants extending the time limit for compensation of balances to 6 months, which would mean likewise enlarging reciprocal credit amounts so that as far as possible payment before the end of the compensation period could be avoided;

(b) To interlink the payment systems of the Central American Common Market and of ALADI. The interconnection of these systems, which would make it possible to operate at the Latin American level, has already been studied from the technical point of view, and the reason why no further progress has been made is basically the want of agreement as to the interest rates that should be applied and the length of the compensation period. If the compensation period under the ALADI system were extended to 6 months, it would be exactly the same as that used in the Central American Common Market, so that it would cease to be a factor of conflict. It should also be possible to reach rapid agreement on rates of interest;

(c) To increase credit amounts and repayment periods under the Santo Domingo financial assistance agreement for balance-of-payments support. This agreement has been invoked on several occasions by various countries and in every case has worked

satisfactorily. However, the resources at present committed under the Agreement are still of very little significance and the credit repayment periods are too short. Larger amounts and longer repayment periods would facilitate balance-of-payments financing in Latin America and would expedite intra-Latin American trade;

(d) To re-update studies for the purpose of establishing a Financial Security Network in Latin America, on the basis of the proposal submitted by ECLA itself in the mid-1970s. The idea propounded envisages a commitment on the part of Latin American official financial institutions to provide funds as 'last-resource lenders', where a member country so requests and provided that the country in question had previously resorted to other sources of financing, including the International Monetary Fund. The mechanism would create a system of evaluation and consultation which could sow the seeds of closer co-operation in the future in fields other than that of financing and in other aspects of financing itself.

9. Co-operation in the field of services, especially in consulting and engineering

In some countries of the region, consulting and engineering services have come to constitute a significant item in their external trade and, complementarily, it can be seen that there is a wide field for the development of the technological and scientific know-how behind these activities. Although all the countries, to a greater or lesser extent, possess experience and knowledge of the technology used in the production sectors most characteristic of their economies, there are still big gaps which could be filled if the capacities of the whole group of countries were appropriately combined and collective initiatives were undertaken to make better use of national consulting and engineering resources. The possibility of co-operating in large-scale works in such sectors as energy, transport and communications, mining, etc., could give continuity to the application of specialized knowledge, eliminating the sharp fluctuations in demand for consulting and engineering services within each country, and

helping to train the Latin American countries for undertaking works in common outside the region.

10. *Export promotion*

Regional co-operation in the area of export promotion might be directed both towards improving knowledge of potential external markets and towards strengthening Latin America's bargaining power, as well as towards presenting a united front in face of the protectionist measures applied by the developed countries. Thus, regional co-operation at the level of governments, individual enterprises and their associations could help to perfect the various instruments of promotion (including insurance and re-insurance), to pool exportable supplies, to maintain publicity campaigns, to form associations of producers of exportable goods, to create multinational external marketing enterprises and to take such collective action as will facilitate access to international markets.

11. *Co-operation with the relatively less developed countries of the region*

If co-operation among the Latin American countries is to succeed it calls for special consideration of the principle of reciprocity, in the sense that the small and medium-sized countries which have not advanced in the industrialization process at the same rate as the larger countries should receive special support treatment, both under integration schemes and in all economic and commercial relations with the more developed countries of the region. Admittedly, this essential aspect of intra-regional relationships has been attended by serious problems when attempts have been made to put it into practice, either because of shortcomings in the means used to implement it or because the less developed countries have only slight possibilities of taking advantage of the opportunities offered. At the present time, however, there are sound political, economic and ethical reasons for seeking new paths and formulas which can contribute to the attainment of a more satisfactory intra-regional equilibrium.

C. SOME ASPECTS OF CO-OPERATION AT THE INTERNATIONAL LEVEL AND WITH OTHER DEVELOPING AREAS

1. *General remarks*

In the 1970s the industrialized countries were harassed by persistent inflation, increasing unemployment and a very unstable balance-of-payments situation, in terms both of surpluses and deficits and of fluctuations in exchange rates. The policies applied to tackle these problems had major repercussions on the developing countries, above all on the non-petroleum-exporting group. Deserving of special mention is the impact of the combination of inflation and greater international liquidity whereby the industrial countries sought to cope with the first fuel crisis. In Latin America's case, as previously noted, the countries of the region made use of the abundant supply of credit and contracted heavy debts, with the aim of

forestalling, as far as possible, significant declines in the growth rate of imports and of the product (and in some cases, of consumption). Furthermore, through foreign trade, they added a considerable component of imported inflation to what were already traditional inflationary problems of their own.

At the beginning of the 1980s the United States decisively changed its policy, thus altering the international panorama. The greater importance attached to anti-inflationary policies, in contrast with what happened in the crisis that started in 1974, resulted in a deeper-seated and more prolonged recession, a pronounced increase in unemployment and a notable rise in real interest rates. The effects on the developing countries have been manifold and have been

superimposed on a high level of indebtedness which did not exist in 1973, thus fostering a situation of deterioration and instability which has already been described in previous chapters with respect to Latin America.

Increasing unemployment and difficulties of production and financing in many developed countries acted as a spur to protectionist tendencies just at the very time when, paradoxically, a tendency to adopt policies of openness in trade and finance was to be observed in the developing countries. The recession in the industrial countries added to their growing protectionism a decline in demand for primary commodities and in their prices, thus bringing about a clearly-defined trend towards an imbalance in foreign trade, as has been pointed out in earlier chapters.

Accordingly, the 1981-1982 crisis found the Latin American countries in a particularly vulnerable situation, in the first place because their greater openness to international trade and to movements of capital facilitates the transmission of external impacts. Secondly, their high level of indebtedness seriously limits their chances of obtaining additional financing to cope with their balance-of-payments crisis. Thirdly, some developing countries do not have enough foreign exchange resources or accommodative capacity to maintain the regular servicing of their external debt, above all in view of the stagnation of international trade and the fact that their terms of trade have deteriorated.

The international trade and financial situation is reflected in a restrictive tendency in the international banking system, whose loan portfolio has been affected by the world recession and particularly by the increasing difficulties of some debtor countries. Furthermore, the recession which began to make itself felt in the Latin American countries in 1981-1982 has already compelled the Central Banks of some countries to adopt measures in support of the national banking systems.

In this connection, it should be borne in mind that a financial bank serves as an intermediary not only between savers and users of funds, but also between the present and

the future. When cyclical fluctuations are very marked and are accompanied by sharp fluctuations in the exchange rates of reserve currencies, the possibility of intermediation between present and future diminishes, because the banks consider its economic feasibility to have been reduced. If this phenomenon spreads to many banks, a choice has to be made between official support for the system or a major financial crisis; this holds good both on the national and on the international plane.

Thus, no solution for the foreign trade crisis is provided in the field of finance; rather are the recessive trends strengthened, with the serious economic and social consequences already indicated in this article.

2. Some aspects of international co-operation

(a) North-South co-operation

A general warning, almost too obvious yet nevertheless indispensable, is that measures to reactivate the world economy must be adopted within the framework of necessary moves to bring about changes in greater depth which will lead not only to a reacceleration and reorientation of economic and social development at the world, regional and national levels, but also to a reorganization of international economic relations. It may be added that the implementation of such initiatives will be easier if, in the different countries, it is approached in a dynamic context within which price stabilization measures are not adopted at the cost of stagnation of investment and continuous worsening of the unemployment situation.

It is important to reiterate, too, that the principal capacity for action to reactivate the world economy lies in the hands of the industrialized countries, inasmuch as they constitute the hub of the system of international relations. Thus, an indispensable priority requisite for such reactivation is a resolute, co-ordinated and steadfast policy on the part of those countries, aimed at surmounting the conjunctural and structural problems that are affecting their development processes, including those linked to the

reorganization of energy resources and to the redeployment of industry. In this respect, the efficacy of the action undertaken is clearly correlative to the coherence both of the diagnoses made and of the measures taken to deal with the trends and difficulties observable in the various industrialized countries.

At the level of the world economy, the international community —through the IDS for the United Nations Third Development Decade— has proposed specific objectives and targets for the developing countries, which have been ratified by the Latin American governments in the Regional Programme of Action. In this connection, the policies and measures adopted, both at the world and at the Latin American level, must take into account, *inter alia*, the points listed below:

(i) Countries with large and continuing balance-of-payments surpluses on current account should establish policies to facilitate their imports, since they are obviously in a privileged position to restore the dynamism of world trade;

(ii) Expansion of the developing countries' export trade should be facilitated with a view to reducing or eliminating their external imbalances. To this end:

— the developing countries could amplify and strengthen their export promotion policies, in relation both to traditional and to non-traditional exports,

— the developed countries could reduce or eliminate the tariff and non-tariff barriers (especially sliding-scale tariffs) which affect their imports from developing countries, especially of manufactures and many primary commodities; this step is indispensable for the success of the export promotion policies suggested in the previous subparagraph and also in order to make sure that the increases in export volumes achieved by virtue of tenacious efforts on the part of the developing countries in general, and those of Latin America in particular, are not nullified by a serious deterioration of the terms of trade;

(iii) It would be necessary to reschedule the servicing of the developing countries' external debt while the world reactivation programme gains impetus. To that end it would be useful to place at the disposal of

the countries a support mechanism for the refinancing of the debt, the possible characteristics of which have been indicated in various ECLA documents, and may be summed up as the right to automatic access to refinancing in accordance with certain objective indicators, and the principle that the scale and terms of rescheduling must be decided on a case-by-case basis;

(iv) The developed countries could apply some measures relative to the international private banking system, such as the acceptance of mechanisms for longer-term refinancing of their portfolios; the transfer of the effects of these measures to heavily indebted countries would enable the latter to obtain some relief of their payments situation;

(v) There would need to be a considerable increase in the operational levels (and also, in some cases, in the types of operations) of multilateral financial institutions, especially the International Monetary Fund and the World Bank, but also the regional credit institutions. The present dimensions of the International Monetary Fund are totally insufficient to cope with the existing situation in respect of external disequilibria, and its usable resources run the risk of exhaustion during the first half of 1983. To prevent this, and to allow the Fund to play an active role in a non-depressive solution of the crisis, the scope of its operations should be enlarged by raising the member countries subscriptions. It should be stressed that a 100% increase in IMF subscriptions would mean adding from US\$ 30 000 to US\$ 40 000 million to the Institution's total loan resources, and that these amounts represent only a proportion of between 10% and 15% of Latin America's current external debt. Lastly, the International Monetary Fund could establish a service to finance external deficits in the developing countries caused by increases in international interest rates, as representatives of Latin American governments have been proposing for some months past, in various forums;

(vi) At the same time, the resources of the World Bank and the regional banks should be boosted in order to enable these institutions to provide financial and tech-

nical support, both of a concessionary and of a non-subsidized character, for changes in the structure of production which are indispensable not only in order to weather the present crisis but also to regain reasonable and sustained world economic growth rates during the rest of the 1980s. The enlargements of funds proposed for the international public banking system would be perfectly feasible if there were rapid and genuine fulfilment of the targets consisting in the transfer to the developing countries of financial resources representing 0.7% and 1% of the industrialized countries' gross domestic product;

(vii) Finally, it would be necessary to bring about at the earliest possible moment a reform of the international monetary system making adequate provision at least to lay the foundations and establish suitable conditions for a process of equitable and symmetrical adjustment; for the creation of liquidity linked to the expansion of world trade flows; for the existence of a régime of flexible but relatively stable exchange rates; and for the satisfaction of the developing countries' needs, especially in respect of the transfer of monetary resources. Equally needful is a reform of the international system of trade making proper allowance for the interests of the developing countries.

(b) *South-South co-operation*

(i) *Trends and potentialities.* During the next few years the economic relations existing between the developing countries should be strengthened and amplified as a means of seeking new dynamic factors of growth and mitigating the harmful consequences of the slow development of the world economy. Increasing interregional co-operation would be added to intra-regional co-operation and to the expansion and reconstruction of the domestic market of the developing countries themselves, as a way of ensuring the Third World the more rapid rate of development which would permit a better form of insertion in an international economy dominated by the passive behaviour of the centres. Co-operation among the nations of the different developing regions is part of the quest for a

new international economic order, and one of the essential elements in the International Development Strategy for the 1980s.

In the 1970s the real potentialities of linkages between the countries of the South became apparent. These countries' will to reduce their dependence upon the centres and to promote their own interdependence has been reflected in action on the part of countries or groups of countries whereby they have been able to get to know one another better, to improve communications and transport, to establish special financing mechanisms, to create joint enterprises, to execute technical co-operation projects (including the transfer and development of technologies of their own), and, of course, to achieve a significant expansion of reciprocal merchandise trade.

The available background data on Latin America's trade with the rest of the developing countries suggest that during the rest of the 1980s an important and sustained expansion of interregional trade could take place. Between 1970 and 1978 Latin America's exports to the other developing countries as a whole rose from 2% of the region's total exports to 5%. The latter figure still seems relatively low, and may be pushed up considerably in the course of the 1980s. This impression is corroborated by the fact that, in relation to the total imports of the developing countries (excluding Latin America), Latin American exports to those countries represented only 1.4% in 1978, a coefficient similar to that recorded in 1970.⁹

The outlook is also promising for a considerable increase in the next few years in the direct inflow of loans and investment from the developing countries of the OPEC to the non-petroleum-exporting countries of the Third World, a large number of which will be generating persistent balance-of-payments current account deficits. In particular, there are possibilities of a future increase in the flow of loans and investment

⁹ See in this connection ECLA, "The external economic relations of Latin America in the 1980s", E/CEPAL/G. 1160, April 1981, pp. 147-148.

of this kind to Latin America, and specific initiatives in this direction exist already.

In another sphere, the experiences of Argentina and Brazil in co-operation with various African countries highlight the possibilities of collaboration in respect of technology. The intermediate technologies available in the Latin American countries for application in other developing countries are especially suitable in comparison with those technologies which it is attempted to transfer from the central countries. In 1982, Secretariats of the Economic Commission for Africa and the Economic Commission for Latin America launched a programme of horizontal co-operation between the two regions, particularly in the fields of foreign trade, development of human resources and science and technology.

(ii) *A programme of action for South-South co-operation.* The various aspects mentioned above have led the developing countries to intensify their search for systematic forms of joint action. As a result of the Conference on Economic Co-operation among Developing Countries, held in Mexico City in 1976; the United Nations Conference on Technical Co-operation among Developing Countries (Buenos Aires, 1978); the Fourth Ministerial Meeting of the Group of 77 (Arusha, 1979); and the High-Level Conference of the Group of 77 which took place in Caraballeda, Venezuela, in 1981, a start has been made on various joint activities of Third World countries which have been reflected in guidelines and decisions in several international forums, especially in United Nations agencies. These have not only given shape to guiding principles for the reciprocal co-operation of the developing countries but have also indicated priorities for action and specific mechanisms for putting such co-operation into effect.

The will of the South to undertake further joint action was particularly clearly reflected at the Ministerial Meeting of the Group of 77 at Arusha, where the First Short and Medium-Term Action Plan for Global Priorities on Economic Co-operation among Developing Countries (ECDC) was adopted. In this it was established that reciprocal economic co-operation 'is a key

element in a collective self-reliant strategy and thus becomes both an essential part of and an instrument for the necessary structural changes required for a balanced and equitable process of world economic development, ushering in a new set of relationships based on mutual interests and accommodations'.¹⁰

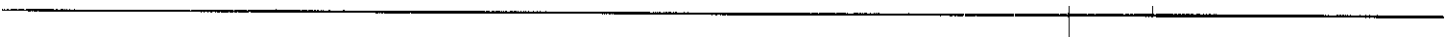
Among the areas of interest defined at the Mexico City Conference, the First Action Plan adopted at Arusha selected 9 in which to take the first measures of reciprocal co-operation: a global system of trade preferences among developing countries (GSTP); co-operation among State trading organizations (STOs); establishment of multinational marketing enterprises (MMEs); strengthening of subregional, regional and interregional economic integration and co-operation; co-operation in the transfer and development of technology; least developed countries; landlocked and island developing countries; monetary and financial co-operation; and multinational production enterprises among developing countries (MPEs). Furthermore, at the Ministerial Meeting at Arusha it was reiterated that technical co-operation is a basic instrument for the promotion of economic co-operation among developing countries, for which reason it was considered necessary that the Buenos Aires Plan of Action and the corresponding resolutions adopted at the United Nations Conference on Technical Co-operation among Developing Countries should be rapidly and effectively implemented.

In view of the progress made to date, and of its paramount importance, special attention will be devoted here to the global system of trade preferences among developing countries. After the preparation of a number of technical studies by UNCTAD and the various meetings at the regional and world levels, the GSTP has entered into the negotiation stage, and progress in this respect during 1982 is promising. The bases approved by the developing countries define the framework within which

¹⁰ See UNCTAD, *Arusha Programme for Collective Self-reliance and Framework for Negotiations*, UNCTAD V, Document TD/236, Manila, May 1979, p. 8.

negotiations leading to the establishment of the GSTP will be conducted. Because of the scope and significance of these agreed bases, the setting-up of the GSTP may lead to the creation of an authentic economic system for the developing countries which will permit the strengthening of relations among them in respect of trade and in many other fields of economic activity.

Lastly, it is of interest to note that at the Venezuela meeting in 1981, it was decided to set in motion a series of mechanisms (working groups, conferences, seminars, etc.) designed to strengthen co-operation among developing countries in the areas of energy, financing, agriculture, raw materials, technology, industrialization and trade.



Technological change in the Latin American metalworking industry

Results of a programme of case studies

*Jorge Katz**

The metalworking industry is passing through a phase of out-and-out transformation in the international scenario. The rapid development of Japanese production and its penetration into European and United States markets, the gradual consolidation of the position of several 'newly industrializing countries' (NIC) like Brazil, Korea or Taiwan as manufacturers and exporters of various products of the industry in question, the dramatic irruption of *robotics* as one of the latest steps in the increasing automation of the production process, and the more and more intensive use of microelectronics in several of its phases, but above all the feeling that the changes now brewing—in the spheres of technology, organization, international trade, etc.—are of considerable magnitude, make this industry an unquestionably attractive field for economic analysis.

In the present article consideration is given to various aspects of Latin America's situation in this respect. The plants manufacturing metal products and machinery in the region are far from constituting a replica of their counterparts in developed countries. Both the production processes and the organization of production predominant in Latin America differ significantly from those observable in exactly the same fields of activity in mature industrial countries. What is more, there are also yawning gaps between the various Latin American countries, reflecting the wide diversity of situations existing in the region.

Hence it is more than obvious that a careful microeconomic scanning of different sub-branches of the metalworking industry in different Latin American countries must constitute a necessary first step towards any subsequent action or thinking, whether in the domain of theory and analysis or in that of the formulation and implementation of instruments of economic and technological policy.

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Introduction

Since 1979 and up to the present day, four international agencies have co-sponsored a programme of research on the manufacture of metal products and machinery in Latin America, the results of which will be discussed in the course of the present article.¹ This Programme represents an attempt to supply the lack of basic information on the real situation of the metalworking industry in the region by means of a large number of case studies in which the economic and technological behaviour patterns of about half a hundred metalworking-engineering firms in Argentina, Brazil, Colombia, Mexico, Peru and Venezuela are examined in detail. The main findings of this research will be presented here, and some observations will be ventured, although only provisionally, on the major aspects of economic and technological policy to which these findings will naturally refer us.

The following pages do not constitute a sectoral study of the conventional type. First, because the sample considered by no means warrants our speaking of coverage in a statistical sense; secondly, and more important still, because the methodology used—individual case studies—enables us to shed some light on the very specific character of domestic production functions and of local industrial organization and innovative behaviour, etc., but does not allow us to arrive at analytical models or at universally applicable conclusions. It may safely be said that much of the information available in Latin America on innovative behaviour, industrial organization and the peculiar and specific character of the production functions locally current is still of a pre-theoretical nature, and that much yet remains to be studied if we are to reach a theory which—even though not formalized—will enable us to give an adequate description of the economic and technological behaviour of

¹ The IDB/ECLA/IDRC/UNDP Research Programme on Scientific and Technological Development in Latin America has given rise to a long list of working monographs. Specific references to these appear throughout the present text.

metalworking enterprises in the region and, subsequently, pass on into the domain of recommendations for public policy.

The main concern of the various case studies which serve as a basis for the present attempt at generalization has been to examine in detail the technological behaviour of the enterprises selected. The point of departure is the idea that this technological behaviour is closely associated with each enterprise's general performance, whether the latter relates to improvements in overall factor productivity, achieved in the course of time, or to changes in the firm's competitive position in the domestic and/or international scenario, etc. It is manifested in at least three major spheres of action in which every enterprise must possess both an *initial* technology—or 'package' of technical information—and a systematic flow of *incremental* technological know-how which will enable it to improve its operational performance. These spheres of action are the following: (i) product design, which embraces detailed specifications of parts, as well as plans and instructions as to manufacture, maintenance, etc., for the product or products to be made; (ii) production engineering *per se*, which involves the selection of machines to be used, the gadgets and tools accompanying them, the rules for the operation and maintenance of such equipment, etc.; and, lastly (iii) the organization and planning of production, an area which includes the employment and management of subcontractors, the control of purchases, stocks and inventories, the planning of the machine load, etc. In other words, the technological behaviour pattern of every industrial enterprise comprises both the original selection of technology and its subsequent improvement and modification through time, and relates to product design, to production technology *per se*, and, lastly, to the technology of the organization and planning of production.

The technological behaviour pattern of an enterprise is the outcome of a complex interrelationship of variables. As will be seen later, some of these variables have their origin in the techno-economic history of

each individual firm; others derive from the market in which the firm operates and from its competition with rival enterprises. Lastly, yet others emanate from the overall macroeconomy in which the market in question is inserted and from the rate of general technological progress affecting the technical frontier of the branch of industry under consideration. In other words, the behaviour of entrepreneurs in general—and their technological behaviour in particular—results from a complex interaction between the strictly specific (or idiosyncratic) features of a given industrial plant, the market in which the said plant operates and the techno-economic parameters of the economy as a whole. This interaction is of a dynamic character and implies a sequential process which can feasibly be broken down by 'phases', in the course of which the firm accumulates experience, achieves successes and suffers failures, and gradually develops the possibility of using 'packages' of technological information of increasing complexity. All this constitutes the pith and marrow of a long-term maturation process which, as we shall argue, has not yet been adequately described or understood by conventional economic development theory.

The results presented below are the product of an exploratory effort at the microeconomic level which is beginning to bear fruit in terms of a novel description of the techno-economic behaviour of Latin American industrial enterprises and the sequential process of maturation which they undergo through time. The results in question shed new light on the old discussion regarding 'infant' industry, dynamic comparative advantages and the industrialization pattern, by showing that the learning of technology, and the externalities associated with it, are much more far-reaching in their scope than has often been admitted in the conventional literature of the subject in recent years.²

² With respect to what we are calling here 'conventional literature', the reader may consult Bela Balassa and Michael Sharpston, "Export Subsidies by Developing Countries: Issues of Policy", in *World Bank Reprint Series: Number Fifty-one*, Reprinted from *Commercial Policy*

The outline of the present study is as follows. Chapter II examines in some detail certain technical features proper to the technology of the metalworking industry, making a quick comparison between this and the technology of the so-called "processing industries" —typically the petrochemicals industry, steel-making, etc.—, in which the end product is more homogeneous and standardized, and in which the production process generally takes the form of a continuous flow, is executed with equipment and plant designed *ad hoc*, and is exempt from the multiplicity of subprocesses and the final assembly work which characterize the manufacture of metal products and machinery.

Several of the technical features identified here as proper to the technology of the metalworking industry influence the techno-economic behaviour of firms in the sector. Both in the original selection of technology, and its subsequent modifications through time, entrepreneurial decisions are swayed, *inter alia*, by forces and facts which stem from the very nature of the technology of the industry in question. We therefore think it important to begin the present analysis of results with a systematic review of the technical conditioning factors that affect metalworking enterprises in general.

Chapter III plunges straight into analysis of the results obtained. It is obvious at once that where the metalworking industry is concerned widely differing stages of maturity are to be found within Latin America itself. Some countries —typically Brazil— have successfully worked their way through a slow process of maturation and accumulation of experience, the duration of which must be measured in decades. In the course of this maturative process the

metalworking industry has gradually broadened and diversified the fields covered, and electrical has become progressively more important than non-electrical machinery. Concomitantly, the proportion of skilled and technical personnel employed in this branch of industry has gradually increased, while at the same time a significant autochthonous technological base has little by little been developed. Other countries —like Peru and Venezuela— are only in the initial phases of a sequence which began more recently and which implies the production of simpler metal products and machinery —for example, agricultural equipment such as ploughs, harrows, etc., or machines for the construction industry, such as trailers, cement mixers and others. The case studies undertaken in the framework of the present Research Programme afford a good deal of information as to the disparities in maturity which are seen to be associated with the difference in the age of the sector in various countries of the region. And similarly linked to the question of age is that of the technological complexity of the manufacturing establishments studied. Argentina and Brazil have been showing significant signs of development in metalworking activities since as long ago as the 1930s. Several of the case studies carried out in these countries relate to firms which have completed three (and even four) decades of manufacturing life, and whose techno-economic history embodies a wealth of experience and is representative of long-term trends and decisions. Peru and Venezuela, on the contrary, confront us with much shorter enterprise histories, in some cases of less than a year's duration. Again, Colombia and Mexico stand somewhere midway between the two extremes.

Various other features of the metalworking plants covered by the survey confirm this first impression regarding the maturative differences referred to in the context of the age of the factories concerned. These other features include, for instance, the complexity of the equipment, the employment of subcontractors, the development of the different intra-firm

Issues, Geneva, November 1977; Bela Balassa, "Export Incentives and Export Performance in Developing Countries: A Comparative Analysis", in *World Bank Reprint Series: Number Fifty-nine*. Reprinted from *Weltwirtschaftliches Archiv* 114, Tübingen, 1978; Jagdish N. Bhagwati and T. N. Srinivasan, "Trade Policy and Development", in *World Bank Reprint Series: Number Ninety*. Reprinted from *International Economic Policy: Theory and Evidence*, Rudiger Dornbusch and Jacob A. Frenkel (eds.), Johns Hopkins University Press, Baltimore, 1978.

engineering departments or sections, and their degree of 'sophistication' in respect of product design, process engineering and planning and organization of production.

Throughout chapter III the material emerging from the various case studies will be subjected to comparative analysis, with the aim of shedding light on the scope, determinants and implications of the above-mentioned differences in maturity.

The object of chapter IV is to pick up some of the old threats of the theoretical discussion on 'infant' industry, externalities and dynamic comparative advantages, but this time in the light of the results presented in the preceding chapter. Despite the fact

that all we have before us is empirical evidence of a partial character, the material gathered in the various case studies constitutes an important asset on the basis of which it is interesting to take another look at received theory.

Lastly, the fifth and final section of the article ventures, although only briefly, into the domain of economic and technological policies. Attention is devoted here to various aspects where our findings reveal the existence of fertile ground for improving the *modus operandi* of the Latin American metalworking industry and its position in the international scenario.

I

Nature of metalworking technology

The metalworking-engineering industry embraces all those sectors of production which undertake metal-processing activities.³ In this industrial subgroup are included not only casting and forging plants but also workshops for the stamping, cutting and welding, heat treatment, etc., of a variety of metals. Lastly, the sector also comprises establishments engaging in the assembly of electrical and non-electrical machinery, vehicles and transport equipment and miscellaneous scientific apparatus.

The technology of these branches of production has a range of features peculiar to it which undoubtedly affect the technological behaviour pattern of enterprises, both at the time of the initial selection of technology and throughout the firm's subsequent technological history. Among these special features, typical of metalworking technology, the following are worth mentioning: (i) the large number and

enormously wide variety of subprocesses necessary to the manufacture of a given metalworking product; (ii) the magnitude and complexity of the 'components tree' which links up parts, subassemblies and end products; (iii) the universality, or multipurpose capacity, of a more or less substantial part of the equipment used by the sector, and (iv) the high degree of substitutibility between subprocesses, production techniques, etc.

Together with other variables of an eminently economic nature, such as market size, relative factor prices, the degree of imperfection prevailing in the factor and information markets, the level of protection, etc., the technological features mentioned above influence both the original selection of technology made for the installation of any new productive establishment, and the type of technological effort expended by the said establishment *a posteriori*, on the occasion of launching new products on the market, incorporating new machinery or lines of production, reorganizing the plant lay out, etc.

Accordingly, in view of the crucial importance which we attach here to these

³See United Nations, "International Standard Industrial Classification of all Economic Activities", Department of Economic and Social Affairs, *Statistical Papers*, Series M, No. 4, Rev. 2, New York, 1969.

technological features as determinants of a firm's behaviour, it seems appropriate to begin by examining them in greater detail. To this analysis the following pages are devoted.

1. Differences between continuous and discontinuous processes

Unlike the so-called processing industries—in which, as a general rule, we can speak of the transformation of a raw material into a relatively homogeneous product, via a single subproduct, or a sequence involving a limited number of phases—the output of the metalworking sector covers an extremely heterogeneous range of products obtained by way of a lengthy series of subprocesses. Cement production, steel-making, etc., or petroleum refining are instances of the first type of situation, whereas the manufacture of an electric motor, a passenger car or a harvester exemplify the second. The extensive range of subprocesses required for metalworking production, together with other features such as the heterogeneity of output, the labour-paced character of many subprocesses—especially during the assembly phase—and so forth, meant that the processing industries, as they are called, were those that lent themselves most easily to continuous production. Let us first consider the number and complexity of the subprocesses required and the high degree of substitutability prevalent among them. To manufacture a car or tractor axle, the first requisite is casting—or alternatively forging—, followed by machining, then by heat treatment, etc. Here we may observe both the diversity of the subprocesses required and the technical possibility of substituting one subprocess for another. What is more, the machining process will be different according to whether the axle in question comes from a casting shop or from a forging plant, a fact which reveals not only that substitution between subprocesses exists but that it may sometimes alter the technical nature of the subprocesses used and even the plant lay out and design. So much for what is implicit in the number of subprocesses and their interdependence.

We remarked earlier that the metalworking industry is also characterized by the complexity of the 'components tree' which links up parts, subassemblies and end products. What happens is that any complex final product—for example, a passenger car—is the sum of a series of subassemblies, each of which in turn has to have its own assembly process carried out beforehand. Some subassemblies or parts may be common to various end products, as when standardized electric motors are used in the manufacture of different electric appliances and housewares. The possibility of decentralizing production of these standardized items (a possibility which arises out of the very nature of metalworking technology) has a marked incidence on manufacturing costs through the emergence of scale economies and the option of employing specialized subcontractors.

The differences between the processing industries and the metalworking branches of industry are of course not confined to the larger number of subprocesses that normally make up the technology of the latter, nor to the greater complexity and magnitude of the 'components tree' and the decentralization and specialization options implicit in this. Other equally important technical features are: (i) the universal and multipurpose character of a substantial part of the equipment used. This means that a very significant proportion of the machines and tools used by the sector can serve for the manufacture of a wide variety of end products; (ii) the immense diversity and heterogeneity of the final products made. In this context appear not only the wide variety of specifications and models often used in the manufacture of one and the same product, but also the differences in quality that may be found in products which fulfil more or less equivalent functions; (iii) in many subprocesses the calibre of the manpower available frequently determines the time spent on machine preparation, the level of tolerance attained and the rate of faults and rejects with which a given manufacturing establishment operates. We shall see later that considerable inter-

enterprise differences in productivity exist side by side in a particular branch of production. These differences are partly accounted for by the disparities in the quality of the manpower employed by different firms. Let us look at all these technical features in a little more detail.

The universality and multipurpose character of some of the equipment and the heterogeneity—as regards specifications and qualities—of the products offered influence the selection of technology, inasmuch as they make substitution of one piece of equipment for another feasible at the level of individual subprocesses, while at the same time they also affect the optimum sequence of subprocesses required in manufacturing a given part or component. In its turn, the labour-paced nature of many subprocesses means that the theoretical technical coefficients are only of an indicative nature, as a wide margin exists for the learning of know-how and for inter-enterprise differences in productivity, even between close competitors.

The technology adopted by any metalworking establishment will be bound to reflect the technical features listed above; it will do so from the very moment of the original selection of equipment and lay out design with which every factory enters operation, and will then continue to do so throughout the firm's technical history, whenever the occasion arises to launch new products, to incorporate new machinery, to reorganize the plant lay out, etc.

In broad outline, and taking into consideration the *type* of product and the *volume* of output to be produced, we may categorize three basic forms of metalworking technology.

(a) *Production in large batches*

In the metalworking sector continuous production takes the form of the manufacture of large batches of homogeneous items. Typical cases in point are afforded by the manufacture of passenger cars, standard electric motors, etc. The degree of automation may vary, depending upon the number

of subprocesses which are executed by hand,⁴ and the degree of mechanization of the activities ancillary to production, such as transport, quality inspection and control, etc.

In continuous production plants part of the capital equipment is often specific to a given subprocess, or to several subprocesses taken in conjunction, as, for example, in the case of 'machining centres'. An extreme situation may also be reached, in the shape of a totally automated continuous production line designed for the manufacture of a single standard product (for example, simple electric motors).

(b) *Production in series of small batches*

Many metalworking sectors produce in small batches to meet a very limited number of orders per year. Their range extends from the manufacture of agricultural machinery to that of aircraft or locomotives, and includes machine-tools, etc. Establishments of this type are organized on a workshop basis, i.e., in sections or departments which carry out a given machining job and to that end group together all the equipment of a specific type: for example, the turning-shop, the grinding section, etc. Here the parts and subassemblies are conveyed either manually or by mechanized transport from one shop to another.

In this instance the equipment employed by each section is more universal and the manpower more skilled than in the preceding case. The greater versatility of the equipment and the higher level of skill of the operatives are characteristic features of discontinuous production in small batches, or to meet individual orders. In factories of this type relatively less time is spent on machine preparation—prior to machining

⁴For example, in a plant manufacturing electric motors, the winding of the rotor can be a manual, semi-automatic or totally automated process, irrespective of whether production is or is not organized on a production line basis. The same may be said of other subprocesses, or of tasks ancillary to the production process, such as transport or quality inspection and control.

itself— and, likewise in relative terms, direct machining time increases.

An establishment of a discontinuous type may or may not have undergone a technical reorganization process aimed at partly offsetting the negative effects of its fragmented character. Generally speaking, when such a reorganization is undertaken, its purpose is to linearize successive sections of the overall production process through the application of 'group technology' as it is called, organization by 'technological groups' or some other organizational technique which implies standardization and normalization efforts.⁵






(c) *Production of custom-made items or to meet individual orders*

Plants specializing in the manufacture of custom-made or individually-ordered items—for example, turbines, equipment for hydroelectric or atomic power stations, etc.—, are also organized as workshops, i.e., on a discontinuous basis. In these cases the output mix is broader than that of establishments producing in small batches, the result

being a higher degree of organizational complexity.

After this preliminary characterization of the three basic types of metalworking establishments commonly found in practice, and following the observation that production both in small batches and to meet individual orders takes place in discontinuous plants, organized on a workshop basis, we shall pursue our analysis in greater depth by concentrating on two basic types of organization of the production process: (i) production in long series, organized on a production line basis; and (ii) production in short series, or of custom-made items, organized on a workshop basis. For the purposes of detailed understanding of the fundamental differences between the two forms of organization, we shall divide the production process into activities, as is normally done in industrial engineering;⁶ this will enable us to track down the source of the most striking differences in operation and productivity between the two types of organization of work.

Every industrial establishment carries on the following five 'activities':⁷

<i>Symbol</i>	<i>'Activity'</i>	<i>Meaning</i>
	Transport	Implies the transfer of an object from one place to another, except in those cases where the said transfer is part of a machining operation.
	Operation	This is the physical or chemical modification of an object, its assembly with another or disassembly, or its preparation for a subsequent operation.
	Inspection	This is the examination of an object to identify the quantity or quality of any of its properties.
	Delay	Delay occurs when conditions—other than those intentionally introduced—preclude execution of the next activity provided for in the production process.
	Storage	Storage exists when the object is kept in store while awaiting an authorized transfer.

⁵E.A. Arn, *Group Technology*, New York, Springer-Verlag, 1975. In particular: "The Group Technology Flow Line", pp. 9 *et seq.*

⁶See, for example, *Introduction to work study*, the ILO, Geneva, 1969, p. 180.

⁷In this connection we wish to express our appreciation of the help given us by Mr. Angel Castaño, who afforded us access to general bibliographical information on this subject, and also to an unpublished manuscript of his own in which he discusses the use of numerical control in the metalworking industry on the basis of categories similar to those adopted here.

The sum of these five activities constitutes the production process of every industrial plant, including those manufacturing metal products and machinery. If a comparative study is made of factories organized on a production line basis and discontinuous production plants organized as workshops, it becomes clearly evident that out of the total number of hours worked in each case, the proportion of direct machining time —or 'Operation' hours— is significantly less in the discontinuous process plants organized on a workshop basis. In these the operatives spend much more time on: *Delays and Transport* of materials, tools and special devices; *Looking up and Interpreting* technical information; *Repairing* machines and tools (outside normal Maintenance hours), etc. In other words, it is in the very nature of metalworking technology that discontinuous production processes organized on a workshop basis are as much more 'dead time'- and transport time-intensive,⁸ as a plant organized on a production line basis minimizes *ex ante* the duration of the manufacturing cycle. In a production line technical activities and machining processes succeed one another in balanced and coordinated fashion down to the micromotion level. The stocks and storage points of materials undergoing processing, parts, subassemblies, etc., are located and sized in accordance with the general balance of the line. For all this to happen, the end product must be highly standardized and part of the capital equipment must be of a specific nature, i.e., specially designed for the performance of a particular job or combination of jobs.

In contrast to this picture, discontinuous plants organized on a workshop basis are much less carefully planned entities. The

workshops are not bound to occupy one particular spot in the physical space, nor is their location constant through time. Several different products are manufactured simultaneously, since it is now the product that circulates from one workshop to another, not the factory lay out that is designed in correspondence with the successive technical operations required by a given product. In the present case great flexibility exists in respect of the way in which production is organized. Since all the machines of a certain type can perform a particular task, the job is assigned to whatever machine happens not to be in use at the time. It is on this account that a crucial role is played by the organization of the (weekly, daily) machine load programme, since upon that will depend the higher or lower degree of utilization of the available capital equipment.

To sum up: there are obviously major structural differences between the technology of a continuous production plant organized on a production-line basis and that of an establishment going in for discontinuous workshop-based production. The physical structuration of the plant, the capital equipment used, the organization of the production process, etc., will be significantly different in the two cases. The choice between one option or the other —i.e., whether to install a continuous-process plant operating on a production-line basis, or whether to set up a workshop-type factory— is conditioned by: (i) the type of product to be manufactured; (ii) market size (or the volume of output envisaged); (iii) relative factor prices, etc. In its turn, the selection of one or the other way of organizing the production process will infallibly condition the entire techno-economic history of an enterprise from the very moment of its installation. In the course of the present study we shall argue that in a long list of metalworking industries the typical mode of production in the Latin American region is of the workshop-based discontinuous order, whereas in developed countries production is based on continuous-process production lines with a high degree of automation. The differences in global productivity deriving from

⁸ The existence of these spells of 'dead time' is not a necessary and sufficient reason for a continuous production line to be more efficient than workshop-based production. The difference in the wages of the operative personnel employed in each case and the differences deriving from the other inputs will also have to be taken into account in order to arrive at a comparative appraisal. See Howard Pack, "The Capital Goods Sector in LDCs: A survey" (mimeographed text), Washington, April 1979.

this dissimilar organization of the production process are extremely important and determine the actual viability of Latin American producer enterprises, if this is supposed to be evaluated in a framework of openness to international competition. In this context we shall have occasion, later in the present article, to note how in a great many instances the initial technological decision to set up a small plant, organized on a discontinuous basis, inevitably marked out and restricted not only the technological paths subsequently accessible to a given enterprise, but also the actual viability of the firm's subsistence in an atmosphere of increasing international competition.

As up to now we have shown how the very nature of metalworking technology conditions the technological behaviour pattern of enterprises, we shall next consider how this pattern is influenced by other determinants, including the volume of output, relative factor prices, etc.

2. Type and volume of output, available supply of skilled manpower and other determinants of the production process adopted in the metalworking industry

The production process adopted by a given metalworking plant—continuous or discontinuous, automated or manual, etc.—is clearly associated with the type of equipment used and the skills of the manpower employed. At one extreme, the equipment may be constituted by universal-type machines and tools and by a manual system of handling, transport and control of materials, parts, etc. In this case the organization of the production process is highly flexible, but it also accumulates various spells of 'dead time' and diseconomies of scale. At the other extreme, equipment may consist in a set of transfer lines especially designed for manufacturing specific families of parts in large batches. Here flexibility almost entirely disappears. All sorts of intermediate options are conceivable, such as, for example, conventional machine-tools combined with automated (or semi-automated) systems of handling and transport of parts, or 'islands'

of programmable machines, manipulated by robots and designed to produce families of parts in large batches, but, unlike transfer lines, susceptible of reprogramming should it prove necessary. Each of these models for the organization of the production process calls for skills of a particular type on the part of the operatives employed by the plant and the equipment it uses.

The kinds of equipment and, therefore, the continuous or discontinuous nature of the production process, the level of automation and the type of manpower chosen by a given manufacturing establishment will depend upon different technical and economic variables. These include: (i) the type and volume of output to be produced; (ii) relative factor prices; (iii) the prevailing flaws in the labour, financial and other markets; (iv) the look of the competition which the firm will have to face, etc. The incidence of some of these variables will next be reviewed, beginning with the type and volume of output. To that end, let us look in detail at the internal structure of what is termed direct machining or 'operation'.⁹

Machining (or 'operation') implies:

(a) *Machine preparation*

This comprises the execution of all the activities necessary to carry out the machining or assembly operation. It includes selecting and installing the appropriate machine-tools, determining feed and speeds of metal chipping, etc. What is involved is a series of *given* activities—their incidence being therefore *fixed*—which are consequently prorateable among all the parts to be machined. The longer the series, the greater the amount of prior effort that may justifiably be expended on machine preparation—including the

⁹In some of the firms studied under the present Programme, machining operations absorbed from 20 to 25% of the total time covered by the industrial process. In establishments with continuous production the machining (or 'operation') time tends to be relatively less, inasmuch as the 'dead time' inherent in discontinuous production and in small batches is to some extent reduced.

manufacture of masks and special gadgets—, inasmuch as the unit machining (or ‘operation’) time proper can thereby be reduced.

(b) *Loading and unloading of part into and from machine*

(c) *Machining (or ‘operation’) proper*

This comprises metal chipping, welding, etc., *per se*. The speed of execution will be a function of: (i) manual constraints, which depend upon the skill of the operative; and (ii) technical constraints, which depend upon: the machine (its age, motive power, etc.); the type of metal that is being worked; the tool employed; the lubricant used;¹⁰ the complexity of the job to be carried out; the acceptable level of tolerance, etc.

(d) *Inspection and control*

This covers the controls effected by the operative, over and above the quality controls programmed in the production process.

Generally speaking, it may be said that industrial engineering has at its disposal standard estimates of the time which has to be spent on machine preparation, loading and unloading, machining (or ‘operation’), etc., in order to perform a specific type of activity, given the equipment and operational conditions of the process (lubricants, cutting tools, etc.).¹¹

For the purposes of the present analysis—where what concerns us is to show the relation existing between the equipment to be chosen by a given metalworking plant and the type and volume of output envis-

aged—, the essential fact to be stressed is that machine preparation time, which may come to constitute a significant proportion of total ‘operation’ time, is a fixed charge independent of the size of the batch, upon which, precisely, its incidence on the unit cost of production will therefore depend, i.e., upon the number of parts—or in other words the size of the batch—that will be manufactured once the machine is prepared.

How does the size of the batch influence the type of equipment used by a given plant?

If we assume that one or two units of a fairly simple part are to be produced, a hand-operated machine of a universal type—for example, an engine lathe, a drill, etc.—would be sufficient. Machine preparation time would be comparatively short, but a longer time would be spent on machining proper. In view of the low relative cost of the machine involved in the technique in question, this latter may probably be the most justifiable choice, inasmuch as it certainly minimizes the unit cost of capital.

This extreme situation—in which the selection of equipment is relatively simple—would undergo modifications in correspondence with at least two specific facts. Firstly, in response to the complexity of the part to be manufactured and, secondly, in relation to the size of the batch and/or the number of annual orders for the same part.

A well-known example of the first of these cases is the airspace industry, where many items were practically impossible to produce successfully on the basis of an operative and a conventional tool. Here the application of sophisticated numerically controlled equipment and of programmable manipulation and control machinery proved justified in relation to the technical complexity of the parts to be made and the limits of tolerance required. Similarly, a significant expansion of the volume of output—due to an increase in the size of the batch and/or a larger number of annual orders for the same part—warrants, in the first place, a greater machine preparation effort in the shape of the manufacture of masks and special devices, and, secondly, if

¹⁰ “Water-based Cutting Fluids Cut Machining Costs. Switching from Neat Cutting Oil to Water-Based Coolants Helps to Reduce Production Costs—and Conserves Oil”, in *Machine Tool Review*, Vol. 63, Nos. 363 and 365, Coventry, England, 1975.

¹¹ See for example, A.S. Manne and H.M. Markowitz (eds.), in *Studies in Process Analysis. Economy-Wide Production Capabilities*, Cowles Foundation for Research in Economics at Yale University, New York, John Wiley & Sons, Inc., 1963.

the volume of output so permits, the incorporation of equipment at a higher level of complexity and automation. At the upper extreme—in cases of mass production—there is justification for the use of a highly automated machine, specially designed for the purpose of manufacturing a particular part or component.¹² This might be a transfer machine or a reprogrammable 'island' of numerically-controlled machines.

So much for the relation between the complexity of the product manufactured, the volume of output and the selection of technology in given metalworking plants. Another variable which significantly influences the nature of the equipment used is the availability and cost of skilled manpower.

Simple equipment, of a universal type, makes intensive use of skilled manpower, some of it being of a quasi-artisan character. With automated equipment and transfer lines, on the contrary, these skilled operatives—whose training may take four or five years—can be replaced by much less skilled personnel, who can be trained in rather less than a year. In the course of interviews conducted under the present Programme, one case was recorded in which, as the result of introducing numerically controlled equipment, it was possible to replace 44 skilled workers by approximately 20 operators of automatic equipment; while in another instance, 21 operators of numerically controlled equipment today do the work that was formerly performed by 63 skilled turners.¹³ In addition to the operatives directly in charge of it, this numerically controlled equipment called for qualified instructors and programmers. In approximate terms, it is estimated that from 6 to 8 numerically controlled machines are served by one instructor and one programmer. Consequently, the change from one tech-

nology to the other also involves a change in the nature of skills—indirect instead of direct—and reduces employment of skilled direct operatives.

From analysis of the preceding paragraph it can be inferred that automatic and semi-automatic equipment acquires greater relative importance in those countries where the supply of skilled workers is relatively small and their wages are therefore relatively higher. Influence in the same direction—that is, in favour of relatively greater use of automatic equipment—is exercised by the various possible flaws in the labour market which may prevent or hinder continuous operation with night shifts. Situations of this type are relatively commoner in European countries (the United Kingdom, Sweden, etc.) than in Latin America, although there are obviously considerable inter-country differences within the Latin American region itself.¹⁴ We shall revert to this topic in the last section of the present article.

In addition to the type and volume of output, the supply and cost of skilled manpower, the institutional conditions prevailing in the labour market, etc., there are obviously other factors which have an incidence on the kinds of equipment, the nature of the production process and the level of automation chosen by a specific metalworking enterprise. Among these it is worth while to mention the following: the rate of interest or cost of capital; the greater or lesser availability of financing; the degree of uncertainty prevailing in the economy, etc. In combination with the variables mentioned above, these will affect the capital recoupment period or planning horizon by which a given productive unit is swayed at the time of making its choice of production techniques.

So much for what is inherent in the relation between kinds of equipment, type and volume of output and relative prices and

¹² See A. S. Manne and H.M. Markowitz (eds.), *op. cit.*

¹³ S. Jacobsson, "Technical Change and Technology Policy. The Case of Numerically Controlled Lathes in Argentina" (mimeographed text), Lund, Sweden, July 1981, p. 12.

¹⁴ Berth Jonsson, Corporate Development AB VOLVO, "Corporate Strategy for People at Work. The Volvo Experience", International Conference on the Quality of Working Life, *QWL and the 80's* (mimeographed text), Toronto, Canada, 30 August-3 September 1981.

available supply of factors. Another crucially important feature of metalworking technology is that it opens up the possibility of decentralizing production through the employment of subcontractors. The following pages are devoted to discussion of this topic, which will reappear later when—in section III—we present the several findings obtained in the various field studies. It will also crop up again at the end of the present article when we refer to possible official policy measures.

3. *Subcontractors*

Another of the basic characteristics of metalworking technology is the broad spectrum of subcontracting relationships which it permits. They have their origin in the complexity of the 'components tree' and subprocesses that go to make up the sector's activity, with the result that plants and workshops can exist which specialize not only in the manufacture of particular parts and components but also in the execution of specific jobs, such as casting, heat treatment, etc.

We shall now explore the economic content of these subcontracting relationships.

The existence of such relationships reveals the presence of flaws of various kinds in the operation of the market mechanism. In a perfectly competitive world, where large numbers of undifferentiated buyers and sellers operate, every economic agent obtains all the requisite information through the price system. In such a model there are no transactional costs, and each firm maximizes its operations without resorting to any data other than those provided by the market.

In contrast, there is obviously a large number of markets for intermediate products—as there are many in which subcontracting relationships figure in the metalworking field—where various forms of inter-firm co-ordination emerge whose economic content it is of great interest to explore. In a recent study, S. Lall remarks that there are two possible alternatives. The first is that the costs of co-ordination of independent

firms are so high as to warrant the complete internalization of the market by way of vertical integration. The second implies that the advantages of commercial independence outweigh that of complete internalization, but that recourse to co-ordination is justifiable as a means of surmounting the imperfections of the market.¹⁵ And he adds that vertical integration is the result of a complete failure of the market mechanism, whereas the several forms of inter-firm co-ordination derive from its partial failure.

In order to go more deeply into this subject we must ask what are the underlying economic facts or features here.

The subcontracting relationship presupposes the presence of at least two economic agents. One of these, the firm engaging the subcontractor, must be able enough to co-ordinate its external supplies of parts, components, etc., in such a way that getting them from outside is profitable. This necessarily means obtaining prices, standards of quality, guarantees of punctual delivery, etc., at least similar to those implicit in producing its own inputs. The other contracting party—the subcontractor—must be in a position to meet the requirements in question reliably and systematically.

It is readily understandable that subcontracting relations may involve technical, financial, organizational and other aspects, and may have a fundamental incidence on rights of ownership over technical information, on the subcontractor's entrepreneurial capital, etc.; and, furthermore, that problems will necessarily arise in connection with the appropriation of entrepreneurial profits deriving from the productive activities of the subcontractor. In principle, because these are contractual relations in which the rules of competition are only very imperfectly operative, there is a wide margin for negotiation between the interested parties, by means of which all sorts of different agreements can be reached, given the more or less extensive

¹⁵ S. Lall, "Linkages Revisited" (mimeographed text), Oxford, 1980.

range of possible situations of equilibrium.¹⁶

Let us take a look at some of the aspects normally present in subcontracting relationships.

(a) *Technical aspects*

It often happens that the subcontractor's work calls for an *initial* technical information component—plans, design specifications, standards of quality, etc.—, as well as an *incremental* flow of such information that will enable the subcontractor to work in unison with the technological changes introduced by the subcontracting firm. Co-operation and co-ordination between the two is necessary here in order to make up for deficiencies in the diffusion of know-how. There is literally no way in which the market can provide the necessary information in time for the operations of the two firms to take place efficiently in default of prior agreements.

Obviously, apart from questions inherent in the diffusion of technical information, important problems also arise relating to the appropriability of its benefits. The subcontracting firm may (or may not) hand over to the subcontractor intangible assets in the form of technical information. The sales price of such assets may differ substantially from their purchase price, and this opens up a wide margin for negotiation between the contracting parties and a similarly broad spectrum of possible situations of equilibrium. Given the highly specific nature of each contractual relationship, all sorts of cases are conceivable in which the implicit profits are divided differently between the subcontracting firm and the subcontractor, depending upon the structure of the subcontractors' market, the bargaining power of the terminal firm *vis-à-vis* its own customers, etc.¹⁷

¹⁶J. Katz, *Importación de tecnología, aprendizaje local e industrialización dependiente*, Mexico, Fondo de Cultura Económica, 1974, pp. 24 *et seq.*

¹⁷In an earlier study we have presented a simple geometric model which may be applied to the present case. See J. Katz, *ibidem*, 1974.

It can also be seen that in their turn the ownership relations existing between the terminal firm and the subcontractor, and the degree of control which they allow, will likewise exert a decisive influence on the nature of each contractual relationship. In general terms it may be assumed that a 'captive' subcontractor will have better access to the subcontracting firm's stock of technological information—with the consequent generation of greater externalities—than an independent subcontractor who can operate freely in the market. But having better opportunities of obtaining externalities in terms of technological information does not necessarily imply enjoying the possibility of appropriating its benefits, inasmuch as this will depend upon the price formation mechanism in operation between the two firms, and upon the underlying ownership relations.

(b) *Economic and financial aspects*

Over and above the strictly technological plane—which we have described as the segment of technical information involved in plans, formulae, manufacturing instructions, engineering handbooks, etc.—, the relation between a terminal firm and a subcontractor may also have regard to financial matters—loans of share and/or working capital—, production questions, investment flows—amount and nature of the subcontractor's output mix—, etc. Here again we have the extreme case of the 'captive' subcontractor, who has to consider himself an operational appendage of the terminal firm, which in reality is the taker of decisions as to volume of output, conditions of sale, etc. At the other end of the scale we find the situation of the independent subcontractor who operates freely in the market and who decides upon his own plan of production, investment, etc., relatively regardless of the subcontracting firm.

A fair-sized metalworking firm which decides to operate on the basis of subcontractors may normally do business with scores (or even hundreds) of workshops supplying parts and components, or with plants responsible for carrying out specific

subprocesses such as casting, heat treatment, and others.

There is no reason whatever why the contractual terms stipulated in any one agreement should be reproduced in the other agreements entered into by the firm.

In each individual case the morphology of the specific submarket where the subcontractor operates, the difference in costs between supplies obtained from internal and external sources, the greater or lesser importance of the part, component or sub-process and the degree of dependence which it entails, etc., will have a bearing on the relative bargaining power of the two parties, on the final price and on the several other terms in accordance with which the operation is finally agreed upon. Since on many occasions a reference price simply does not exist, and the range of possible situations of equilibrium is wide, the result of each subcontracting arrangement is not easy to decide *a priori*. In some cases the subcontractor is a mere 'price-taker', transferring a good deal of his profit to the terminal firm, while in others the situation may be reversed and the relative weakness of the terminal firm is thrown into relief.

It is precisely because of the diversity of possible situations that the management of a global subcontracting policy constitutes a complex problem of organization and planning of production from the standpoint of the terminal firm, which often needs a specialized technical department capable of simultaneously concluding a large number of extra-firm production agreements, and balancing the deliveries of external suppliers in such a way as to minimize unnecessary costs of stocks, risks of supply shortages, etc.

In developed countries the employment

of subcontractors is common practice. And in contrast it is much less frequent in the semi-industrialized world, an assertion which holds good even in the case of local subsidiaries of transnational corporations.

Thus we bring to a close the present section dealing with some of the outstanding features of metalworking technology. We have noted that perhaps more often than the processing industries the various branches of metalworking admit of discontinuous organization of the production process, the use of equipment of a universal and multi-purpose type, the employment of highly-skilled quasi-artisan labour that it takes a long time to train, the utilization of specialized subcontractors, etc. Obviously, the fact that this is feasible from a technical standpoint does not necessarily indicate that these technical options are actually turned to account. The type and volume of the output to be manufactured, relative factor prices, the prevailing flaws in the labour, financial and other markets, the look of the competition that the firm has to face, the level of protection that it enjoys, etc., will necessarily be powerful determinants not only of the technology originally chosen by every manufacturing establishment, but also of the modifications in it which the establishment in question will introduce through time.

In the next section we shall have an opportunity to look into the incidence of these structural features of metalworking technology in different production scenarios in Latin America. Radical evolutionary disparities exist in the region and are clearly apparent in the differing production, organizational and other technologies adopted by the manufacturing establishments studied in the course of the present research.

II

The Latin American technological scenario in the metalworking field. Empirical evidence arising out of a programme of case studies

Metalworking plants in Latin America are far from constituting a replica of the manufacturing establishments producing similar goods in mature industrial countries. To explore the most striking differences and their implications both at the theoretical level and at that of the formulation of instruments of public policy, attention will have to be devoted to such aspects as: (i) the size of the factory; (ii) the nationality of the enterprise and its organizational 'model'; (iii) the age of the firm and the degree of technological maturity of its technical departments; (iv) the morphological characteristics of the supplier market—monopolistic or competitive, in the latter case with alternative supplies of domestic and/or foreign origin—; (v) the factor markets where inputs are obtained; (vi) the legal and institutional framework in which the enterprise operates, etc.

As stated in the preceding chapter, these variables—since metalworking technology so permits—have brought about the emergence and consolidation in Latin America of a metalworking sector—which in the more developed Latin American countries accounts for practically one-third of the industrial product—formed by factories with a very specific lay out, with equipment which includes a high proportion of machinery of their own manufacture, with a mode of organizing production that is little inclined to the use of subcontractors, and so on. The purpose of the present chapter is to describe some of the key features of these metalworking plants. This will later enable us to speculate as to the possibility—and the public and private measures through which it might materialize—that some of these industrial establishments may subsist on competitive terms under less protectionist international trade régimes.

The differences in maturity within the

Latin American region are extremely marked. Some countries—such as Argentina and Brazil—began to develop their metalworking industry relatively early, near the beginning of the present century, and during the 1920s activities like casting and forging, welding, etc., were started. In these countries the following decade already saw the emergence of plants of some importance manufacturing machine-tools, durable consumer goods, etc.; many of these grew up from maintenance and repair shops run by distributors and importers of products from abroad. At that time the said countries' parks of motor vehicles, durable consumer goods, etc., were large even in comparison with those of countries in the developed world, and the maintenance infrastructure they required permitted the appearance not only of local repair shops but also of the first attempts at domestic manufacture of the simpler capital goods needed in that connection.

During the 1930s various subsidiaries of metalworking groups in developed countries settled in Argentina and Brazil. They were not, at that time, production units proper, but distribution and commercial representation branches, many of them concerned with durable consumer goods and with capital goods for the food, textile, and other industries. Obviously, several of these firms set up departments for providing technical assistance to customers, as well as for repair and maintenance of the corresponding local park. The gradual increase in the index of incorporation of domestic production, in respect of spare parts first and later on components, and the derived demand for metalworking products which this triggered off, constitute another of the important historical background data which must be borne in mind when studying the early

development of the metalworking industry in Argentina and Brazil.

In other countries of the region the emergence of metalworking activities is of more recent date, being traceable to the 1950s in Mexico, Colombia and Chile and the close of the 1960s or the beginning of the 1970s in Venezuela or Peru.

These differences in the 'age' of the region's respective metalworking industries are reflected in significant disparities in maturity. This explains why, on an average, the Brazilian or Argentinean metalworking industry is nowadays in a position to operate on the basis of a package of technical information more sophisticated and complex than can be handled, for example, again on an average, by the metalworking branch of industry in Venezuela or Peru.¹⁸

The age of the plant and the degree of technological maturity of its technical and engineering cadre are not the only sources of disparity between the technical and economic results achieved by Latin American firms. Equally important is the size of the local market, in so far as it influences, as we have already seen, the selection of production techniques. In Argentina and Brazil, and to a lesser extent in Mexico and Colombia, there are various branches of the metalworking industry in which continuous-process plants exist, where the work is organized on a production-line basis as is appropriate to mass production programmes geared to large markets. The degree of automation of these production-line plants, however, is significantly less than in comparable establishments in the developed world. The most striking examples of production lines are

connected with durable consumer goods and with the motor-vehicle industry and its subsidiary branches supplying parts and subassemblies. With differing degrees of vertical integration—higher in Argentina and Brazil and lower in Mexico and Colombia—these are the only countries in the region where domestic manufacture of passenger cars is undertaken. Assembly of vehicles on the basis of imports of disassembled units, and with very little incorporation of domestically produced elements, can also be found in other Latin American countries such as Venezuela, Peru or Chile.

Apart from what has already been said—i.e., from the fact that Argentina, Brazil, Mexico and Colombia are the countries where continuous-process plants organized on a production-line basis are most numerous—, the empirical evidence collected also suggests that these are the countries where greater domestic technological efforts are observable in the direction of linearizing segments of the production process in factories originally organized on a discontinuous basis as a succession of 'islands' or workshops. As we shall have occasion to observe a little farther on, this reveals a by no means negligible advance in terms of local technological maturity, inasmuch as the technological effort required to linearize a discontinuous process may be considerable in respect of product design engineering (for example, normalization and standardization of parts and subassemblies), as well as in the fields of process engineering and industrial organization (employment of subcontractors, etc.). The important point at this stage of our argument is that only in a few countries in the region—typically Brazil, Argentina, Mexico and Colombia—has the metalworking industry gradually developed, in different plants, enough domestic engineering capacity to explore, on the basis of domestic technological effort, ways of linearizing a factory lay out initially conceived as discontinuous.

In short, when we attempt to examine metalworking technology in the Latin American region we find ourselves faced with a complex mosaic of technical differences between manufacturing establishments; and

¹⁸ Two interesting examples afforded by the case studies on which the present article is based clearly reveal the significance of this matter of maturative differences. The first relates to the technological effort made by a Venezuelan firm to design a sugar-cane harvester; the second to a method—by welding—chosen by a Peruvian plant to manufacture the revolving drum of a cement tipper. In both cases the firms concerned had a short production history and were faced with serious technical problems not only in the product design area but also in that of process engineering; and in both the technical problems in question had been resolved several years before by Brazilian and Argentinean metalworking firms.

these differences are significant not only within each country and between Latin American countries, but also between establishments in the region and industrial plants in the developed world. At all three levels the differences in question call for careful scanning.

Semi-automatic or manual in-factory transport; manual or semi-automatic coil-winding of motors; manual, loading and unloading of parts and tools; relatively greater use of conventional equipment instead of numerically controlled equipment (and, therefore, a different distribution of personnel between skilled operatives and programmers); longer spells of time allowed for the product engineering department to arrive at a new design ready to put on the market; a high degree of self-sufficiency as regards supplies of parts and subassemblies, etc.; all these are characteristic features of Latin American plants which significantly differentiate them from one another and from their counterparts in developed countries.

1. *Production lines*

We shall begin this analysis of results by considering continuous production plants, organized on a production-line basis, before going on to review discontinuous-type establishments, i.e., those organized as a succession of workshops. Within the framework of the case studies on which the present attempt at generalization is based, the plants that we had an opportunity to look at include several that run on a production-line basis. To this subgroup pertain: Perkins (motors) and Metalúrgica Tandil (casting) in Argentina; Metal Leve (pistons) and Romi (engine lathers) in Brazil; Sofasa (passenger cars) in Colombia, etc.

Continuous production lines constitute a 'mode of production' whose history in Latin America is relatively brief. The amount of know-how accumulated with respect to the management of this type of organization of production is therefore still modest, and difficulties of various kinds are encountered. For example, as the result of

an over-diversified output mix, a continuous production line designed to produce a flow of highly standardized items is often used in Latin American countries to manufacture short series of relatively differentiated products, so that substantial economies of scale are lost through an increase in the number of stops, in machine preparation time and in dead time arising out of any change in the production plan. Perkins Argentina, or Sofasa in Colombia, are eloquent cases in point. The first of these firms gained a great deal in labour productivity during the second half of the 1970s when it decided to introduce an additional production line and specialize the output mix produced by each individual line; while much the same thing happened in Sofasa when this firm standardized engines, gearboxes, brake systems, etc., as between the Renault-4 and the R-6, thus eliminating dead time and stops.

It may be said that there are few cases in which the factory lay out was originally designed for continuous production of an only slightly diversified output mix, or a single individual product, so that immediate and full advantage could be taken of the economies of scale proper to this mode of organization of production.

The small size of the domestic market, an economic policy which compelled terminal firms to operate with a high and increasing degree of vertical integration, the lack of reasonably efficient subcontractors, etc., are all circumstances inherent in the Latin American metalworking environment which may have influenced the fact that the original output mix was unduly wide in its range and thus gave rise to inefficient use of continuous technology.

Much of the domestic technological effort of factories of this type is marked by concern with how to obtain greater economies of scale for the respective manufacturing establishments. In some cases, this has stimulated efforts in the field of product design engineering aimed at standardizing parts and subassemblies, as in Sofasa, Colombia, while in others the same end has been pursued through planning and organization

of production, for example, by way of rationalization of the output mix and more specialized use of the available equipment.

Whichever the way chosen, it is important to stress here that adequate exploitation of the advantages of continuous production is neither *immediate* nor *automatic*. Far from it. Attainment of the economies of scale inherent in a design for a continuous-type plant generally takes time and calls for domestic engineering efforts on the part of the various technical departments which make up the enterprise.

In this respect the nationality of the firm may come to play a significant part. The Latin American subsidiaries of foreign enterprises have at their disposal a plentiful stock of technical information belonging to the parent firm, and this information may make it easier for the local subsidiary to take greater or more rapid advantage of the economies of scale implicit in every continuous-type technology.

There are, however, exceptions to this rule, especially when the Latin American subsidiary operates with a more diversified output mix than that of the parent firm itself (which generally possesses production lines, or even complete plants, specializing by product), or with a process technology which, although organized on a production-line basis, is far from resembling that applied by the parent firm as regards the degree of automation of the production process. In this last case, obtaining the economies of scale implicit in the technological design locally used will probably necessitate a substantial amount of 'made-to-measure' technological effort.

Table 1 summarizes various technological and economic features of the continuous metalworking plants, organized on a production-line basis, that were studied under the IDB/ECLA/IDRC/UNDP Research Programme.

These plants produce, on the one hand, durable consumer goods, such as, for example, passenger cars and the various sub-assemblies (for instance, motors) or individual parts (pistons, camshafts, cylinder blocks, intake manifolds, etc.) required by

the terminal establishments, or, on the other hand, certain capital goods sufficiently simple and standardized for them to be manufactured on a production-line basis: in this case, conventional engine lathes.

Three of the five firms forming this subgroup started out as ventures undertaken by national entrepreneurs on the basis of domestic capital, and entered operation in the post-war years. In one of these three cases the enterprise was subsequently purchased by a terminal firm which is a subsidiary of a multinational group, for which reason it must nowadays be regarded—from the standpoint of the legal ownership of capital—as a foreign enterprise.

The two remaining firms are of more recent date—1961 and 1970, respectively—and both have belonged from the outset to foreign enterprises.

In relation to this whole group of firms, which are organized on a production-line basis, we shall next examine the sources of the product and process technologies locally applied, the sources and nature of the embodied technological change introduced by enterprises in the course of time, the magnitude of the technological effort they tackle, etc.

Let us first look at the origin of the embodied technology, beginning with product engineering and going on to the technology of the production process *per se*.

In the two subsidiary firms owned by foreign capital product design engineering is almost entirely provided by the corresponding parent firm; the enterprises in question are Perkins Argentina and Sofasa in Colombia. The external origin of product design is no bar to either local firm's introducing adjustments, changes in parts, gradual improvements in the performance of the original design, etc., but it can safely be said that in both situations product engineering primarily stems from outside the enterprise and outside the Latin American region.

In the case of the other three firms that make up the group of production-line enterprises—i.e., the three which were at first owned by domestic capital—, consideration of the source of product technology

raises a question of morphology which cannot be disregarded, i.e., whether the firm concerned produces a final good or an intermediate input. One of these three firms manufactures a final good; this, as has been stated, is a simple engine lathe, of conventional type. In this instance product technology is entirely local and is the outcome of a long process of evolution which started with copying a similar product of European origin, more than two decades ago. The other two are subcontractor enterprises manufacturing intermediate inputs for terminal firms that produce vehicles. By their very nature as suppliers of subassemblies and parts, both firms are bound to work with a product technology largely pre-specified by the corresponding terminal firm. However, this does not prevent one of them --Metal Leve, Brazil-- from maintaining a sizeable product engineering team, supported by a Research and Development Office concerned with questions relating to physics, chemistry and metallurgy. This office carries on an active interchange with universities in Brazil and abroad and participates in the designing of new products both for the terminal firms themselves and for other well-known international enterprises. The fact that this firm does a great deal of business in the international market undoubtedly obliges its product engineering department to be constantly updating technology. Thus, even though the product engineering with which it operates is often pre-specified by the product design of the terminal firm for which it is working as a subcontractor, the firm may safely be said to be in close contact with the world technological frontier in the field of product engineering.

If we briefly revert to the topic of product technology in the enterprise based on domestic capital which manufactures a final good --i.e., Romi, Brazil-- it may be noted that the firm uses domestic technology for a wide range of conventional-type machine-tools in which the state of the art has evolved slowly in the last few decades. In contrast, and despite the fact that the enterprise is heavily committed to R&D spending --as we shall see later-- it is of

interest to observe that when we pass on to the designing of numerically controlled equipment --where the world technological frontier is advancing rapidly in our time-- the enterprise has encountered various difficulties, in consequence of which it has recently been looking into the viability of reaching a technical assistance agreement with an Italian firm, a world leader in this field. In view of the importance attaching to this subject from the standpoint of the design and implementation of economic policy instruments, we shall revert to it in the last section of the present paper.

If we now turn our attention to the source of the process technology used by the five firms studied, we shall again observe a number of interesting facts.

Three of the five firms came to apply a production-line technology in the course of their evolution, after having operated for several years on the basis of a discontinuous technology. In the other two cases --Perkins Argentina and Sofasa, Colombia-- the plants started out straight away with a continuous-type plant design, although in both instances, owing to the unduly broad output mix chosen, it became difficult to take immediate advantage of the economies of scale implicit in the original technology.

In these two cases, when a continuous-type technology was used from the very outset, plant design was provided by the corresponding parent firm --both are subsidiaries of foreign enterprises-- and a factory design in which the parent firm concerned already had experience elsewhere was reproduced locally.

Conversely, in the three cases in which continuous technology was reached by way of evolution, local product engineering played a much bigger part. It must not be forgotten that these three firms were originally owned by domestic capital. In two instances it was the rapid expansion of the local market, following upon the installation of the motor-vehicle industry, that provided the inducement to switch over to the continuous process. In the third it was the decision to export *en masse* a standardized and homogeneous product --engine lathes-- that fig-

Table 1
SOME TECHNO-ECONOMIC FEATURES OF THE CONTINUOUS PRODUCTION PLANTS STUDIED UNDER
THE IDB/ECLA/IDRC/UNDP PROGRAMME

Enterprise	Product	Nationality and ownership	Source of technology	
			Product design	Production process
1. <i>Perkins Argentina</i> Argentina, 1961	Motors	United Kingdom, foreign enterprise	Design furnished by terminals and parent firm in UK. Little local engineering effort	Very specific, with a great deal of 'home-made' equipment. The plant is European, rehabilitated
2. <i>Metalúrgica Tandil</i> Argentina, 1948	Casting Blocks Camshafts Intake manifolds	<i>Initially:</i> Domestic capital <i>Today:</i> Subsidiary of foreign firm	Given by terminals. Little domestic effort. Product design undertaken for third parties	Conventional process replaced by Shell moulding or 'hot mould'. Technical information from Germany
3. <i>Metal Leve</i> Brazil, 1950	Pistons	Domestic capital. Private enterprise	Designs given by terminals but plenty of local technical effort in respect of designing for foreign firms	Automated production line opened in 1976 which puts out 600 parts per hour as against 200 from the conventional production line
4. <i>Romi</i> Brazil, 1941	Engine lathes	Domestic capital. Private enterprise	Conventional design improved in the course of the years. Much local effort in product design for other lines	Firm has 60 machining centres. Own casting. A great deal of 'home-made' equipment
5. <i>Sofasa</i> Colombia, 1970	Passenger cars	50% public enterprise and 50% subsidiary of foreign firm	Design given by parent firm adapted locally. New parts locally designed. Standardization of motors, brakes, gear-boxes	Equipment provided by parent firm. Only a few changes and one or two local designs

Source: Prepared by the author on the basis of the different field studies. See Appendix.

ured as the primary incentive to set up a continuous production line.

It is important to note that these three firms experienced very significant increases in overall productivity on passing from organization on a discontinuous basis to a continuous-type production process. The time saved in the subprocesses of core-making and trimming after the introduction of the continuous conveyor belt in *Metalúrgica Tandil*, the virtual trebling of the number of parts per hour obtained by *Metal Leve* from its continuous production lines, and a similar development in the history of *Romi*, reflect the tremendous impact implied by the transition from one mode of produc-

tion to the other. In contrast, in the two cases in which continuous production was introduced straight away the misuse of the potential advantages implicit in this way of organizing production is blatant; over-diversification of the output mix seems to have been responsible in both instances for an initial phase laden with examples of operational inefficiency.

In all five cases studied the continuous production line was set up on the basis of equipment primarily brought from abroad, though nevertheless, in four of the firms at least, the design and self-supplying manufacture of machinery within the firm was important in the past, even for

Nature of technological change		Scale of engineering and research and development (R&D) efforts	Morphological features of the market		
In product design	In process and organization		Type	Protection	Exports
(1) Different uses of the motor manufactured (2) Improvements of quality in watertightness, mechanical strength in blocks, crankshafts, etc.	Important equipment in the 1970s and embodied technical change. Flexibility of production line reduced. Greater integration	Engineering effort takes up 8% of total hours	Concentrated Oligopoly	Special régime favourable to high degree of vertical integration and low import content	
	(1) Significant increase in productivity in core-making and trimming shops, through time-saving (2) Rejects drop from 13% (1976) to 5% in 1980/1981		5% of total market and 10% of major enterprises.		Very few
		1.5% of sales spent on R&D. Approximately 60 persons. Exchange with universities and support from FINEP	70% of pistons market		
		7% of sales. Since 1979 R&D independent of product engineering offices and plant technical assistance	70% of domestic market		17% of sales in 1979
(1) Design of new parts for R-18 (2) Increases in R-4 cylinder capacity (3) Improvement in quality (for example, crankshafts cast instead of forged)	(1) Great improvement in planning of production, management of stocks, etc. (2) Substitution between subprocesses	2% of sales, 13 persons in the plant and 45 in all 35% of time spent on process engineering	Concentrated oligopoly		

setting up the continuous production line.

So much for the origin of the product and process technologies used by the firms under consideration; let us now go on to study questions inherent in technological change in these enterprises.

The resolution of problems associated with the technology originally embodied, the fact that these are enterprises manufacturing final products or intermediate goods, the quest for improvements in quality and/or for ways of cutting costs, the substitution of subprocesses (casting instead of forging, for instance) or of raw materials, the more efficient management of stocks and inventories, the development of subcontracting,

etc., constitute some of the key elements that must be taken into account in examining the technological behaviour pattern of the five firms studied.

As previously pointed out, the two plants that were originally installed with continuous-type technology seem to have made very poor use at first of the economies of scale implicit in the technology chosen. In one of these cases the technological response to this initial state of affairs involved the standardization of parts and assemblies and the rationalization of the output mix. At the same time, the firm significantly improved the organization and planning of production, management of

stocks, etc. Here technological change is largely 'disembodied', and includes aspects relating both to product engineering and to organizational techniques. In the other enterprise —Perkins Argentina—, utilization of economies of scale necessitated an intensive equipment programme which the firm put into practice almost ten years after its installation. Unlike the foregoing instance, this is a case of 'embodied' technological change which reduces the flexibility of the plant, increases its degree of production line specialization, and by this means improves the use of time in the establishment.

Of the three remaining cases, in which the installation of a continuous production line is reached by a process of evolution, two exhibit a more marked domestic technological effort in the field of process engineering. The first is a 'captive' casting shop which works almost entirely with product designs from the terminal firm which it supplies, while the second is the firm manufacturing conventional engine lathes, an item with a high degree of standardization and universality. In both cases domestic efforts in respect of process engineering were substantial and significantly more important than in product engineering. This must be interpreted, however, not as a general neglect of product engineering on the part of the firms in question, but as an indication that the production line under discussion here called for little technological effort in that direction. It should be borne in mind that the firm manufacturing engine lathes possesses several other adjacent establishments organized on a workshop basis, in which it produces a wide range of engine lathes, turret lathes, etc., and miscellaneous machine-tools. The group as a whole earmarks 7% of the value of its annual sales for research and development activities, and although the product engineering required by an engine lathe run off a production line is only a very small part of the overall technological effort undertaken by the enterprise, it should not be forgotten that the firm does product engineering work in many other additional directions. Similarly it seems worth while to note that in the case of the 'captive' casting shop the firm proves

to have engendered an independent economic group —Ingeniería Santander— engaged in the design and construction of equipment and machinery for third parties. In other words, even though the 'captive' character of the casting shop's production line significantly limits requirements in respect of product engineering, the increase in design capacity displayed by this firm reveals the powerful synergic element implicit in the accumulation of engineering capacity in general.

The foregoing paragraphs summarize the empirical evidence gathered as to the nature of embodied technological progress in the five production-line plants that have been studied under the present research programme. A striking feature is the wide diversity of situations recorded. While in one case the bulk of technological change is disembodied, and involves product design engineering and organization of production, in another it is primarily embodied, and is based on the technology of the production process *per se*. In the subcontractor firms technological change seems to have been related more to process than to product engineering, a situation which is apparently reproduced in the case of the firm manufacturing a relatively standardized and multipurpose final good.

A wide variety of situations also reappears when we attempt to classify the motivations accounting for the incorporation of the technological changes observed. Exploitation of economies of scale, improvement of quality, substitution between subprocesses or of one raw material for another, cutting costs by reducing direct machining ('operation') time, more efficient management of inventories, etc., are the motives most commonly in evidence.

Generally speaking, the production-line plants are comparatively large in proportion to the specific market in which they operate. While Metal Leve and Romi supply about 70% of their respective markets, Perkins Argentina and Sofasa, Colombia, are also clear instances of concentrated oligopoly.

Given the relatively large size of all the production-line firms considered here, it is

not surprising to find that they all maintain sizeable engineering departments that employ a staff ranging from about half a hundred technicians and professionals in Sofasa to twice (or three times) that number in Metal Leve or Romi. It becomes understandable that production scales of that magnitude can cope with the maintenance of cadres specializing in the various branches of engineering, and even of R&D offices more directly concerned with exploratory tasks that have a greater basic science content. In this context there can be no by-passing the fact that the two firms with the clearest R&D commitments are Brazilian, are owned by domestic capital and have received and still do receive definite State support in the field of technology. Again, both are integrated in the international market, maintain plant scales closely resembling or similar to those current in the developed world, and in various respects rise above the narrow-minded concentration on production for the domestic market which prevails in most of the manufacturing establishments born of import substitution strategy. We shall revert to this topic when discussing comparative advantages, technology and official policy.

2. *Discontinuous production organized on a workshop basis*

Here we pass on from analysis of the five continuous-process establishments organized on a production-line basis to consideration of the other metalworking plants studied under the IDB/ECLA/IDRC/UNDP Research Programme on Scientific and Technological Development in Latin America. The factories in question number about a score, most of them of smaller dimensions, and operating with a discontinuous production process and a plant lay out organized on the basis of 'islands' or workshops.

Within this group of firms those that manufacture custom-made goods to meet individual orders exist alongside those producing in small batches.

As was pointed out in section II, a metalworking establishment producing custom-made items or in small batches re-

presents a mode of production substantially different from that considered hitherto. The enterprise of family type and origin, set up on the basis of the mechanical ability of an immigrant, showing a marked predominance of product design engineering over process engineering and organization of production, and still taking little –but gradually increasing– advantage of the economies of scale deriving from standardization and normalization, etc., is the representative firm in this subgroup.

Two or three decades of sustained operation seem to have been necessary in some of these cases for the initial factory –often a mere repair workshop for imported machinery– to attain the category of a reasonably equipped and organized industrial plant, in which accounts are kept by 'cost centres' so that the standard manufacturing costs can be reconstructed, in which the 'follow-up' of parts is effected through the various subprocesses, in which a stable routine of quality control and preventive maintenance of the available equipment is carried out, etc.

In many of the cases examined the physical volume of output has been quintupled –and even increased tenfold– in the course of a few years, and consequently the whole character of the industrial operation has altered. Inter-temporal analyses of productivity must be approached with the greatest caution, inasmuch as the output mix has normally changed, as has likewise the quality of each of the items in the mix; the schedule and nature of the subprocesses used has been modified *pari passu* with the equipment incorporated and with the subcontracting to third parties; the proportion of direct to indirect workers has decreased; the skills and qualifications of the personnel have altered, etc.

Admittedly, in many respects the manufacturing establishments in operation today still bear the indelible stamp of their initial technical structuration –which at different points of time limits the possible techno-economic options open to them–, but at the same time they superimpose upon it a complex history of expansions, changes of strategy, and gradual development of

domestic technological capacity. In the following pages we shall endeavour to describe the historical sequence of this process.

To this effect, we shall divide the history of the firm's evolution into 'phases' or 'stages'. The first of these—which we shall term the phase of 'original installation'—combines a number of quasi-artisan characteristics, typical of a family-style productive organization. There is no functional specialization, the equipment is of a universal and rudimentary type, and the product manufactured is elementary, often merely the parts and spare parts for pre-existing equipment imported from abroad or a reproduction of some 'old' model of a capital good or a durable consumer good, likewise brought from outside the region.

The second phase or stage comprises the transition from this artisan workshop to a more modern factory. This transition must not be thought of as an organic plan in any way assimilable to what would be an optimum situation such as is commonly described in conventional textbooks. It is frequently characterized by: (i) a move to a different physical location; (ii) intensive expansion of equipment; (iii) rapid recruitment of direct operatives. At this stage there is not yet much order or rationalization in the successive steps taken by the enterprise. As a general rule the new building or factory is not specially designed in relation to the firm's specific tasks, so that the plant layout is the offspring of chance rather than of programming. The equipment and operational personnel are not seldom selected and incorporated in the light of extra-economic criteria based on extremely imperfect information. Errors of excess and defect abound in a situation where the focal point is rapid expansion of the physical volume of output. The quality of the product begins to improve in consequence of the new equipment, but there are still no organic criteria that are applied as a matter of routine in relation to quality control.

The third phase is characterized by the development of plant engineering in association with a gradual process of 'digestion' of the installed capacity and the operative and

technical personnel. At this stage the ratio of direct to indirect workers varies substantially as the firm brings in technicians and professionals and rationalizes the use of its productive resources. Formal criteria begin to supersede oral tradition, and management of technical information becomes more orderly; thus, plans per part, machine maintenance manuals, quality control routines, etc., make their appearance.

The fourth phase—the last in the evolutionary sequence which we shall describe in the following pages—definitively incorporates organization and methods engineering in connection with a global operational programme for the firm which embraces not only the plant itself but also the other complementary functions such as buying warehousing, technical sales services, etc. At this stage a start is now made on linearizing various segments of the production process by the application of organizational engineering methods such as studies of 'families of parts', 'technological groups' and several other techniques which facilitate standardization and normalization and, in more general terms, make it possible to obtain economies of scale by improving batch sizes, and reducing machine stoppages and dead time. Time and motion studies, development of subcontracting, etc., are proverbial features of this fourth phase, reflecting a relatively sophisticated stage of operation and organization of the firm's various engineering departments.

The evolutionary sequence described above does not occur overnight; rather, we must not be surprised if it takes something like 15 to 20 years. Nor is it any wonder if there is no sign of linear or balanced-expansion characteristics in a specific situation. Lastly, neither is it impossible that an individual firm may be unable to pass from one phase to another, or may simply fail in the attempt to subsist as a productive organization, dropping out at some point in its history. The firm should be envisaged as moving through successive situations of disequilibrium in which, by too much or too little, it misses the optimum, and has to seek a more rational allocation of resources. As at

the same time the environmental variables are changing (the market, the macro-economy), this adjustment lag is a recurring process.

There is of course nothing obligatory, or logically necessary, in the functional relations and the phases described here. Other sequences taking exactly the same (or a different) length of time seem logically viable in less protectionist contexts, or in scenarios where the factor markets operate in accordance with rules of the game different from those that are proverbial in the Latin American region. (Particularly significant cases in point are those of Japan, Korea, etc.).

A few —but only a few— of the firms studied here have succeeded, during their evolutionary history, in moving through the four phases described; in particular, this is true of Argentinean, Brazilian and Mexican enterprises. To a lesser extent the statement holds good for Colombia. The great majority of the metalworking plants considered may be located at some point corresponding to phases two and three of the sequence propounded (see table 2).

Many of the enterprises forming the subgroup under study enjoy a measure of 'natural protection' deriving from the existence of locational advantages or from better technological adaptation to specific requirements of demand, etc. This natural protection weakens the role of external competition and must be taken into account both in examining the techno-economic behaviour pattern of the firms considered, and in proposing public policy measures and instruments.

It is perhaps this very thing that may explain the basic importance that seems to have been attached to product engineering in the very origins of many of the firms making up this subgroup. The problem consisted more in meeting existing demand than in doing so at a cost or with a quality specification which could have stood up to external competition.

This original product engineering stemmed in a good many instances from a copy of a similar foreign good, as can be seen to have happened in the case of agricul-

tural machinery, machine-tools, flour or rice mills, etc. At first this copy was generally made from a relatively old 'technological vintage' of the product concerned. This occurred, for example, when Turri¹⁹ and Romi²⁰ copied a European back-gear lathe on first entering operation in the 1940s, or when Zaccaria²¹ began to produce rice mills in the 1930s in the region of São Paulo, Brazil. The practice was partly due to the limitations of the capital equipment available —extremely rudimentary at that time—, but account must also be taken of significant information lags in these initial attempts at product design and copying.

In the great majority of these cases, it would not appear that process engineering —and far less still that of production organization— played a meaningful role until one or even two decades after the original entry into operation. The initial equipment abounded in secondhand and 'home made' machinery. Plant lay outs arrived at by accident or chance are much commoner than those deriving from production programming. There are major technical imbalances between one section of a plant and another —see, for instance, among the factual evidence collected under the Programme, the spectacular imbalance between the forging, machining and die-sinking departments which characterizes the original plant design in the case of Forjas, Colombia.²² Obviously, these workshops have no technical

¹⁹ See A. Castaño, J. Katz, F. Navajas, "Etapas históricas y conductas tecnológicas en una planta argentina de máquinas-herramienta", *Working Paper No. 38*, IDB/ECLA/IDRC/UNDP Research Programme on Scientific and Technological Development in Latin America, Buenos Aires, January 1981.

²⁰ See H. Nogueira da Cruz, "Relatório Parcial Parte II. Firma E" (mimeographed text), IDB/ECLA/IDRC/UNDP Research Programme on Scientific and Technological Development in Latin America, Buenos Aires, January 1981.

²¹ See H. Nogueira da Cruz, "Evolução Tecnológica no Setor de Máquinas de Processar Cereais. Um Estudo de Caso", *Working Paper No. 39*, IDB/ECLA/IDRC/UNDP Research Programme on Scientific and Technological Development in Latin America, Buenos Aires, July 1981.

²² See D. Sandoval, M. Mick, L. Guterman and L. Jaramillo, "Análisis del desarrollo industrial de Forjas de Colombia, 1961-1981", *Working Paper No. 50*, IDB/ECLA/

Table 2

SOME TECHNO-ECONOMIC FEATURES OF PLANTS ORGANIZED ON THE BASIS OF DISCONTINUOUS PRODUCTION IN SMALL BATCHES OR CUSTOM-MADE

Manufacturing enterprise and country	Product	Ownership, nationality	Source of technology	
			Product	Organization process
1. <i>Gherardi</i> Argentina (1937)	Agricultural machinery. Stock	Argentine. Family enterprise	Adaptation of imported designs	Forging, machining and welding are the most capital-intensive
2. <i>Zaccaria</i> Brazil (1920)	Agricultural machinery. Custom-made	Brazilian. Family enterprise	Copies of similar imported products, simple at first, later more complex	Secondhand equipment. First factory, workshop-type, set up in 1943. Equipment and machine-tools made in the factory itself. Equipment becomes more sophisticated in the 1970s
3. <i>Forjas</i> Colombia (1950)	1. Caterpillar mounting for tractors 2. Parts for passenger cars 3. Currently: crankshaft forged for Renault 4. Flanges and grinders	Colombian, 30% domestic, 60% foreign. Management German, then Italian and subsequently Instituto de Fomento Industrial (IFI)	First phase: a great deal of diversification and small batches of caterpillar mountings for tractors. Second phase: increase in diversification with the incorporation of FIAT products, but more subcontracting. Third phase: IFI reduces diversification	Initial studies made by a German consultant. German management up to 1970. IFI management since 1980 but by now there are many instances of obsolescence. There has always been an imbalance between forging and machining and between forging and die-sinking
4. <i>Ramo</i> Mexico (1941)	Flour mills. Almost all products custom-made. For repairs some equipment made for stock	Mexican. Family enterprise	Derived from a family tradition in milling. Firm began by repairing old equipment and manufacturing spare parts. Is diversifying output, introducing other products	Moved to new premises in 1961. There entered upon the manufacturing phase. Has its own casting-shop
5. <i>Rota-Agro</i> Venezuela (1961)	Agricultural machinery. Produces for stock	Venezuelan. Family business started in Cuba	Rotary harvester copied from a United States model. Efforts at adaptation to the local environment. Possession of its own casting-shop influences product design	In 1963 set up its own quite simple workshop. Since 1968 also has a casting-shop

Source: Prepared by the author on the basis of various field studies. See Appendix.

standards or proper costing systems until many years later. Similarly, in view of the lack of subcontractors, plus a family tradition of self-sufficiency, vertical integration is almost complete, including casting, the civil engineering connected with the erection of new buildings, etc.

The evolution following upon this first phase of an enterprise, based on extremely rudimentary and informal process and

production organization engineering, must be viewed as a historical sequence marked by the dynamic interaction of variables inherent in: (i) the firm, within which changes take place in the skills of the personnel, technical functions are developed and specialized and new equipment is introduced, and the whole enterprise goes through a gradual learning process; (ii) the market, of which, at the same time, the morphology and competitive climate alter; and (iii) the macroeconomy of each individual society.

So much for what is inherent in the origin and characteristics of the initial

Description of technical change		Subcontractors and suppliers	Patents taken out	Increases in productivity, their source and magnitude
In product design	In process technology			
Emphasis on product engineering. Demand plays important role in second phase. Seeding equipment absorbs a great deal of innovation	Time saving in machine preparation	Boom in subcontracting. Greater degree of internal processing in the more complex models (70%). Gear boxes designed, and manufactured in the plant	Yes, and especially in the 1970s	Increase in economies of scale due to reduction of machine preparation time. Output increases with innovations
Cereal huller incorporated in 1948. The new generation (1970) begins to go in for machine-tools	A start made only recently on producing in small batches. Goods previously made to meet individual orders. Second generation introduces a proper costing system, installs a computer, etc.	1. Total vertical integration. 2. 1944 casting-shop and rubber section set up. Subcontractors' delivery times, prices and quality unsatisfactory. 3. Casting dropped in the 1970s and replaced by buying from third parties	Yes. Firm has some 20 product patents, pertaining to recession period. Patents not taken out during expansion	No major increases. Measurement problems posed by breadth of mix and changes in quality and in subprocesses covered.
As from 1975, in association with FIAT, more FIAT-designed passenger-car parts produced. Renault design used since 1977	1. Die-making a key area in which improvements are effected with the introduction of new machinery 2. Attempts to make the furnace forging machine stage continuous in order to reduce fuel costs 3. Batch sizes increased	During the FIAT phase recourse is had to subcontracting to reduce the negative effect of the greater diversification due to FIAT designs. IFI increases subcontracting and reduces diversification	No	High degree of underutilization at all times. In the past, almost 50% in forging; 60% in machining
Wide diversification of uses of similar equipment	A few up-to-date machines purchased in 1979. At first 90% of every plant constructed was imported. Later on production by the firm itself gradually increased		First patent registered in 1965	An embodied effect observable in the 1970s
Close contact with farmers provides indications of adaptations needed. Output mix subsequently broadened, still on the basis of copying reinforced foreign models	Attempted to increase its degree of vertical integration by incorporating casting and manufacture of plough disks. Organization more defective than that of Tanapo or Nardi. Improving nowadays through imitation of others	At first, the introduction of casting enabled the firm to reduce costs. Not so today, since there are better subcontractors. Develops a range of 'outside shops' which enable it to lower costs and face up to the recession	No	Productivity improves with reduction of degree of diversification. Rival firms are beginning to use numerical control. Rota-Agro not yet

package of technology with which many of the discontinuous metalworking enterprises examined under the IDB/ECLA/IDRC/UNDP Programme seem to have entered operation.²³

²³ Obviously this is not the only possible situation, although it is the commonest in the present universe of case studies. A different model, with an original product and process design much more external to the local society, can be seen in the study on Forjas of Colombia (*op cit.* (1982)), a firm to which initial packages of technical information on both types of design were provided by a German firm. Other examples in which foreign technology also forms a predominant part of the original package of technology can

The time has now come to turn our attention to technological change, i.e., to all the above-mentioned modifications of the initial package of technical information handled by each of the firms under discussion. What concerns us is to study the determinants, nature and implications of these changes.

Product engineering was undoubtedly

undoubtedly be found in the group of metalworking firms organized on the basis of workshop-type discontinuous production, but these are definitely in the minority in the sample considered here.

Table 2 (conclusion)

Manufacturing enterprise and country	Structural features of growth	Exports	Concentration	Macro-influences	Manpower skills
1. <i>Gherardi</i> Argentina (1937)	Two periods. 1. Up to 1972; 2. 1972-1978. Latterly obliged to simplify during recession. Innovations in 1974 prove a failure and complexity is lessened	Yes, a great many to adjacent countries. May reflect adaptation to demand	Four enterprises account for two-thirds of the total in five families. Share is a function of new orders	Subsidy to farmers	A bigger field for informal characteristics. Length of service and seniority
2. <i>Zaccaria</i> Brazil (1920)	Fluctuations of demand lead to diversification. Demand changes appreciably in the 1970s and induces the firm to improve the product	Only in the years 1965 to 1970 does the firm begin to export, again in response to a recession	From the first held about 20% of the market	In times of recession simpler versions are launched and the firm takes to exporting; this more recently	Only with the expansion in the 1970s are techniques incorporated that require higher skills and expensive and specific machinery
3. <i>Forjas</i> Colombia (1950)	Three clearly defined stages. German: ball bearings manufactured and design engineering undertaken. Italian: Intra-FIAT group passenger-car parts are produced. IFI: an agreement is concluded with Renault which increases batch sizes and exports	15 to 18% at recent dates (1975)	Monopsony at first. Only buyer General Electric	Imports opened up in 1965, just at the time of entry into production. Devaluation increased the debt in marks and brought about bankruptcy	During the German phase the technical team (undertaking product and methods design) comprised 40 persons. In the Italian period all this was done away with. IFI reverts to the previous organization
4. <i>Ramo</i> Mexico (1941)		As early as 1959 began to export to the United States. Sold complete plant in Costa Rica. Today exports 15% of output	Holds 50% of the domestic market. 40% held by the other competitor (foreign)	1. High degree of protection 2. Subsidized credit	Training school since 1966
5. <i>Rota-Agro</i> Venezuela (1961)	The climate of competition gradually changes through time, after a monopolistic start. Today the firm has to imitate its competitors since it feels itself left behind	Does not export	For almost a decade the only firm in the sector. Then two competitors appear on the scene: one a subsidiary and the other a licensee of foreign enterprises	1. Subsidized credit to farmers is main source of expansion of demand 2. The 1977-1981 contraction affects this firm more than the other two	Few improvements introduced until the recent incorporation of the 'professional generation'

the first thing to attract domestic technological effort in the group of firms analysed here, and it implies: (i) the design of successive 'vintages' of the product manufactured; (ii) the broadening (and, on some occasions, the narrowing) of the output mix offered; and, lastly, (iii) an improvement in the quality of individual items in the mix.

The first step in product engineering often seems to have been a move to get away from the external model or models originally copied, in an attempt to reduce the technological gap existing between the products offered locally and internationally and at the same time adapt more closely to the needs of domestic demand.

An autonomous technical component, endogenous to the firm, and deriving from the learning of technology in its design offices, together with a component exogenous to the enterprise, relating to changes in the morphology of the market and in the nature of demand, may be traced as the main determinants of a greater domestic technological effort in the field of product engineering during the early years of the enterprises reviewed here. Let us take a more detailed look at these components in the light of the empirical evidence collected.

From one of the studies carried out under the Programme, we extract the following information on the determinants of the

Raw materials	Role of the State and externalities	Nature of technological change	Other specific features
Greater thicknesses are used in sheet for reasons of quality, and this gives it more weight and strength	Significant role played by INTA in diffusion of information. Hybrids, biological innovations and characteristics of demand	More complex machinery launched in 1974. This was a failure and a simpler design had to be made. Technical information on a French machine used	<ol style="list-style-type: none"> 1. Frame welded instead of bolted as before. Increase in output leads to changes of process 2. Contradiction between specificity of user and economies of scale through standardization 3. Normalization between one generation and the next 4. Active producer and active user
Substitution between metal and wood at first	Virtually no State intervention other than protection	Great improvement in quality. 'Natural sequence' in treatment of cereal to be processed	<ol style="list-style-type: none"> 1. After 1970 the 'second generation' comes on the scene. Great changes in management of firm 2. In 1966 firm engages services of consultants on organization and management. This is proposed by a member of the second generation 3. In the 1970s producers group themselves in co-operatives and begin to insist on better products
Borum steel substituted for chrome steel in ball bearings and production cycle reduced	<ol style="list-style-type: none"> 1. Training and mobility of personnel 2. This is a public enterprise 	In die-sinking, several capital-saving advances (through saving of time and cost of new dies). This change is embodied via a milling-machine, a glass pulverizer, etc. Also many changes in crankshafts	<ol style="list-style-type: none"> 1. Completion of installation coincides with a drastic slump in demand 2. In 1971 the firm goes bankrupt and closes down 3. FIAT manages it from 1974 to 1980. The engineering department is closed and emphasis is placed on sales of parts for passenger cars 4. This is an interesting case of training of human resources and rotation of personnel. 5. Furnace constructed in 1975 for small parts designed in the plant 6. Many bottlenecks in the machining-shop
	A great deal of subsidized credit	A production technology already familiar put to new uses	<ol style="list-style-type: none"> 1. At first self-financed with resources brought from Spain 2. Expansions in 1961 entirely on a family basis 3. Even today satisfactory bookkeeping and general records are lacking
This firm has less capacity for analysis of materials and use of substitutes than its competitors but the latter operate under external licenses	Incidence of credit policy on the agricultural sector is very marked	The bulk of technological change relates to product design engineering	<ol style="list-style-type: none"> 1. Recently an important 'generational change' seems to have begun which implies the emergence of a technically qualified stratum. This poses the question of overhauling methods of work and ways of facing up to competition 2. Interesting experience in the development of 'outside shops' on the basis of piece work. Since 1976 'inside shops' are also being developed, in an attempt to evade labour laws

early expansion of product engineering: "With regard to the firm, we have pointed out that ... the change in its staple product from an engine lathe that was a copy of the Czechoslovakian Mass model to a copy of the URSUS model —which is significantly more sophisticated and complex—, together with the increase in equipment and technical personnel which is associated with the modification of the product (given that the scale is maintained in 10 to 12 monthly shifts on an average), constitute the first step in the transition process ...".

The study goes on to show that this change is induced on the one hand by the appearance on the scene of the motor-

vehicle industry, and, on the other by the autonomous development of the firm's internal design engineering capacity. The motor-vehicle industry brings about "... a differentiation between two types of demand on the lathes market. One, already traditional, represented by repair, maintenance and machining shops manufacturing low-quality products; another, formed by enterprises with a large output that demand automatic and semi-automatic lathes as well as more quantitatively and qualitatively serviceable universal machines. In the first segment ... the work to be done induced demand for low-price and low-quality universal lathes, copied from European models

of the 1940s—for example, the back-geared lathe or the Czechoslovakian model produced by Mass in the 1950s. In contrast, the firms in the second group called for better-quality and higher-productivity machinery. In this connection the URSUS engine lathe represents a great advance on what the firm was producing before”.²⁴

With reference to this same enterprise, and to our previous argument regarding the determinants of the technological effort in design engineering, the study points out that the copy of the URSUS model dates from 1958—i.e., from three or four years before the real beginning of the motor-vehicle boom in Argentina, which may be placed in the very early 1960s—and is clearly associated with the building of a new factory, with the introduction of new and better equipment (a new copying lathe, a radial drill, etc.) and, above all, the arrangements made to include a specific product design office in the firm’s organizational chart. All this reveals the existence of an autonomous technical component, stemming from learning within the plant, as a determinant of the improvement in design engineering, over and above the signals emanating from the market, which in this case are also present and call for a more complex and sophisticated product to satisfy a new type of customer.

In this specific instance—and in several others in the sample of firms examined here—the changes in market morphology and the gradual enhancement of the role of competition from third enterprises, do not begin to play a significant part in inducing innovative behaviour until at least a decade later. In other words, and still with reference to the initial development of engineering capacity and the greater relative effort in product design by which this seems to have been marked, outstanding importance attaches to the autonomous technical factor—within the firm—and the messages emanating from demand, while at the same time the negligible role of competition in inducing innovative behaviour is also revealing.

Notwithstanding that the available empirical evidence confirms the earlier development of design engineering, it also shows the high degree of linkage existing between this and production engineering. From the very first a relation is apparent which becomes closer after the lapse of a few years, when the development of the climate of competition so warrants: namely, that existing between the quality of the product and the equipment used to manufacture it. Even though in its infancy the firm may lack a specific technical department concerned with production engineering—a department which in many cases comes into being as the plant scale grows larger, the output mix is diversified and the equipment becomes more complex—it seems obvious that the improvement in the quality of the product originally offered, or the release of better and better ‘vintages’ of that initial product, calls for the introduction of new and superior machinery, and the emergence of new subprocesses not applied before (such as, for example, grinding or heat treatment of parts). This incorporation of additional equipment and activities frequently entails tackling problems of plant design, process engineering, etc., which, although they do not necessarily involve the creation of a specific department or office for the purpose, must infallibly absorb some of the working hours of the technical and engineering personnel.

Hitherto we have considered questions relating to the designing of new vintages of the original product and to the gradual improvement of quality embodied in the product concerned. Entrepreneurial strategy based on early development of product design engineering also partly consists in the broadening and diversification of the output mix. Obviously, this must of necessity call for technological effort in respect of product design, just as does the improvement of quality or the launching of successive vintages of the original product referred to above. But as regards the determinants and implications of the broadening and diversification of the output mix offered on the market, it seems worth while to revert to the empirical evidence collected in so far

²⁴ A. Castaño, J. Katz, F. Navajas, *op. cit.*, 1981.

as it reveals additional interesting features.

In many cases the decision to broaden and diversify the output mix seems to have been associated with: (i) the limited size of the domestic market; (ii) recessions at the level of the economy as a whole, reflected in slumps in demand on the specific markets served by the firm under consideration; and (iii) the entry of new competitors into the market.

In this context, the material gathered shows that it is not uncommon for new families of products²⁵ to be started or less complex versions of known products to be launched in response to slumps in demand or to relatively high indexes of gluts on the market,²⁶ or to releases of similar products on the part of competitors.

In one way or another, as regards the implications of diversification, the broadening of the output mix necessarily entails changes in the production plan, a larger number of stops and machine preparation hours and, in general, a heavier incidence of unproductive dead time. In other words, there is clearly a negative statistical relation between the firm's degree of diversification and its exploitation of economies of scale.

We may now attempt a brief summary of what has so far been said with respect to the determinants, nature and implications of the technological change emerging in the initial stages of operation of the metalworking establishments studied. The available evidence suggests that domestic technological capacity tends, in the factories covered by the Programme, to develop early on in the area of product design engineering; this area encompasses the designing of new products, improvement of quality in those

already familiar and, lastly, the broadening of the mix offered on the market. Among the determinants of this early development of domestic design capacity are variables inherent in the initial technical level and subsequent learning of new technologies observable in the firm's professional and technical team, as well as forces emanating from the demand side and, to a lesser extent during the initial phases, from the climate of competition prevailing in the specific market in which the firm operates. As regards the implications to which allusion has been made, we know, in the first place, that the launching of new products and the improvement of quality are usually linked to the incorporation of new equipment and sub-processes in the factory, with the consequent necessity for physical investment in plant and for certain efforts in the field of process engineering, concomitant with those made in product design engineering. Lastly, we know, too, that any design engineering effort which ends by broadening the output mix—given that the available equipment remains the same—will probably exert a negative influence on the technical efficiency of the plant, by increasing the number of machine preparation hours, stops and spells of dead time, and thus reducing the economies of scale obtained by the firm.

The next step in the development of domestic technological capacity seems to be the strengthening of process engineering. It has already been said that primary forms of process engineering generally emerge from the very outset of manufacturing activity even when there is no formal department responsible for this work. What it is here of interest to identify, however, is the set of circumstances surrounding the consolidation of these functions and, once again, the nature and implications of the technological change—or new technical information—emanating from such a department.

The creation of a process engineering department, and its consolidation in the firm's organizational chart, generally seem to be connected with a significant change in the scale of operations of the enterprise. This, in turn, necessarily involves an equipment programme, the redistribution and

²⁵ See J. Berlinski, "Innovaciones en productos y aprendizaje (El caso de una planta argentina de implementos agrícolas)", *Working Paper No. 43*, IDB/ECLA/IDRC/UNDP Research Programme on Scientific and Technological Development in Latin America, Buenos Aires, January 1982.

²⁶ See M. Turkieh, "El cambio tecnológico en la industria venezolana de maquinaria agrícola. El caso de Rota-Agro S.A. El caso de Tanapo S.A. El caso de Nardi C.A." (mimeographed text), IDB/ECLA/IDRC/UNDP Research Programme on Scientific and Technological Development in Latin America, Buenos Aires, 1982.

partial or complete alteration of the plant layout, the incorporation of new operative and technical skills in the manning-table, etc.

Both the initial equipment and the quasi-artisan factory of the early years become constraints on potential development in many of the enterprises considered here. The existence of surplus demand and the opening-up, in some of the cases studied, of new markets linked with the installation of the motor-vehicle industry, hold out optimistic prospects of expansion, which on a good many occasions set in train a change of location, the designing or purchase of a new factory and the contacting of international suppliers of equipment.

Special attention must be paid to questions relating to the financing of the plant expansion which ushers in the second phase of the sequence traced here. The various case studies show that access to the subsidized credit granted by the official banking system, the receipt of external private investment, credits and joint venture agreements with international suppliers of equipment, the firm's own family resources, etc., make plant expansion feasible at this stage. The possibility or impossibility of obtaining financing in one or other of these alternative ways, the specific terms on which it is extended, etc., indubitably affect the probability of one individual firm's gaining an advantage over its immediate competitors at the very time when the market is taking shape,²⁷ with the result that the latter assumes morphological features which thenceforward have far-reaching repercussions.

Proverbial in this phase, in addition to the rapid growth of the physical volume of output, are the following developments: (i) improvement of the quality of the product, in association with the incorporation of new subprocesses (and the equipment necessary for the purpose) such as tempering or heat treatment, grinding, etc.; (ii) a rise in the index of vertical integration; (iii) the introduction of new skills among the operatives

and technical personnel, etc. Explicit references to these topics are to be found in some of the case studies carried out under the Programme. Thus, H. Nogueira da Cruz writes of the Zaccaria plant: "In 1943 the plant was moved to a site belonging to the firm and the workshop characteristics which had marked the production process began to make way for those of a factory endowed with a larger quantity of equipment and better organization of the available space. Manpower productivity, and factor productivity as a whole, increased ... Owing to the underdevelopment of the industrial infrastructure the enterprise took pains to find ways of increasing its vertical integration. In 1944 it set up its own casting-shop and in 1945 created its own rubber-processing section".²⁸

In their turn, A. Castaño and others state in the study on Turri S.A.: "Outstanding, in the first place, is the substantial investment placed in the construction and equipment of the new plant. It is interesting to note the way in which the plant was prepared to produce the new goods and then to enlarge its scale of operations. To begin with, the bulk of investment in machinery and equipment is earmarked for the machining section, with a twofold purpose: to increase production capacity and to improve the quality of the product". A little farther on in the same study it is explained that of the equipment incorporated at that time, the most important machines are the following: (i) a grinder, which makes it possible to quadruple the number of lathes per month that the plant can manufacture, at the same time improving the quality of the gears, a vital part of the lathes in question; (ii) a broaching machine, which takes over the work of a relatively old slotter that also represented a manifest bottleneck in the equipment of the old factory; (iii) a planing tool, which permits of appreciable improvement in the quality of the equipment manufactured, especially as regards the preparation of the engine-lathe bed.

²⁷ A. Castaño, J. Katz, F. Navajas, *op. cit.*, 1981.

²⁸ See H. Nogueira da Cruz, *op. cit.*, 1981.

It is also surprising that among the equipment incorporated at that time a set of special blowpipes appears, manufactured by the enterprise itself. This enabled the firm to introduce tempering of the lathe bed several years before its closest competitors, and thus to become an important leader in respect of quality in the domestic market.

To sum up: significantly to increase the physical volume of output and improve the quality of the product manufactured are initially the key objectives of the second phase described here.

Notwithstanding that in correspondence with these objectives the physical volume of output and the quality of the product make significant progress at the beginning of this second phase, it is a notable fact that for several years an optimum situation is not reached. Instead, the available evidence shows that complete digestion of this expansion process takes time and requires domestic technological effort both in the field of process engineering and in that of methods and organization of production. Once again the study on Turri S.A., is enlightening on this point:

“At the subsections level no instructions whatever as to methods and timing were given to the operative other than those provided by foremen or supervisors on the basis of their own experience. There was also a notable shortage of gadgets, masks and tools in every machining and assembly job, in addition to a marked lack of plans, routines to be followed, etc. At the level of the process as a whole programming tasks were carried out by the plant supervisor on very simple lines. The matter became more complicated when —with the increase in the scale of the enterprise— the planning of purchases and the follow-up of the product grew beyond the plant supervisor’s power to cope with ... (yet) technical experts in method and programming were not to be incorporated until 1968”. (Note that this is a date almost ten years after the introduction of the equipment mentioned in the first part of the preceding paragraph.)

In other words, the enlargement of the scale of operations and the improvement in

the quality of the product manufactured which were implied in the expansion of the original artisan-type workshop called for an intensive equipment programme and the introduction of new skills and engineering routines. The global package of process engineering and organization and methods engineering technology which this involves is not available *ex ante* nor can it be obtained without an effort in respect of made-to-measure domestic technology. Some of these technological efforts must necessarily emanate from the plant engineering department itself, which will be responsible for the design and construction of devices and tools supplementary to the key equipment associated with plant expansion, as well as for the instruments of quality control, etc. Another part of the local technological effort will have to come from the organization and methods department —generally somewhat later in the evolutionary history of the ‘type’ establishment considered here— which will have to deal with time and motion studies, with systems of incentives to improve upon standard times, with control of stocks and, more comprehensively, with the global programming of the entire product operation.

The empirical evidence collected depicts this second phase in the history of enterprises as fundamentally associated with the expansion of the factory, which is far from being based on a harmonious programme. And on this account all sorts of technical imbalances and situations of disequilibrium are generated. It is precisely the process of ‘digesting’ this accelerated expansion that is covered by the third phase of a firm’s evolutionary history.

‘Digesting’ plant expansion may take several years and require major adjustments in factor endowment and in the whole of the operational routine. The macroeconomic framework within which each individual firm operates is by no means unconnected with the speed and nature of this adjustment process. In the context of an expansionist situation where surplus demand exists, the ‘digestion’ of a significant increase in plant scale —see, among the studies carried out

under the Programme the case of Aceros Chihuahua in the Mexican milieu²⁹ must necessarily differ from what happens in a scenario of recession. Examples of this latter type of situation may be seen in the Argentinean cases of Turri S.A. or Gherardi Hnos. during the 1966 depression, or in those of the Venezuelan plants manufacturing agricultural machinery —Rota-Agro and Nardi— when, in 1978, they had to face a sharp contraction in demand just when they had completed their respective plant expansions.^{30 31}

At all events, an interesting point, apart from the form and duration of the process of 'digesting' factory expansion, is that it calls for a considerable amount of technological effort both in the field of process engineering and in that of organization and methods engineering. It is also important to note that almost certainly the enterprise will have to formulate a strategy for tackling the various technical problems posed by its day-to-day operation and that this approach will be closely related, firstly, to the size, rate of recruitment and type of skills of the technical staff; and, secondly, to the nature of the activities and subprocesses undertaken, the equipment used, etc.

It is our impression that this approach strategy passes from the simple to the complex, and from machine-paced jobs —i.e., those for which technical information exists to indicate the theoretical standard of performance of the machine— to the labour-paced tasks which are more difficult to systematize. Similarly, the evidence collected suggests that the technical problems connected with the operation of the machinery, and with process engineering in general, are usually tackled before questions of organization and methods. The gradual embodiment of new specialities and skills in the firm's

technical and engineering personnel reflects the existence of an evolutionary process of the type postulated here.

The fourth and last phase of the evolutionary sequence traced involves the growth and consolidation of organization and methods engineering. Once the plant can be classified as middle-sized, and the rapid incorporation of factors has been 'digested', further spectacular expansion can hardly be expected. This does not preclude the introduction of new equipment, especially in so far as it implies a higher degree of automation in specific subprocesses —welding, coil-winding of motors, etc.—, or the establishment of machining centres, whereby several subprocesses can be combined in a single machine; this at the same time raises the degree of automation of the operation as a whole. In our opinion, however, the key feature of this technological phase is the gradual expansion of technical effort aimed at rationalizing and optimizing the operation of the firm as a whole. Studies of 'families of parts'; the reorganization of the factory lay out by technological groups; studies of methods by sections, beginning with the machine-paced sections and moving on subsequently to those of assembly, which are much more labour-paced than the machining sections; standardization and normalization programmes; studies of optimization of stocks; the development of subcontracting, etc.; all these constitute the typical output of new engineering know-how produced by the organization and methods department in the course of this phase.

Up to a point this flow of technical know-how is of a 'disembodied' nature, but since putting it into practice often simultaneously entails the use of new and better equipment and/or the redesigning of the product, it is virtually impossible to separate the embodied from the disembodied part of the total technological progress achieved by the enterprise.

Hitherto we have discussed the nature and characteristics of the technological changes —i.e., of all the modifications of the initial package of technical information— introduced in the course of time by the metal-working firms included in the present

²⁹ See A. Mercado, "Estudio sobre la Empresa Chihuahua", IDB/ECLA/IDRC/UNDP Research Programme on Scientific and Technological Development in Latin America (mimeographed text), Buenos Aires, 1981.

³⁰ See A. Castañón, J. Katz, F. Navajas, *op. cit.*, 1981; and J. Berlinski, *op. cit.*, 1982.

³¹ See M. Turkieh, *op. cit.*, 1982.

sample. We have devoted particular attention to its sequential character—product engineering first, followed by process engineering and lastly by organization and methods engineering—and to the complex set of variables of a strictly microeconomic nature which affect the changes in question. We have shown that the development of engineering capacity in the establishments studied may be viewed as a succession of phases in which both the size and the composition of the staff of engineers and technicians at the firm's disposal are gradually modified as the requirements of 'digestion' first, and later of optimization of plant expansion, make it necessary. This enables the firm to operate on the basis of an increasingly sophisticated and specific package of technical information. We have also shown that this succession of phases takes time and involves various kinds of learning of know-how in different branches of engineering. It means that the development of these firms must not be envisaged as a situation of dynamic equilibrium; rather is it characterized by errors of excess or defect, and their subsequent correction as the result of a new technological input emanating from the plant engineering departments.

Our description of the evolutionary process has concentrated hitherto on what has been observed in the manufacturing establishments studied. On their account we have paid less attention to another process likewise sequential, collateral to the one just considered, and closely related to it: i.e., the evolutionary process that is concurrently undergone by the market, in respect of its morphology and its climate of competition. As we shall see next, the development of plant engineering activities is not independent of what is happening in the sphere of the market.

Both the morphology of the market and the climate of competition prevailing in a specific branch of industry are subject to modifications through time. Two major 'type scenarios' can be described in the light of the information gathered in the various case studies on which the present article is based. The first of these corresponds to those situations in which a monopolistic régime

was *initially* predominant. The motor-vehicle industry, or some of its subsidiary branches, exemplifies, in various Latin American countries, this type of original morphological conformation of the market.

At the very outset, the industry consists exclusively of a single producer, who is protected from external competition either by tariff barriers or by direct import prohibitions. Surplus demand exists in the domestic market, where periods of waiting for deliveries are characteristic. In the postwar years a situation of this type can be seen in various metalworking markets in Argentina and Brazil, while similar trends appear in Peru and Venezuela only in the 1960s and 1970s.

In view of these initial conditions, it is not surprising that during its earliest years the firm earns abnormally high profits, considerations of costs and/or quality taking no prominent place among its immediate concerns. Setting aside the moment of the plant's entry into operation, which may have required a significant amount of engineering efforts aimed at resolving problems of assembly, balancing of the production line in the case of continuous production, etc., it seems reasonable to assume that in these instances the firm's priority objective should be the attainment of a satisfactory level of utilization of installed capacity.

As the conventional models suggest, a situation of this type is apt to induce the entry of new producers into the market with an eye to the existence of differential profits. Such profits may likewise be conducive to rapid expansion of the installed capacity of the original firm. In each of these two cases, both the morphology of the market and the climate of competition prevailing in the branch of industry concerned will pursue a different path, and this will carry implications for the technological behaviour of the sector. Obviously, if new producers do actually enter the market the share of the original monopolist is bound to diminish. The climate of competition may or may not reflect this inflow of new producers. If external protection remains at a high level and the domestic market affords room both for the original firm and for the new

enterprises, a division of markets may well occur without the participants' engaging in practice, in a competitive struggle which comes to be reflected in prices, quality, etc. Should the opposite happen, the pressure of competition may act as an inducement not only to engineering efforts aimed at reducing costs (and prices) but also to attempts at differentiating products, at broadening the mix offered on the market, and at improving not only the quality but also the 'age' or 'technological vintage' of locally manufactured designs.

The growth of plant engineering departments—and the incorporation of new skills in the professional and technical team—will indubitably reflect the market situation. Where the quality of the product, the output mix or the age or technological vintage of the product offered play a more important part than a price cut, design engineering may be expected to develop early, as described in previous pages. In contrast, in cases where the price-elasticity of demand is greater, and where the quality or age of the product do not assume so essential a role—as for example, in the case of simple machine-tools of a universal type used in repair and maintenance work—there are grounds for expecting a bigger relative effort in the area of process engineering, aimed at bringing down production costs and prices.

The picture would be somewhat different—as regards both market morphology and technological behaviour—if the original surplus demand were to induce expansion of the single plant existing at the beginning of the analysis, and a monopolistic régime were thus perpetuated. In this situation it is less feasible to expect efforts to be made in the field of design technology with a view to differentiating the product, broadening the mix or manufacturing newer vintages of the original design. Greater relative attention might be paid to process engineering and subsequently to organization and methods engineering, with the aim of taking advantage of the economies of scale implicit in the production process, or permitting more efficient plant utilization when under-utiliza-

tion of equipment is due to technical problems, intersectional imbalances, etc.

As stated before, there are several branches of the Latin American metalworking industry which began to operate in monopolistic conditions and later gradually found themselves doing so in differentiated oligopolies. The available empirical evidence suggests that transitions of this kind may cover the history of a specific market for ten years (or more), during which period both market morphology and the climate of competition prevailing undergo a succession of changes. The scale and nature of the technological efforts undertaken by firms and consequently the development of engineering departments and the pattern of utilization of skilled human resources will be closely associated with the above-mentioned market characteristics. These, in their turn, will gradually alter in proportion—*inter alia*—to the technological efforts made by the different enterprises. Thus technological behaviour and market morphology and competitiveness simultaneously interact as mutual determinants.

The second of the two 'type' situations observed in the course of our field studies is initially characterized by the presence of various small and undifferentiated producers. The manufacture of agricultural machinery or of different types of machine-tools approximates closely to this typology.

The existence of various small and undifferentiated producers is not enough to warrant the assumption that there are competitive elements in the market. Both in the manufacture of agricultural machinery and in that of machine-tools, our research revealed the presence of a certain degree of 'natural protection' deriving from the geographical location, from the technological adaptation of the designs offered on the market, etc. The aforesaid fragmentation of supply and the lack of competitive elements are initial features of the market, preceding plant expansion on the part of any of the firms operating in it. In other words, since we have described the evolutionary history of the 'type establishment' as comprising four successive phases or stages, the second

of which implies the rapid expansion of the factory, it should now be noted that this initial state of the market—in which the fragmentation of supply and the lack of competitive pressure are predominant—pertains to a point in time when all establishments are in the first phase or stage of their evolutionary sequence.

Factors exogenous to the market—partnership with a foreign investor, subsidized credit from the official banking system, an innovative success, generally in the area of product design, or some other equally fortuitous circumstance—seem to have helped to explain why at some time or other one of the several undifferentiated producers should have acquired a measure of preponderance over the group of metalworking establishments, and thence moved on into the second phase of its evolutionary history, through the rapid expansion of its factory.

As we have already seen, plant expansion implies both an increase in the physical volume of output and an improvement in its quality, the latter by virtue of the incorporation of new and better capital equipment. Consequently, in the first place, the initial morphology of the market is bound to change inasmuch as there will be an increase in the relative share of that one-time small-scale and undifferentiated producer who is most beforehand in undertaking the expansion of his factory. Secondly, and simultaneously, the better quality made viable by the new equipment will consolidate the position of leadership which the producer concerned will be able to establish. This change in the morphology of the market does not necessarily involve—at any rate straight away—a greater pressure of competition in the industry. Firstly, if there is surplus demand on the market or if, concomitantly with the increase in supply, demand is rapidly growing—as happened in the case of many of the metalworking industries associated with the introduction of the motor-vehicle sector in countries such as Argentina, Brazil, Mexico—, the above-mentioned plant expansion can be absorbed without its meaning that the said increase in supply must necessarily displace established

producers. Secondly, given the improvement of quality attained in conjunction with plant expansion, it may feasibly be assumed that the leader enterprise will cover the more sophisticated segments of demand, leaving the rest to the group of small and undifferentiated firms. In either case, however, competitive pressure is bound to build up as the years go by; and this for several different reasons. Firstly, because it is not unlikely that other producers may attempt to expand their own plants, attracted by the existence of surplus demand or of differential profits in the more sophisticated submarkets. Secondly, because in cyclical downturns the leading producer will probably cope with the slump in demand in his own submarket by invading those of the smaller enterprises, even at the cost of lowering quality or modifying the output mix offered, as can be seen in the study on agricultural machinery carried out in Argentina.³² Thirdly, because of the gradual dissemination of technical information throughout the branch of industry concerned, which will gradually erode the technological advantages of the leader enterprise. In particular, those advantages that do not depend upon new equipment on a massive scale will be bound to spread in a few years' time to the whole group of firms making up the industry.

For each and all of these reasons—entry of new producers or expansion of those already in existence through the broadening of the output mix, slumps in overall demand in cyclical recessions, gradual diffusion of technical information throughout the industrial branch, etc.—, the pressure of competition may reasonably be expected to increase through time. Thus, in the first place, the morphology of the market is bound to change when the most advantaged producer expands his plant, and, secondly, the climate of competition prevailing in the industry will likewise alter in relation to the above-mentioned variables. Accordingly, the initial situation characterized by the presence of various small and undifferentiated

³² See J. Berlinski, *op. cit.*, 1982.

producers, faced with little regular and systematic pressure from competition, ultimately becomes, in the course of time, a differentiated oligopoly, similar in several respects to the case previously discussed.

Here, again as in the preceding case, we must expect a clear connection between the technological behaviour pattern of enterprises and the morphology and competitiveness of the market. The two latter conditions will affect, and be affected by, not only the rate of development of plant engineering departments—including here the nature of the firm's new technical activities and professional skills and the pace at which they are introduced—but also the relative importance attached to engineering efforts bearing on the quality of the product or the breadth of the output mix *vis-à-vis* those others that are concerned with ways of reducing costs (and prices).

Here we conclude our study of the relation existing between market variables and the technological behaviour of individual firms. Hitherto we have devoted attention first to what is strictly specific to the individual enterprise—i.e., to the microeconomic determinants of the evolutionary sequence followed by a given firm's engineering capacity—and, secondly, to market variables—morphology and competitiveness—as forces influencing the said sequence. At the macroeconomic level, too, messages are recurrently generated which have repercussions on the technological behaviour of entrepreneurs. In the framework of the IDB/ECLA/IDRC/UNDP Programme, we have had an opportunity to record technological responses to various incentives deriving from official policy, whether concerned with technology or with other matters. Some of these responses are summarized below.

Instruments of economic policy aiming at the management of aggregate demand—exchange, credit, fiscal, monetary measures—influence the technological behaviour of firms both in the demand side and, in some cases, on the supply side. Let us take a quick look at both situations.

A policy of expansionist (or recession)

indubitably unleashes trends in the same direction—although not necessarily on the same scale—in individual markets. Several of the studies carried out under the Programme show that a common recourse in periods of recession is to launch new product designs, of a relatively less sophisticated and more multi-purpose character.³³ Similarly, another typical reaction to a recession consists in reducing the subcontracting coefficient, and bringing back into the firm subprocesses or activities that had been handed over to third parties in times of normal operation.³⁴ Conversely, the expansionist phase of the cycle—often associated with fiscal and credit policies that subsidize equipment—seems to be linked to an opposite trend in respect of subcontracting and to the launching of new products with a higher level of complexity and sophistication.

It seems needless to point out that any reaction which implies changing the output mix—*inter alia*, recourse to the launching of new designs not necessarily available in the firm's output records—, altering the degree of vertical integration, substituting subprocesses (to enhance the quality of the product manufactured), etc., involves correcting the plant operation routine, the machine-load chart and, more generally speaking, the organization of the production process. Each of the engineering functions—product design, process and organization engineering—is required to play a part in a contingency of this type, until a new operational routine has been established. In other words, the firm will necessarily reflect at the technological level—among others—its reaction to the displacement of the demand curve that results from a programme corresponding to expansion (or recession) in the economy as a whole.

Some of the instruments for the management of aggregate demand—for example,

³³ See J. Berlinski, *op. cit.*, 1982. Also A. Castaño, J. Katz, F. Navajas, *op. cit.*, 1981.

³⁴ See J. Berlinski, "Innovaciones en el proceso y aprendizaje en una planta argentina de fundición", *Working Paper No. 45*, IDB/ECLA/IDRC/UNDP Research Programme on Scientific and Technological Development in Latin America, Buenos Aires, April 1982.

the rate of interest or the exchange rate—also have repercussions on the technological behaviour of firms on the supply side, inasmuch as they increase (or lessen) the costs of plant equipment and organization programmes, of maintaining inventories of parts, etc. Our field research is enlightening at this level too. The rise in interest rates induced Turri S.A. —like many other metalworking firms in Argentina— substantially to curtail the duration of the production cycle, while at the same time it led to the postponement of equipment programmes and the stepping-up of efforts to rationalize the production process. The latter included work on standardization and normalization in the area of design, application of the technological groups and ‘families of parts’ methodologies with the aim at increasing batch sizes, etc. In this sense, the rise in the interest rate may be said to have induced the substitution of local engineering effort for new equipment.

The exchange rate in its turn also seems to be related with plant equipment and modernization programmes, especially in so far as these imply the incorporation of imported equipment. In this connection, there are several technological implications that we have been able to observe in the course of the studies carried out. In the first place, it is clear that the gradual reduction in the cost of foreign currency has influenced the propensity of firms to automate specific subprocesses, particularly in the machining area, where the introduction of numerically controlled equipment figures as a recent trend in the Latin American scenario.³⁵ We had occasion to remark earlier on the demand for engineering efforts relating to ‘digestion’ of the plant expansion process in the transition from the second to the third phase of the evolutionary sequence described in the present article; something similar occurs as a result of the trend to-

³⁵ See S. Jacobsson, “Technical Change and Technology Policy. The Case of Numerically Controlled Lathes in Argentina”, *Working Paper No. 44*, IDB/ECLA/IDRC/UNDP Research Programme on Scientific and Technological Development in Latin America, Buenos Aires, March 1982.

wards automating specific subprocesses by the incorporation of numerically controlled equipment. We have noted in several of the studies carried out that the machining centres, the numerically controlled equipment, etc., introduced in response to the relative fall in their prices require their own ‘digestion phase’. This, of course, must be thought of as closely associated with made-to-measure engineering efforts corresponding to the specificity of the plant incorporating the automatic equipment in question. The study on Perkins Argentina sheds a great deal of light on the subject of the ‘digestion’ of numerical control and machining centres, although this is obviously not the only case in point covered by the present research.³⁶

Apart from policies relating to the management of aggregate demand, there are many other public policy instruments which in one way or another influence the technological behaviour of enterprises, and have repercussion on both the amount and the nature of the engineering efforts tackled by individual firms. Among these, mention should be made of all the sectoral instruments that affect: (i) the rate of investment; (ii) the climate of competition; (iii) the framework of regulations; (iv) the greater or lesser ease with which advantage can be taken of externalities deriving from public R&D work —done by universities, official laboratories,³⁷ etc.— that are prevalent in a particular market.

As in the case of the instruments of macroeconomic policy mentioned above, these measures of a more sectoral nature, but also emanating from the public authorities, undoubtedly influence the process

³⁶ See J. Berlinski, “Productividad, escala y aprendizaje en una planta argentina de motores”, *Working Paper No. 40*, IDB/ECLA/IDRC/UNDP Research Programme on Scientific and Technological Development in Latin America, Buenos Aires, August 1981.

³⁷ With reference to the study on Gherardi (J. Berlinski, *op. cit.*, 1982), special mention should be made of a complementary paper by the same author, “Algunas notas sobre los usuarios de maquinaria agrícola, el Instituto Nacional de Tecnología Agropecuaria (INTI) y la Comisión para el Desarrollo de la Maquinaria Agrícola (CODEMA)” (mimeographed text), Buenos Aires, January 1982.

of technological exploration that takes place within a given industrial firm.

Here we close the present section, of which the object has been to review, even though only provisionally, the material collected in the course of the various field studies carried out under the IDB/ECLA/IDRC/UNDP Programme on technological change in the metalworking industries of several Latin American countries.

III

Protection, technological behaviour patterns and maturative phases in the area of Latin American metalworking production

The material presented hitherto depicts a 'type' enterprise and a competitive scenario bearing little likeness to the conventional images usually formed on the basis of textbooks. In neoclassical tradition: "Firms are the key productive actors, transforming inputs into outputs according to a production function. The production function, which defines the maximum output achievable with any given quantity of inputs, is determined by the state of technological knowledge. Technological knowledge is assumed to be public, or at least this is implicit in models based on an industry or an economy-wide production function. Firms choose a point on their production function to maximize profits, given product demand and factor supply conditions. Generally these markets are assumed to be perfectly competitive, so that a firm treats prices as parameters... Over time output grows as inputs increase and firms move along their production functions, and as technology advances. ... There clearly are some strong presumptions here. The view of firms and markets is very stylized —not much room for incompetent management ...or oligopolistic rivalry. Technological advance, while acknowledged as a central feature of growth, is treated in a very simple way, and the Schumpeterian proposition that technological advance (via entrepreneurial innovation) and competitive equilibri-

In the two following sections —the last in this paper— we shall use the material reviewed up to now as the basis of a body of considerations both in the theoretical domain of industrialization and dynamic comparative advantages, and in that of economic and technological policy in the field of the manufacture of metal products and machinery.

um cannot co-exist is ignored".³⁸

In contrast to so stylized a microeconomic world, the empirical evidence presented suggests that the metalworking sector which we are studying is characterized by: (i) disequilibria and periods of 'digesting' them that are more or less prolonged and complex, depending upon the general macroeconomic context; (ii) by firms that go ahead with innovating and improving their relative position in the market, while others suffer failures and lose ground, or simply drop out altogether; (iii) by entrepreneurs that are better off for information or financing than others; (iv) by different technological strategies even in one and the same market —firms that systematically innovate as against others that systematically imitate; (v) by technical and engineering teams of different quality; and, above all, (vi) by radical changes through time in the relative position of the firms operating and in the climate of competition prevailing in the market.

Whereas in the neoclassical world there are, as R. Nelson says in the study quoted above, few interesting questions that can be

³⁸ See R. Nelson, "Research on Productivity Growth and Productivity Differences, Dead Ends and New Departures", in *Journal of Economic Literature*, Nashville, Tennessee, September 1981, p. 1031.

explored and settled by studying the behaviour of individual firms, in a world such as that depicted by the material presented in the foregoing pages, the subjects that must be approached by studying the inter-firm differences in behaviour are many and complex. First and foremost we shall attempt to construct a typology of metalworking enterprises to assist us in the task of describing differential behaviour patterns in the markets concerned.

Several 'ideal types' of firm emerge from our investigation and can be described in terms of the following characteristics.

1. *The family enterprise, based on the mechanical ability of an individual (or group of individuals)*

This type of productive organization is characterized by the narrowness of its sphere of reference and by the predominance of a number of extra-economic criteria in its day-to-day operation, at least during the first two or three decades of its existence. A strong propensity to self-sufficiency and self-financing, the preponderance of skill in mechanics and design over capacity for the organization of productive activity, the application of extra-economic criteria in the recruiting of technical personnel and the selection of equipment (loyalty to the original nationality of the owner, or to relatives in the case of immigrant entrepreneurs),³⁹ one-man management with paternalistic criteria, etc., are all typical features of firms in this category.

Perhaps a somewhat more careful scrutiny of this 'ideal type' should lead us to recognize the existence of moments or phases within the group in question. In this sense, we should probably differentiate family enterprises that have already undergone an 'opening-up' process and a change of generation in their management cadres, from those others that are still rigidly

subject to the original family hierarchy. Whereas the former are sure to be characterized by a higher degree of professionalization -- deriving from the incorporation of "the generation of engineers, lawyers and graduates in business administration"⁴⁰ in their management teams--, the latter probably still retain something of the Schumpeterian 'animal spirits' that characterized the elder generation. In each of these two cases we must expect different attitudes towards taking risks, towards the relative evaluation of technical and mechanical aspects as against business and financial matters, to specialization in the domestic market *vis-à-vis* the external market, etc.

The material gathered highlights another interesting subject likewise relating to the family-enterprise group: this time, a cross-section not by age or generation of the management teams but by differences in the behaviour of firms of this type in relation to the country where they are operating. In this connection it is worth while to point out that --doubtless in response to the larger absolute size of their domestic market and the more stable and favourable framework of overall economic policy in which they have had to operate-- the family-type firms located in Brazil exhibit a stronger propensity than their counterparts in Argentina or Mexico to (i) advance towards international plant scales; (ii) spend on R&D activities; and (iii) seek access to international markets.

We shall revert to these topics a little farther on when we refer to possible measures in the field of public policy.

2. *Subsidiaries of foreign firms*

Obvious as are their efforts at mimetic assimilation with the local environment,⁴¹ firms of this type differ significantly from

⁴⁰ See H. Nogueira da Cruz, *op. cit.*, 1981.

⁴¹ These efforts at mimetic assimilation have already been identified by other researchers, not only in the Latin American environment but also in remoter contexts, such as, for example, Southeast Asia. See B.I. Cohen, *Multinational Firms and Asian Exports*, Yale University Press, 1975. In his study on the Brazilian case Helio Nogueira da Cruz says:

³⁹ A similar case has been described in the bibliography of recent years in relation to the extra-economic ties underlying the movement of capital, technology, etc., between Hong Kong, Taiwan and Continental China.

the preceding category as productive organizations. To begin with there are the initial differences in technological, financial, organizational and other respects deriving from their structuration as an appendage to their parent firm. These differences, which may be an important asset when they are turned to good account, may also become burdensome hindrances and constraints when it is not understood that the operational norms and standards proper to developed countries must necessarily pass through a period of acclimatization and adjustment which will be all the more prolonged and complex, the more specific is the recipient environment.

Apparently acclimatization difficulties are greater in the case of industrial plants designed for continuous-process production on a production-line basis. An unduly broad specification of the output mix, or an attempt to maintain a high degree of flexibility in the production line—an attempt undoubtedly motivated by the small size of the domestic market and the need for diversification which it implies—have permitted an initial misuse of this particular form of organization of the production process.

In addition to the initial differences relating to the typology discussed above, there is also the fact that over the years the firms that are subsidiaries of transnational corporations continue to have access to the resource pool of the parent firm, but generally enjoy less freedom of decision and elasticity of movement than local enterprises. In a variety of particular submarkets this situation has enabled national concerns—of family origin or others—gradually to strengthen and consolidate their position, especially when innovative agility of mind is a key feature of the operation of the market.⁴²

⁴² "The fact is that production and market conditions compelled these firms (the foreign ones) to adapt to local patterns". See "Observações sobre a Mudança Tecnológica no Setor de Máquinas Ferramentas do Brasil", *Working Paper No. 47*, IDB/ECLA/IDRC/UNDP Research Programme on Scientific and Technological Development in Latin America, Buenos Aires, May 1982, p. 35.

⁴² An interesting example of greater innovative agility in the group of family firms than in the sector consisting of

3. Public enterprises

Although there are not many cases of metalworking production in the hands of public enterprises that we have had occasion to look at in the course of the present Research Programme, they obviously constitute a type of enterprise different from those described above. As is suggested, for example, in the study on Forjas, Colombia,⁴³ it is reasonably safe to assume that when the State acts as a producer, there may well be an association between public ownership and the original selection of technology, the timing and nature of new investment, the magnitude and duration of situations of disequilibrium, the manner of coping with the process of 'digesting these', etc.

As in the other two groups mentioned above—family firms and local subsidiaries of transnational corporations—the public enterprise constitutes a typology with objectives and constraints of its own, little resembling those of the other 'ideal types'.

Viewing the field of metalworking production in Latin America, it may be observed that certain branches of the industry—for example, production of agricultural machinery or machine-tools—are typically composed of family-type firms, with many of the characteristics previously attributed to this 'ideal type'. Others—for example, the motor-vehicle industry or the manufacture of tractors—comprise almost exclusively subsidiaries of foreign firms and, lastly, a third category—the manufacture of parts for passenger cars, for example—combines enterprises of both types. Given such heterogeneity as regards firms, it is difficult to accept that a single model of 'the' firm—for instance, the conventional

subsidiaries of transnational corporations can be seen in the case of the Argentinean pharmaceutical industry. See J. Katz, *Oligopolio, firmas nacionales y empresas multinacionales. La industria farmacéutica argentina*, Buenos Aires, Siglo XXI, 1974; and J. Katz, "Estadios de desarrollo e industria químico-farmacéutica", in *Desarrollo Económico*, Vol. 21, No. 83, Buenos Aires, October-December 1981. See also Helio Nogueira da Cruz, *op cit.*, 1982, pp. 23 and 24.

⁴³ See D. Sandoval *et al.*, *op. cit.*, 1982.

neoclassical paradigm— could prove equally useful as a research instrument in all cases. Similarly, in our opinion, rather than eliminating inter-firm differences *a priori* on the basis of more or less restrictive assumptions—for example, equal access to information, the presence of a perfect capital market, etc.— it is more appropriate in some cases to construct alternative behaviour models which explicitly incorporate these differences, since with them the real operation of the market is probably closely linked.

So much for the matter of ‘the’ typical metalworking firm. Equally serious doubts arise when we have to introduce assumptions relating to the firm’s objective-function—maximization of profits, margin of profits over costs, share in the market, etc.—, and to the look of the competition current in the market. While in this last connection we have had occasion to discuss in earlier pages the changeability of the climate of competition predominant in many of the metalworking markets studied, as regards the objective-function of the enterprises considered, it can hardly be assumed that in extremely imperfect markets, protected against external competition, and operating with multiproduct and multiprocess plants displaying varying and generally high degrees of underutilization of the available equipment, firms will do much more than resort to general indicative parameters—rules of thumb—in their adoption of decisions. In a great many cases, the intra-plant information system we have found would barely enable the firm to calculate some simple indicators of costs and productivity per hour on which to base its day-to-day operation.

In short, the neoclassical paradigm seems too simplistic to further our understanding of the behaviour of firms in the Latin American metalworking scenario. The existence of several different types of firms within the sector, with dissimilar objectives, organization and constraints, with varying access to technical information and to factor markets, etc., plus a climate of competition changing through time, a macroeconomic scenario overloaded with imperfections, a high level of protection, etc., seem to us essential features that any exploratory

attempt to shed light on long-term trends in this sector of production ought necessarily to take into account.

On the basis of this reformulation of the conceptual framework within which we consider that the study of the Latin American metalworking sector may usefully be approached, let us now return to the subject of technological change, its sources, nature and implications, and endeavour to analyse the long-term role played by this sector in Latin American industrialization. In other words, given the various types of firms comprised by the sector, the features assumed by competition and what we now know of the evolutionary stages or phases of the typical metalworking establishment, it seems desirable to revert to the time-honoured—but not yet settled—question of protection, dynamic comparative advantages and the pattern of industrialization. In our opinion, the empirical evidence gathered gives us something new to say on the time that protection should last, as well as on the criteria in the light of which the maturative process of a firm or an infant branch of the industry must be judged.

Although the body of literature assembled does not prove that the pattern of industrialization is in any sense accounted for by the pattern of protection, there is little doubt that protection in itself induced industrial development. This idea is clearly expressed by J. Bhagwati and T.N. Srinivasan in their well-known article on “Trade policy and development”, when they say that although it is in fact true that protection for the manufacturing sector *in toto* buttresses the industrial development of the relatively less developed countries (RLDC), it does not thence follow that the pattern of industrial production is explained by the pattern of protection, as this is measured in the RLDC (these authors are referring to the case studies on effective protection carried out under the NBER Project in 1975 and 1976, and covering Turkey, Israel, the Philippines, Ghana, South Korea, India, Egypt, Colombia and Chile).⁴⁴

⁴⁴ See J. N. Bhagwati and T.N. Srinivasan, *Trade Policy and Development ...*, *op. cit.*, 1978, pp. 1-38.

Once the premise is granted that protection eventually causes a budding industry to spring up where it did not exist before, several new questions arise. Among them: In what conditions is protection justified to induce the development of an industrial sector? How much protection must we provide, and for how long? To what end? All these questions bring us back to the essence of the 'infant industry' argument, as it appears in the work of John Stuart Mill, and thereafter throughout the writings of the classical school.⁴⁵ We shall tackle the analysis on the basis of two kinds of material: firstly, the theoretical argument on protection, returns to scale, etc., mentioned in the passage referred to above; and secondly, the empirical evidence collected in the course of the present research programme, which will be used as a background of reference for the discussion that follows.

In what conditions is protection justified for the sake of developing a branch of industry? Mill's reply speaks of 'naturalizing' a foreign industry. But, according to him, this industry must be adapted perfectly to the country's circumstances. The country concerned should preferably be young and expanding, and protection should be temporary. The principle is valid when the only difference between the country in which the industry already exists and the country which wishes to acquire it centres in the individual experience and level of skill of their nationals, so that the superiority of one or the other country is only a question of the acquisition of this experience or level of skill, to which process there are presumably no obstacles other than the cost of learning itself.⁴⁶

What is meant by an industry's being adapted perfectly to a country's circum-

stances? The above-mentioned study by R. Soifer clarifies this point, re-creating Mill's line of argument: the country introducing the new branch of production should ultimately become better fitted for that activity than the society where it originally came into being.⁴⁷

In the foregoing pages of the present paper plenty of light has been shed on the main features — technological, organizational, etc.— of the industry of whose 'naturalization' in Latin America we are speaking here, i.e., the metalworking industry. We know, for example, that this is a branch of production in which it is possible to identify continuous-production plants, organized on a production line basis and highly automated, together with discontinuous-production workshops, producing small batches or even custom-made items, 'made to measure' for the individual buyer. We also know that between the two modes of organization of the production process there is an enormous difference in respect of scale economies, relative incidence of dead time, etc. Furthermore, we have learnt that this industry is made up of a large number of family-type firms, subject to specific rationale criteria, along with domestic subsidiaries of transnational corporations which operate on the basis of the package of technological information provided by the parent firm concerned, and with a greater or lesser degree of flexibility and adaptation to the scenario of the recipient country. It is not worth while to lay further stress here on other structural features of the metalworking industry, regarding which enough information has been furnished in earlier pages.

It is this industry — not a hypothetical sector of production deriving from the neoclassical paradigm— which is to be naturalized in the Latin American context. We should therefore ask ourselves in what conditions the various organizational and enterprise typologies that characterize the sector in question can 'be adapted perfectly' to the circumstances of the recipient societies, so that once the cost of training and

⁴⁵ In the course of the following pages we shall cite an unpublished study by Ricardo Soifer, who rigorously analyses the discussion on protection and infant industry in "Some Aspects of Trade, Development and Protection", London, September 1978. J. S. Mill's argument appears in *Essays on Some Unsettled Questions of Political Economy*, Essay I, London, 1844 (reprint).

⁴⁶ Mill, *op. cit.*, according to R. Soifer, *op. cit.*, 1978.

⁴⁷ Mill, *op. cit.*, according to R. Soifer, *op. cit.*, 1978.

learning of know-how has been covered –i.e., once domestic technological capacity has been developed– the resulting industrial firms could continue to operate on a competitive footing without requiring additional support.

The material gathered in the course of the present Research Programme enabled us to formulate the concept of maturative stages or phases in the evolution of a 'type' metalworking plant. On the basis of this concept it should be possible, in our opinion, to confer a concrete meaning –useful, therefore, for the purposes of designing instruments of public policy– on the idea of acquisition of domestic technological capacity –accordant with received theory– by a given industrial enterprise (or branch of production). We have argued that a complete maturity sequence can be defined as permitting the development and consolidation of the different plant engineering departments –i.e., product design engineering, plant (or process) engineering *per se*, and the organization and planning of production. Various studies show this maturation process to require that the firm be joined by a considerable number of professionals and technicians with different specialities and levels of skill, ranging from the expert in design engineering to the specialist in organization and methods. The same studies indicate that it often takes two or more decades for a given firm to work its way through the complete cycle.

Not all the countries studied under the present Programme nor all the organizational patterns adopted by the metalworking industry have successfully completed the maturative cycle. On the one hand there are those branches of metalworking in which production is continuous and is organized on a production-line basis both in countries of the developed world and in the Latin American scenario. In this subgroup of metalworking branches, the firms examined here reveal results that differ widely when different countries are compared: firms in Brazil, for example, are much more successful than those installed in Argentina or Colombia. On the other hand, we find metalworking plants organized, both in Latin

America and in the developed world, on a workshop basis and producing to meet individual orders. This is a set-up quite different from the foregoing case, and therefore in order to analyse whether protection to enable the internal maturative sequence to proceed is or is not justified, other variables and arguments must be invoked. Lastly, there are also those sectors of metalworking production in which plants in the developed world operate on a continuous production-line basis, while Latin American establishments do so in discontinuous-process workshops organized to produce in small batches. These situations, too, call for independent consideration of whether it is or is not reasonable to protect domestic development of the industry, since the probability of nationalizing it after a certain number of years depends upon variables that differ significantly from those figuring in the preceding cases.

First and foremost, let us take the continuous-production branches of metalworking. Here the Brazilian situation calls for remark. Among the several production-line enterprises studied under the Programme, two Brazilian firms are those most closely approaching results favourable to the protection thesis. These are Romi, producing conventional engine lathes, and Metal Leve, manufacturing pistons. In these instances the firms studied: (i) have progressed towards international plant scales, introducing production line principles in branches where it is this form of organization of production that prevails in the developed world; (ii) have strikingly expanded their research and development efforts, closely approaching the international frontier of technology; and (iii) have significantly increased their exports to international markets, actively competing in countries of the developed world.

There seem to have been three reasons why the above-mentioned firms were relatively more successful than their counterparts in Argentina, say, for example, Turri S.A. and Perkins Argentina. In the first place, the great size and dynamism of Brazil's domestic market, with its high and steady rate of growth over several decades (setting aside brief spells of contraction) have en-

abled the firms to rely on a large and protected domestic market on which to base their expansion. Secondly, and this perhaps in consequence of the foregoing circumstance, in both cases there is a definite propensity to install plants on an international scale—a tendency absent in other countries of the region—which has made it possible for adequate advantage to be taken of economies of scale. Lastly, there is the important fact that both firms are operating in branches of industry whose world technological frontier has not been advanced by very spectacular leaps and bounds in the last few decades; this has permitted a gradual closing of the relative gap existing between the firms in question and their counterparts in the developed world.

In other words, where the size of the domestic market has allowed of the establishment of plants on an international scale—which do not suffer from disadvantages of size in relation to enterprises in developed countries—for the purpose of manufacturing metalworking products whose world technical frontier has not been very rapidly extended through time, an official policy of protection, systematically maintained for several decades, may well be justified in so far as it not only enables firms to nurse along a vigorous process of capital formation, but also promotes the consolidation of a satisfactory level of domestic technological capacity.

It is important to note that, as the classic 'infant industry' argument contends,⁴⁸ what we have said in the preceding paragraph assumes the state of the art to be given and constant at the international level. If we admit that in reality it is perpetually changing—the numerically-controlled lathe tends partly to supersede the conventional engine lathe, and the same thing happens with pistons manufactured on the basis of new metal alloys—the situation becomes more complicated and calls for a dynamic analysis which takes into account these

changes in the state of the art. In the first place, if the 'new' product is not a perfect substitute for the 'old' one—i.e., if there is still a sufficient market for the 'mature' product—there is no reason why its manufacture on a production line basis should encounter problems, even if the same firm does not tackle the manufacture of the 'new' product, but specializes exclusively in the 'mature' product. In terms of the Brazilian case, as long as demand (national or international) for conventional lathes and pistons subsists, our previous opinion as to the justification of protection in both situations does not seem to come up against any difficulties.

A further dynamic question rises when we postulate that sooner or later the mature product should disappear altogether and be entirely superseded by the new product. In this event, it may happen that the development of domestic technological capacity stemming from the production of the mature good has given rise to a set of technological specialities and skills which are not necessarily the most appropriate for closely following (or even leading) the process of change in the world frontier of technology. This latter may well call for a different group of technological skills which the production of the mature good perhaps does not afford (or require), or does so too partially and inadequately for the firm to tackle the transition from the mature to the new products.

Something like this, we think, is happening in the case of Romi, Brazil, in its transition from conventional engine lathes—an area where the firm has successfully traversed the various stages or phases of the maturative sequence—to numerically-controlled lathes, where apparently the firm has recently come up against technological difficulties which led it seriously to consider the necessity of operating on the basis of an Italian licence. The State has again intervened in this instance, once more raising the issue of the need to grant protection to a new maturative sequence, this time in the field of numerical control. Clearly, the case is somewhat more complex than that posited by the classic argument. Must

⁴⁸ See, for example, M.C. Kemps, "The Mill-Bastable Infant Industry Dogma", in *Journal of Political Economy*, February 1960. (Quoted by R. Soifer, *op. cit.*, 1978.)

society shoulder the burden of protecting a succession of maturative sequences to prevent a reopening of the technological gap which has been successfully closed in respect of a given product, or should it be the profits of the first maturative cycle that finance the dynamics of the process? To this and to other associated questions we shall revert in the last section of the present paper, when we refer to matters of official policy.

As regards the other metalworking establishments organized on a production-line basis that are studied here —i.e., the non-Brazilian firms in the present sample— there is virtually not one that can be viewed as favourable to the infant industry thesis. Clearly, in each and all of them the various forms of domestic technological capacity have appeared and developed —Perkins Argentina or Sofasa, Colombia are cases in point— while at the same time export capacity has expanded, although the exports concerned are to ‘captive markets’ in the multinational integration framework of their respective parent firms. Nevertheless, whether because they are local subsidiaries of transnational corporations, whose original design and location were directed towards satisfying the domestic market, or because they imply plant sizes and modes of organization of production relatively far removed from international standards, or because they have less operational flexibility than the firms owned by domestic capital which were examined above (Romi and Metal Leve), the fact is that these production-line establishments are a long way from constituting examples of successful naturalization in the Latin American environment.

The situation changes appreciably when attention is turned from continuous production organized on a production-line basis to workshops producing small batches or custom-made items to meet individual orders.

Let us consider first the case of production of custom-made items, or to meet individual orders, which is undertaken in discontinuous workshop-type plants, both in the developed world and in the relatively less developed countries. It was previously

shown that metalworking industries of this kind involve much greater heterogeneity of output, a far less important role for intra-factory scale economies, a certain degree of natural protection —deriving from the heterogeneity of output and the specificity of the customer—, etc. It is in this new setting that we must endeavour to ascertain whether protection is or is not justified in terms of the probability of naturalizing this specific form of metalworking production in Latin American scenarios.

Whereas in discussion on the foregoing case —production lines— market size and its relation with the viability of installing industrial plants on an international scale were the heart of the matter, here a crucial role is assumed both by the development of design engineering and by the complexity of the available equipment. Reference is intended here to metalworking plants required, for example, to produce complex equipment for nuclear or hydroelectric power houses and power stations, large turbines and generators, heavy boiler equipment, etc.; these being establishments in which design capacity and the possibility of moving and machining big and highly complex parts impose a number of minimum requisites on the necessary equipment and the team of design specialists required.

Here there are two problems: one relating to the minimum scale of operations on the basis of which the unit incidence of design department costs can be kept low; and one connected with the quality and complexity of the equipment —numerically-controlled equipment, machining centres, etc.— needed in order to tackle certain types of job characterized both by their complexity and by the high level of tolerance required.

In other words, in metalworking plants of this type the possibility of naturalizing the industry in the Latin American context depends decisively on the viability of creating and developing a good design and project engineering office and, at the same time, operating with plant at a high level of technical complexity. For both reasons the plants concerned are skilled labour-intensive, and it is precisely the supply of such man-

power that is the main constraint as regards the installation of metalworking establishments of this kind.⁴⁹ Such countries as Argentina, Brazil, Mexico and Colombia must be regarded as those for which, in the Latin American context, it should be relatively easiest to naturalize satisfactorily a metalworking industry of this type.

Yet another additional remark seems to be justified in this field. The leading customer for the metalworking products manufactured by industrial plants of this type is undoubtedly the public sector, through basic infrastructure works; and it is this sector whose demand can provide a stable prop for the activity of a project engineering department of adequate size and level of specialization. This is a matter of official policy to which it will be appropriate to revert in the final pages of the present article.

Worthy of careful consideration is the desirability of maintaining in the Latin American context a third type of metalworking industry, i.e., that in which the region's production is organized on the basis of small batches and in workshop style, whereas developed countries increasingly tend to organize their corresponding production on a production-line basis. As in the preceding cases, what is of interest here is to evaluate how far it is admissible to resort to protection as a means of promoting the naturalization of the industry, even with the *a*

⁴⁹ It must be noted that a contemporary trend in metalworking plants in the developed world which manufacture products of this kind is that of the introduction of Computer Aided Design Systems (CAD), which substantially changes the work of the design department, substituting micro-electronic technology for specialists in design. The subject gives rise to a series of interesting questions. Some of these relate to the desirability of substitution between capital and labour in environments where different relative factor prices prevail. Others, posed by the incorporation of CAD, concern the time required for the work of design and its incidence on the competitive capacity of a given firm. Lastly, it should be borne in mind that the introduction of CAD is now beginning to spread in Latin America, as we are told by R. Kaplinsky in a recent study. See R. Kaplinsky, "The Technological Gap between DCs and LDCs: Computer Aided Design" (mimeographed text), Institute of Development Studies, University of Sussex, Brighton, Sussex, 1981; and "Trade in Technology, Who, What, Where and When?" (mimeographed text), Institute of Development Studies, University of Sussex, Brighton, Sussex, 1982.

priori knowledge that local production will labour under manifold disadvantages arising out of its different organizational arrangement.

Two facts play an important role in situations of this type, over and above the conventional differences in relative factor prices, which may in themselves wholly or partly offset the above-mentioned disadvantages.⁵⁰ We are referring, in the first place, to the degree of natural protection to which allusion has already been made, and which may often be found in given items of metalworking production, such as, for example, a harvester or other agricultural equipment entailing a more or less exacting task of technological adaptation to the specific environment in which it will be used. Secondly, in recent years substantial progress has been made in the application of techniques and methods of organizational engineering—such as studies of 'families of parts' or manufacturing organization by technological groups—allow of considerable gains in respect of scale economies in the framework of limited production on an essentially discontinuous basis.⁵¹

In some specific branches of the metalworking industry the sum of a measure of natural protection plus adequate exploitation—in terms of organization and methods engineering—of the economies of scale implicit in discontinuous technology may result in a successful naturalization of metalworking plants producing in small batches. Cases in point are some of the agricultural machinery plants studied under the present Programme. Of course, it is not a logical necessity that this should happen. We are speaking here of a relative difference in respect of the production function of a plant organized on a production-line basis—such as operates in markets in the developed world—; accordingly, where the disparity in scale economies between the two types of manufacturing organization permits, i.e., in that branch of metalworking in which the

⁵⁰ See H. Pack, *op. cit.*, 1979.

⁵¹ E.A. Arn, *Group Technology, op. cit.*, 1975.

said disparity is not very wide,⁵² the viability of naturalizing the industry in the Latin American context must not be dismissed *a priori*. And conversely, where the difference is really substantial, an attempt to force naturalization of the industry by means of protection may lead to a situation patently suboptimal from the social point of view.

To sum up: we have shown, in the first place, that the metalworking branch of industry is formed by at least three different segments – production lines, production in small batches and production of custom-made items or to meet individual orders. Secondly, that the feasibility of naturalizing a given branch of industry which can be installed or developed under the aegis of protection, depends upon: (i) the relative gap existing between the organization of the production process in the developed economies and in the relatively less developed countries; and (ii) the learning of technical know-how in each of these contexts.⁵³ Following on all this, we have offered empirical evidence to substantiate the idea that, setting aside specific cases in Brazil, where the domestic market has warranted the installation of branches of metalworking based on production lines, with operational scales similar to those internationally prevalent, in the rest of the region the same branches are

lagging far behind equivalent plants in the developed world. Hence it can hardly be supposed that there has been successful naturalization of this type of organization of production. In contrast, the relative success of the naturalization effort seems to be greater in those metalworking branches which produce custom-made items or to meet individual orders, and in those others which operate on the basis of short series, offsetting by means of a strong local organization and methods engineering component the diseconomies of scale inherent in this mode of organizing the production process.

Perhaps what matters most is to have shown that no generalization seeking to evaluate the desirability or non-desirability of protecting the development of the metalworking industry and its naturalization in the Latin American scenario can be a blanket appraisal based on a simplistic specification of the production function, with the consequent disregard of the complexity of each individual situation.

The following section, the last in the present study, deals briefly with the question of economic and technological policy, and attempts to reflect, in relatively rough outline, some of the most important issues that the present exploration has brought to light.

IV

The metalworking industry and public policy

In the course of the foregoing pages we have reviewed various features of the technoeconomic behaviour of about thirty metalworking establishments operating in six Latin American countries: Argentina, Brazil,

Colombia, Mexico, Peru and Venezuela. These enterprises cover the various types of organization of production that can be found in the metalworking sector, i.e., mass production, based on production lines, of

⁵² It must be borne in mind that here we are not speaking only of scale economies in the conventional physical sense. S. Jacobson's study shows that in the case of production of numerically-controlled lathes, operating on the basis of long series makes it possible to obtain very considerable reductions by placing the annual order for electronic control units –which represent practically one-third of the

value of the machine – with the corresponding subcontractor. Producing in small batches implies a relative disadvantage so great as to call in question the very viability of naturalizing this type of metalworking industry. See S. Jacobson, *op. cit.*, 1982.

⁵³ Several years ago we had the opportunity to present a model of this type in J. Katz, *op. cit.*, 1974, chapter II.

highly standardized items, such as passenger cars and their parts and subassemblies; the manufacture of made-to-measure or custom-made individual products, such as, for example, the boiler equipment for a petrochemical plant or the turbine for a hydroelectric power station; and, lastly, production of small batches of such items as agricultural machinery or machine-tools. Briefly summing up some of the main findings obtained, we may say that the research has highlighted the enormous differences in physical structure and techno-economic behaviour between these various types of metalworking establishment. Again, the material gathered also reveals the wide disparities observable within Latin America in the evolution of metalworking production. While the evolutionary histories of enterprises in Argentina or Brazil extend over periods of thirty or forty years, the Peruvian or Venezuelan plants are much younger. Roughly speaking, there is an obvious establishment tendency towards correlation between the age of the firm and the size and complexity of the package of technology it handles.

Some of the various studies mentioned here have made it possible to describe the evolutionary process of a 'type' metalworking plant as being made up of successive phases or stages, which in their turn are linked to the gradual maturation and development of the firm's internal technological capacity. This latter involves the creation and consolidation of the various engineering or technical activities relating to the operation of any enterprise, i.e., product design, process and lastly production organization and methods engineering. It has been noted that as a general rule the development of domestic technological capacity follows a sequence which is influenced not only by the constraints and potentialities inherent in the product initially manufactured and in the equipment available for the purpose, but also by the nature of the climate of competition and of the macroeconomy in which the firm operates.

A complete maturative cycle—that is, a domestic technology learning process where-

by adequate local engineering capacity is consolidated at each of the three technical levels mentioned above—may well last for several decades, and necessarily entails the recruitment of a wide range of professionals and technicians with different specialities and levels of skill.

Although in most of the enterprises studied we have found plenty of evidence of the appearance and development of different kinds of local technological capacity, there are few firms that can show they have successfully passed through the whole sequence of phases or stages relating to the maturation and consolidation of domestic technological capacity. And there are still fewer which, having done so, can, at the end of the maturative process, go on operating without having to resort to some form of protection or subsidy provided by the economic authorities. This last aspect of the problem is affected not only by the special form that local learning of technology has taken, but also, and essentially, by the rate and nature of the technological change occurring in the world frontier of technology.

In other words, only some of the cases considered seem to argue in favour of the infant industry dogma—i.e., that of protection for the growth of domestic technological capacity—, while others appear to have induced merely partial technological progress, or simply and solely to have given rise to the development of a package of technical and engineering skills not particularly well-fitted to enable the firm to continue operating on a competitive footing without requiring protection sustained through time.

So far we have briefly summarized the findings obtained. We shall next attempt to formulate, on the basis of the material presented, some observations on various subjects relating to official policy. The following pages are concerned not with putting forward a specific programme of action but with pointing to a number of topics which call for direct attention on the part of the authorities responsible for technological, education, and industrial policies, the last-named in a broad and general sense.

1. *Market size, production lines and exports*

Production lines in plants on scales far removed from those internationally prevalent breed disadvantages of several types which the present research has repeatedly brought to light; among them are not only the static effect of the higher unit cost of production, but also a dynamic effect associated with the character that this kind of plant imparts to the development of domestic technological capacity.

A caution against factories of this kind may reasonably be issued to those developing countries whose domestic market is relatively small, and which at the same time are embarking on integration programmes (for example the Andean Pact). The relative inefficiency of establishments of this type increases with the degree of diversification of the output mix, for which reason also wariness is advisable with regard to economic policies that tend to promote the broadening of the mix.

Generally speaking, in view of the size of Latin American domestic markets, production lines should imply high export coefficients—50% or more of the invoicing value—so that the installation of plants of this type must necessarily be accompanied by a comprehensive package of such industrial policy measures as promote—or at least do not discourage—the quest for international markets.

The lack of a relatively large domestic market to justify the installation of plants operating on the basis of production lines is of course no proof whatever that other forms of metalworking production—items that are custom-made or manufactured in small batches—are also inadvisable. The availability of good design engineering and the possibility of running workshop-type factories endowed with relatively sophisticated equipment, as well as the existence of a certain degree of natural protection resulting from the specificity of local demand, clear the way for the establishment of metalworking industries that can operate efficiently in special niches of the local and international market for products that are

custom-made or manufactured in small batches. This would appear to be an option worthy of consideration by countries—such as several of the Latin American economies—with small domestic markets but with relative advantages in respect of the available supply of skilled human resources.

Obviously, a strategy of this type must be complemented with specific programmes relating to such questions as the following: (i) purchases by the public sector—unquestionably the leading buyer for custom-made or individually ordered metalworking products; (ii) training of skilled human resources; (iii) diffusion of technology—uses of numerical control, machining centres, etc.—and technical information (on normalization and standardization, minimum quality control criteria, etc.). The fact that Argentina's Atomic Energy Commission is at the same time engaged in designing, constructing and setting up an atomic reactor for Peru affords preliminary but suggestive evidence in support of the idea that countries like those mentioned can operate to some advantage in branches of the metalworking industry producing to meet individual orders.

2. *Duration of the period of learning technology, protection policy and the concept of the relative technological gap*

The empirical evidence brought to bear suggests that the development of domestic technological capacity—that is, the consolidation of the various plant engineering departments to the point of making viable the long-term maintenance of autonomous competitive capacity—may well necessitate a lengthy period of subsidization, certainly longer than is suggested in the recent literature of the subject.⁵⁴

⁵⁴ Commenting on the normative position of B. Balassa, L. Westphal remarks that the author in question supports a standard programme of effective protection not exceeding ten or fifteen per cent for all those activities not classified as instances of 'infant industry'. Save in exceptional cases, it does not seem justifiable to grant the latter a rate of effective protection more than twice as high as those accorded to the mature sectors of industry. In addition, this protection for infant industry must be temporary, subject to a declining schedule which reaches the level of the other

It should likewise be borne in mind that almost as important as protection itself is the creation of an atmosphere of relative stability in the economic policy programme, which should avoid the erratic behaviour and the abrupt changes of direction which undoubtedly militate against slow-maturing projects such as many of those relating to investment in industrial plant and the development of domestic technological capacity.

A similar conclusion is reached by J. Bhagwati and T.N. Srinivasan in the NBER research programme referred to above. According to these authors, it would seem that the transition to a liberalization policy and its subsequent continuity are of crucial importance for the achievement and maintenance through time of successful export results. Otherwise, occasional spurts of liberalization –instead of the maintenance of a stable policy– would mean a continual going back to square one.⁵⁵

Two other matters of importance in connection with protection policies are: (i) criteria for selection of the branches of industry to be protected; and (ii) the explicit formulation of a time schedule or time chart. At both levels a useful concept is that of the relative technological gap, which is simply an indicator that takes into account, on the one hand, the initial disparity between productivity (or costs) in the society opening its doors to a new industrial branch and, for example, in the latter's country of origin; and, on the other hand, the rate of learning of technology attained by the said industry in each of these locations.⁵⁶

It seems evident at a glance that both a satisfactory choice of branches of industry to be given preferential treatment, and the

made-to-measure design of an optimum time schedule or time chart for the relevant rates of protection, must necessarily be based on a more or less approximate idea of the 'relative technological gap' concept, as expounded in the preceding paragraph.

The work done by various researchers shows that this gap is determined by such factors as the plant size chosen in comparison with international sizes, the scale, composition and nature of local engineering efforts, the organization of the production process (degree of vertical integration, handling of subcontractors, etc.) among other.

In view of the peculiar features of each situation, and the specificity of each maturative sequence, it is impossible, in our view, to speak of protection programmes that are unvarying from one country to another or from one branch of industry to another, as has been the practice in recent literature on effective protection.

3. Research and development efforts and diffusion of technological know-how

The design and implementation of official programmes of action relating to the generation and diffusion of new technological know-how is justifiable on many and diverse grounds. At both levels –that of the creation of new technological know-how and that of the diffusion of technical information– plenty of reason exists to suspect *a priori* that the price mechanism does not send out appropriate or sufficient signals to induce a socially optimal resource allocation and that the intervention of the authorities is warranted for the sake of exploring alternative ways of approaching the optimum in question.

There come into play here not only the amount spent by a specific community on the above-mentioned activities and the relative participation of the public and private sectors in financing them, but also the degree of centralization and decentralization with which they are to be carried out, i.e., which and how many of the tasks of research, development and diffusion of technological knowledge will be undertaken by the private sector or, alternatively, by de-

subgroup in, say, five to eight years. See L. Westphal, "Empirical justification for infant industry protection", an article due to appear in *Trade, Technology, Equity and Stabilization in Latin America*, Moshe Syrquin and Simon Teitel (eds.), New York, Academic Press Inc.

The passage cited from B. Balassa comes from "Reforming the System of Incentives in Developing Countries", *World Development*, Vol. 3, 1975.

⁵⁵ See J. Bhagwati and T.N. Srinivasan, *op. cit.*, 1978, p. 16.

⁵⁶ Such a model is presented in J. Katz, *op. cit.*, 1974.

centralized public-sector entities, such as the universities, institutes of industrial technology, the Atomic Energy Commission, etc.

A first point seems clear: current spending on research and development in the field of metalworking technology, as well as on the diffusion of technical information in the various branches of that sector of activity, is on a relatively small scale in comparison with what is disbursed under these heads by enterprises and governments in the developed world⁵⁷ or even in some of the countries of Southeast Asia. We have noted that the R&D spending of the most successful firms in the sample examined here amounts to about 5.7% of their sales.⁵⁸ This is undoubtedly an atypical situation for the metalworking industry as a whole, the average for the sector being probably only one-fourth of that figure, perhaps less. Accordingly, it seems reasonable to assume that the margin of action available for boosting the domestic technology effort undertaken by the private sector is still wide, and that there is full justification for co-ordinated action in this respect. Although the information available on R&D spending and diffusion of technical information by the public sector is definitely unsatisfactory, such a conclusion does not seem to us unrealistic, for which reason we also think it valid to advocate a substantial increase in public expenditure on the work in question.

Let us next look at possible paths to follow, beginning with the task of disseminating technical information.

One of the studies prepared under the present Programme describes the operation of a sectoral centre whose function is to evaluate new production technologies and to disseminate technical information in the field of agricultural machinery. The organization and *modus operandi* of this centre are

extremely attractive inasmuch as they could serve as a model for the experimental designing of similar channels for the diffusion of technical information in other branches of metalworking production.

The example alluded to is afforded by Argentina's Commission for the Development of Agricultural Machinery (Comisión para el Desarrollo de Maquinaria Agrícola - CODEMA), a body to whose work we are introduced in the study by J. Berlinski.⁵⁹ CODEMA is a sectoral centre for the evaluation and diffusion of technology in which the various entrepreneurial associations of manufacturers of agricultural machinery participate, together with the National Institute of Agricultural Technology (Instituto Nacional de Tecnología Agropecuaria - INTA) and the National Institute of Industrial Technology (Instituto Nacional de Tecnología Industrial - INTI). "*Inter alia*, the CODEMA experiments subcommittee dealing with machinery for the planting of crops has drawn up rules and guidelines for both laboratory and field trials of seeding-machines."⁶⁰ These norms, widely disseminated among users, INTA extension agents, entrepreneurs in the sector, etc., make the market picture clearer—and therefore improve the operation of the price and competition system—and encourage and guide technological innovation in the industry concerned.

Measures of this type—i.e., creation of sectoral centres for evaluation of technology, preparation of technical norms and diffusion of information—, which require not only applied research and experimental development on the part of the public sector but also the establishment of a system of co-ordination between that sector and entrepreneurs in a given branch of industry such as may ensure the viability of technological dialogue between them, should in our view be extended to other fields of metalworking activity.⁶¹

⁵⁷ By way of example, although the figures are not up-to-date, the reader may refer to the statistics on R&D published by the National Science Foundation. See, for example, *Research and Development in Industry, 1966*, Washington, National Science Foundation, US Government Printing Office, 1968.

⁵⁸ See, for example, H. Nogueira, *op. cit.*, 1982, table C.1., p. 100.

⁵⁹ J. Berlinski, "Algunas notas...", *op. cit.*, 1982.

⁶⁰ J. Berlinski, "Algunas notas...", *op. cit.*, 1982, p. 4.

⁶¹ See, for example, the mode of operation, in the

In addition to the evaluation of technology and the diffusion of technical information, sectoral nuclei of this type may also be envisaged as a fitting framework for the implementation of group measures relating to other aspects of technology. These could include situations in which price signals are belated or incorrect, or where there is imperfect appropriability of benefits. Cases in point might arise in relation to the training of skilled human resources, or the generation of scientific knowledge of a more basic character, but useful in the event for the overall development of the technological atmosphere in which a given branch of production operates. (These questions will be taken up again a little later.)

Of course this is not the only way of promoting the diffusion of technical information in a specific branch of production. In some activities—for example, crop farming—the role of the extension agent is typically that of a disseminator of information. With few exceptions, little attention has been paid to this role in the field of industrial production, probably because of the difference in degrees of private appropriability between scientific and technological knowledge relating to the primary sector and information of the same kind concerning industrial production. There is some suggestive empirical evidence to hand—for example, the repercussions on overall productivity that on different occasions we have seen to be produced when members of the technical sales service of large firms visit their customer firms in order to consolidate the business position of their respective enterprises.⁶² What it suggests is that the

industrial extension agent might become an important figure in relation to the perception of technical plant problems by the private entrepreneur and the consequent dissemination of technical information bearing on their solution. Little attention has hitherto been paid to the role that could be performed in this respect by public-sector technological institutes—such as INTI, mentioned above—or by the universities.

Other channels through which technical information can be disseminated are industrial fairs and exhibitions, sectoral conferences and meetings, programmed visits to industrial plants in developed countries, mass distribution of information on patents and other similar documents, preparation and diffusion of norms and standards for plant operation, maintenance, quality, industrial safety, etc. All these measures have a single common denominator: the social exceeds the private benefit, a basic justification for their implementation and financing by the public authorities.

Let us now go on to the subject of R&D spending. This may be conveniently divided here into expenditure on adaptation, optimization, etc., of known technologies, and major items, i.e., those involving technological exploration and development in frontier fields. As regards the former, we have found plenty of empirical evidence which shows that the private metalworking sector in the bigger Latin American countries has coped in the past—and is still coping today—with a vast spectrum of effort comprising: (i) the designing of new products; (ii) enhancement of quality in products already known; (iii) use of new materials; (iv) more efficient utilization of available equipment; (v) introduction of modern equipment, highly complex and automated; (vi) improvement and rationalization of plant lay out; (vii) application of up-to-date organizational engineering methods such as studies concerned with families of parts and with rationalization of the production process by technological groups, etc.

Obviously, not all the enterprises studied have covered every one of these technological areas, nor, when they have

United States context, of the Co-ordinating Committee for enterprises manufacturing motor vehicles, sponsored by the Office of Transportation Programs of the Energy Department. This Committee has published a long list of documents summing up what has happened at the successive meetings for exchange and diffusion of technological information in which all the major motor-vehicle manufacturers in the United States have participated, as well as the great majority of their suppliers and subcontractors.

⁶² See J. Katz *et al.*, "Productividad, tecnología y esfuerzos locales de investigación y desarrollo", *Working Paper No. 13*, IDB/ECLA/UNDP Programme of Scientific and Technological Research in Latin America, Buenos Aires, March 1978.

attempted it, have all done so equally well. Implicit just in the very idea of maturative sequences which underlies the whole of the present paper is the concept of evolutionary differences and of wide inter-firm dissimilarities, even between close competitors, in respect of the technological paths they follow. A list of themes like that suggested before, and the above-mentioned notion of maturative differences, should, in our opinion, constitute the basis for the construction of an agenda of research and development projects of the adaptive type—i.e., of projects implying the adaptation and optimization of known technologies—to be tackled by the various engineering teams of the metalworking establishments in operation.

As stated earlier, many technological efforts of this type are being undertaken today even when the fiscal incentives provided are purely conventional or, in some cases, do not even serve as inducements. Generally they take the form of R&D projects with high rates of private profit⁶³ and short maturities, and therefore obviously attractive. This does not mean, however, that from the social standpoint it is not desirable to induce expansion of the resources which society as a whole earmarks for this purpose. This end might be served by seeking to ensure that more is spent on projects of this type by firms that are already tackling them today, or getting small and medium-scale entrepreneurs, currently playing little or no part on the technological scene, to take a gradually increasing interest in it. Fiscal incentives are conceivable—more localized and focalized than at present—, or programmes of direct action in which decentralized public-sector institutes, specific nuclei of the university system, etc., could assume the leadership. To judge by the empirical evidence collected, the increments in overall productivity that could be engendered by this means—especially where

organization and methods engineering would permit a drastic elimination of dead time and other indicators of inefficiency—are of considerable magnitude. The sectoral centres for evaluation and dissemination of technological information might possibly be regarded as a suitable framework for the drawing-up of an R&D agenda concerted between the public and the private sectors and enlisting the approval and active participation of both.

While in the adaptive field the idea is to promote a significant increase in the type of technological effort which today is undertaken, although only in part, by the private sector, where the exploration of frontier areas is concerned it is the public sector that has to play the more outstanding role as leader and in many cases even as direct executor. Obviously, the greater the elements of uncertainty and risk, the longer the periods of maturation, and the more sophisticated and complex the type of human resources and equipment required for exploratory work, the lesser is the likelihood of the private sector's allocating sufficient resources to allow local development of a scientific and technological base adequate for closely following or even taking the lead in the extension of the world scientific and technical frontier. The rapid penetration of microelectronics and the difficulties that some of the biggest manufacturers of capital equipment in Latin America have encountered in recent years on this account bear eloquent witness to the problem posed here.

In contrast to the case of adaptive R&D, where the objective of technological policy ought to be that of getting many different firms to join in a generalized programme of domestic technological development, with regard to frontier R&D projects careful selection would be necessary, respecting not only their object *per se* but also the entrepreneurial group and the technical and professional team with which it is decided to implement the programme. Again in contrast with the preceding case, this is a field in which technological dialogue between the production sector and the universities will necessarily have to be intensified, since human resources with a high level of skills

⁶³ See P. Maxwell, "Implicit R&D Strategy and Investment-Linked R&D. A study of the R&D Programme of the Argentine Steel Firm, Acindar S.A.", *Working Paper No. 23*, IDB/ECLA/UNDP Programme of Scientific and Technological Research in Latin America, Buenos Aires, March 1979.

and a proper grasp of the main lines of exploration pursued at the international level are a *sine qua non* for progress along this path. Different experiences connected with the development of spearhead technologies in industrialized countries reveal that there are few firms in the private sector which are capable of promoting this technological dialogue with the universities and with the public-sector offices responsible for scientific and technological policy and for industrial planning. Furthermore, the available evidence suggests that these are slow-maturing programmes whose incidence on the production sector barely becomes apparent in periods of less than a decade, or even longer. Financing and direct action by the public sector in this context are not only considered admissible but are openly practised by all the countries of the developed world.

4. *Subcontractors and supply of basic inputs*

Over and over again our studies bring to light the existence of many difficulties in connection with the employment of subcontractors as well as in obtaining supplies of basic inputs such as iron and steel and other similar raw materials.

We shall first consider the matter of subcontractors. Their absence must be interpreted as a general problem of maturity of the industrial structure and as a manifest failure of the price mechanism; here we are faced with a breakdown of the market that should be corrected by direct public action.

In our opinion, an organized effort in this direction would have to begin with a broad programme of standardization and normalization of parts, subassemblies, materials, etc., and also with a concerted agreement to reduce the output mix manufactured by each firm, or per production line. This would make it possible, in the first place, to take advantage of economies of scale deriving from specialization and from elimination of dead time—delay, machine preparation, etc.—and, secondly, to select a list of specific fields in which it would be

advisable to induce the emergence and development of independent subcontractors.

The aforesaid work of standardization and normalization involves difficulties which must by no means be minimized. The existence of profits deriving from differentiation of products, of miscellaneous problems inherent in the private appropriability of technical know-how, etc., means that awkward obstacles have to be surmounted in the implementation of a programme of public action in this domain. Inter-firm co-ordination and a time schedule of close collaboration with public-sector technological institutes seem to be indispensable requisites for any real progress. In this connection, the sectoral centres for evaluation of new technologies and dissemination of technical information, whose significance was previously discussed, might be envisaged as valid nuclei through which to promote measures such as those suggested here.

The standardization and normalization effort will undoubtedly assist in the identification of a schedule of activities and lines of production in which the economies of scale potentially obtainable through the development of specialized subcontracting are sufficiently attractive to convert these branches of industry into priority items on the industrial policy agenda. Castings, gear-boxes, electric motors, etc., are obvious targets for incorporation into such a list.

The next step relates to the area of industrial policy and consists in the preparation and launching of specific investment projects in the fields thus selected. Conventional fiscal incentives, or direct agreements with entrepreneurial sectors whose day-to-day operations would be affected, may, at this level of generality, be thought of as possible channels for the installation of an infrastructure of specialized subcontractors. These measures would have to be complemented by others relating to diffusion of information, strengthening of the channels of financing for small and medium-sized firms, and other similar activities favourable to the consolidation of a productive sector of society which today is on a definitely shaky footing, or, in many cases, simply non-existent.

Moving on now to the subject of basic inputs, it seems important to note that almost invariably the metalworking firms studied declared that they encountered difficulties in respect of the costs, quality and delivery times of basic raw materials such as iron and steel or others of a similar kind, often supplied by decentralized public sector enterprises. In various branches of the metalworking sector, the relative incidence of inputs of this type on the overall costs structure is significant, for which reason the trickle-down of the operational inefficiency of basic sectors to the terminal establishments raises the latter's production costs and impairs their capacity to compete with international substitute products. Measures of various kinds are conceivable as means of counteracting this situation, from temporary import permits to the management of an effective rate of protection which could take care of the high level of inefficiency often present in the production of basic inputs. Ultimately it is the overall problem of protection of the basic production sectors that will have to be tackled through suitable instruments, but during the transitional phase it seems wise to adopt specific measures to prevent transfers of operational inefficiency originating outside the metalworking industry.

5. Equipment and skilled human resources

A number of points call for attention in connection with manufacturing equipment and the training and incorporation of skilled human resources.

As regards the first matter—manufacturing equipment—, it seems clear that the diffusion of numerical control, of Computer Aided Design systems (CAD), of flexible machining centres and lines, and of robotics in general, has barely begun to take place in the Latin American metalworking industry. This sluggishness in the dissemination process is partly attributable to the problem of relative prices, but due account must also be taken of major shortcomings in respect of access to the relevant technical information, as well as in the methods of evaluation available to the entrepreneurial community.

Clearly, in the medium run the region's metalworking industry cannot stand aside from the technological revolution in this field which is now brewing in the international scenario: a revolution whose epicentre is in the Japanese economy.⁶⁴

The questions inherent in the dissemination of technical information on these new kinds of equipment could be dealt with both through industrial extension agents and by means of the sectoral centres for evaluation of technologies proposed above.

It seems important to note here that a considerable proportion of the new numerical control technology is especially suitable to production in small batches and must therefore be viewed as particularly useful for the type of production programmes predominant in Latin America. This leads us to assume that an adequate programme of technical assistance for users, capable of providing information on the optimum type of systems and equipment for each individual situation, will undoubtedly have a highly positive effect on the rate of dissemination of numerical control technology throughout the region's metalworking sector.

Obviously, over and above informational shortcomings, there is also a problem of relative prices and of available supplies of skilled manpower, as regards the rate of dissemination of numerical control, machining centres and other forms of automation. While the question of relative prices could be tackled through specific legislation to encourage investment in equipment through tax and credit advantages, etc., the problem of the skilled human resources required to operate this modern equipment involves not

⁶⁴ During the 1980s we are witnessing a revolution in production systems in so far as a larger number of metalworking establishments is incorporating entirely automated machining centres to take the night shift ... Furthermore, special attention is apparently being paid to flexible manufacturing systems (FMS) which are concerned with the work of handling, positioning, etc., of materials and parts and in which numerically-controlled lathes and other miscellaneous equipment operate at the orders of a single intelligent and reprogrammable robot. Such is the approximate wording of a comment in *Metalworking Engineering and Marketing*, a two-monthly Japanese magazine responsible for disseminating information on the state of the international production frontier in the metalworking field.

only their training at the level of society as a whole, but also the informal training often given by the individual manufacturing establishment. Where in-service training is concerned, as we suggested in connection with incentives to physical capital formation, use may be made of fiscal and credit subsidies for private expenditure on the training of technicians and professionals, fellowship programmes, periodical refresher courses, and other similar outlays undertaken by the individual firm.

If we now go on to the second of the topics discussed here, i.e., training of skilled human resources at the level of society as a whole, it becomes immediately evident that the spectrum of problems involved is extensive and will have to be the object of a special programme of action whose coverage ranges from society's expenditure *per se* on education and training in the various professions and specialities linked to metalworking production, to the curricula of the various educational programmes. It is a matter not only of stepping up the effort made by society as a whole in the educational field but also of improving the dialogue and interrelationship between the educational system and the productive sector. Special care should be devoted to such questions as the mobility of professionals and technicians between the various places of study and the main enterprises in the sector, the creation of new technical careers and specialities not offered in the curriculum today, the launching of programmes of collaboration in basic and applied research between university professionals and personnel of public and private enterprises in the metalworking sector, etc.

APPENDIX

Details are given below of the working papers published by the IDB/ECLA/IDRC/UNDP Research Programme on Scientific and Technological Development in Latin America. Up to No. 36, the papers correspond to the first phase of this programme, and as they do not deal with the metalworking sector they have not been included on the following list.

- 37 – Staffan Jacobsson, *The Use and Production of Numerically Controlled Machine-Tools in Argentina* (December 1980).
- 38 – A. Castaño, J. Katz, F. Navajas, *Etapas históricas y conductas tecnológicas en una planta argentina de máquinas-herramienta* (January 1981).
- 39 – Hélio Nogueira da Cruz, *Evolução Tecnológica no Setor de Máquinas de Processar Cereais. Um Estudo de Caso* (July 1981).
- 40 – Julio Berlinski, *Productividad, escala y aprendizaje en una planta argentina de motores* (August 1981).
- 41 – M. Ramírez Gómez and José Leibovich G., *Cambio tecnológico en la firma Distral S.A. fabricante de calderas y equipos de presión* (August 1981).
- 42 – D. Sandoval, M. Mick, L. Guterman, *Análisis de la trayectoria de una planta automotriz en Colombia: El caso de Sofasa*. (November 1981).
- 43 – Julio Berlinski, *Innovaciones en productos y aprendizaje (El caso de una planta argentina de implementos agrícolas)* (January 1982).
- 44 – Staffan Jacobsson, *Technical Change and Technology Policy. The Case of Numerically Controlled Lathes in Argentina* (March 1982).
- 45 – Julio Berlinski, *Innovaciones en el proceso y aprendizaje en una planta argentina de fundición* (April 1982).
- 46 – Marcos Eugenio da Silva, *Inovação Tecnológica no Setor de Máquinas Ferramentas Brasileiro - Um Estudo de Caso*, (May 1982).
- 47 – H. Nogueira da Cruz, M.E. da Silva, L.A. Gunnar Hugerth, *Observações sobre a Mudança Tecnológica no Setor de Máquinas Ferramentas do Brasil* (May 1982).
- 48 – Julio Berlinski, *Cambio en la información técnica y aprendizaje en una planta argentina de motores* (June 1982).
- 49 – D. Sandoval, L. Jaramillo, *La industria de máquinas-herramienta en Colombia. Estudio de una firma productora de tornos y otras máquinas para trabajar metales* (June 1982).

50 – D. Sandoval, M. Mick, L. Guterman,
L. Jaramillo, *Análisis del desarrollo in-*

dustrial de Forjas de Colombia,
1961-1981 (June 1982).

The Andean peasant, water and the role of the State

A. Dourojeanni
and M. Molina*

The Andean regions of Latin America encompass a vast mountainous zone of alternating high peaks, hillsides and relatively narrow valleys; rivers and ravines form a large number of basins in this area inhabited by scattered population groups which exert heavy pressure on the fragile renewable resources to be found there.

In order to live in this environment, the inhabitants of the Andes must have the organization and know-how necessary not only to meet their own food production needs through proper management of natural resources—mainly water and the soil—but also to promote the conservation of those resources.

In the opinion of the authors, history demonstrates that the pre-hispanic inhabitants considered three elements as being essential for proper management of the basins in general and of water in particular: (a) the organization and co-ordinated participation of the community in the work; (b) the use of technologies and working methods adapted to the zone; and (c) control over a sufficiently large vertical and horizontal area to allow various ecological levels to be managed simultaneously.

At present there are still only a few government-sponsored programmes and projects in Latin America which take the above considerations into account and devote their efforts to providing technical assistance to the peasants for integral management of basins or hillsides on the basis of appropriate technologies. The study emphasizes, however, that the programmes in operation which cover these aspects, although few in number, indicate that there is a vast potential for the exchange of know-how through appropriate horizontal co-operation machinery. Such co-operation would primarily take place among the countries of the Andean region, but could be expanded to include all of the region's mountainous areas, thus benefiting the rural population of mountainous areas throughout Latin America.

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Introduction

Water in the upper Andes is a relatively scarce, and therefore very valuable, resource; it is of crucial importance to the well-being of the region's inhabitants, since theirs is a primarily agricultural economy.

For that reason, the pre-Columbian Andean culture developed complex techniques for developing this resource which allowed the people to preserve the catchment areas (i.e., basins and hillsides), to manage the water through water works and by changing the gradient of the slopes, and to protect themselves from risks during times of excessive rainfall.¹

Although the Spanish colonists did not neglect agriculture entirely, they did permit the catchment basins and the works designed for water use and control to deteriorate.² The advent of the republics (independence) did not improve the situation which arose under the colonists,³ and water ceased to be a reasonably reliable factor of well-being for Andean peasant communities.

The objective of this study is to describe the present situation of the Andean inhabitants, and particularly the peasants, *vis-à-vis* Andean hydrological dynamics, as well as to propose means of improving these people's relationship with their environment, using water management as a frame of reference. Because of their particular characteristics, Andean hydrological dynamics call for a special form of management which takes into consideration the well-being of the Andean inhabitant in terms of his organizational capacity, real needs, cultural values and technical know-how as regards environmental management.

The nature of water dynamics in the Andean environment, taking into account both the geo-physiographic environment

¹ S. Antúnez de Mayolo, "La predicción del clima en el Perú precolombino", in *Interciencia*, Vol. 6, No. 4, July-August 1981, p. 206.

² H. Villanueva and J. Sherbondy, *Cuzco: Aguas y poder*, Cuzco, Centro de Estudios Rurales Andinos Bartolomé de las Casas, December 1978.

³ Oliver Dollfus, *El reto del espacio andino*, Lima, Instituto de Estudios Peruanos, February 1981.

—particularly river basins— and the hydrological phenomena peculiar to the Andes, are dealt with below. A description then follows of the way in which utilization of the natural resources of the basins has evolved and how it has deteriorated from pre-colonial times until today. An assessment is then given of the various programmes, projects and activities currently being carried out in order to prevent further degradation of the high mountain basins and its resultant effects on the water and the inhabitants. Finally, some broad conclusions are drawn based on the preceding analysis.

This study attempts to demonstrate the historical and technological importance of participation by the inhabitants and users of the basins in the management of the natural

resources they contain, as well as to point out the responsibility which should now be assumed by the State in facilitating and promoting such participation. It also explains that, as history has demonstrated, various ecological levels must be managed simultaneously in the high Andean region if efforts are to be successful. Finally, it emphasizes the need to retrieve, adapt, develop and disseminate technologies appropriate to the area, and to that end, recommends the promotion of horizontal co-operation among countries and specialized institutions. The progress which has been made through the creation of Latin American co-operation networks for these purposes and the need to encourage their operation are also underscored.

I

Water dynamics in the Andean environment

1. *The configuration of the Andes*

The Andean cordillera has distinct characteristics depending upon the latitude concerned. In Ecuador and Peru, it is 150-250 km wide and towards the north has a series of mid-elevation basins flanked on the east and west by formations more than 5 000 metres in height, whereas towards the south the basins are generally dry and bisected, and already show a difference between the dry western side and the humid Amazon face.

In southern Peru and northern Bolivia the cordillera is much bigger, attaining its greatest width, of approximately 500 km, in Bolivia. High plateaux extend over most of its width and are circled by peaks with heights of more than 6 000 metres above sea level.⁴

2. *The Andean hydrographic basins*

The particular configuration of the Andean

chain gives rise to the formation of hundreds of hydrographic basins displaying a wide variety of hydrological features, according to the direction of flow of the rivers, their latitude, altitude above sea level and the slope on which they are located.

In the valleys and on the slopes formed by these basins are large population centres whose main activities are agriculture, stock raising and mining. To a large extent they are dependent upon climatic conditions for their survival, particularly upon the availability of water.

The most important valleys and human settlements from a geo-socioeconomic standpoint are between 1 500 and 3 600 metres above sea level. Many towns are located at the headwaters of the basins, where there is a shortage of water during certain times of the year due to a lack of adequate catchment areas and dam sites.

The most heavily populated upper basins usually have a longitudinal orientation parallel to the major branches of the Andean cordillera, as in the case of the Mantaro, Santa and Cajamarca river basins in Peru. In their upland regions, they contain suitable

⁴ Oliver Dollfus, *ibid.*

water storage areas in the form of glaciers, snowfields and numerous lakes, mostly located at altitudes of over 4 000 metres above sea level.⁵ The management and control of these lakes for the regulation, protection and supply of water is an important and familiar activity in the Andean zone.

When suitable dam sites are lacking, all that can be done is to retard the flow of surface water as much as possible, using agricultural, forestry and pasturage methods of basin management and small collection structures for sub-surface flows. This activity is unfortunately not widespread today.

3. Elements of Andean hydrological dynamics

The geography of the Andes, because it includes a variety of altitudes, latitudes and directional trends, is conducive to the presence of water in all its forms.

(a) *Precipitation* (table 1) occurs mainly as rainfall from northern South America to central Peru, at which point precipitation in the form of snow increases in the highlands. In Peru and Bolivia,⁶ rainfall in the inter-Andean basins ranges from 300 to 1 100 mm, which allows annual and perennial crops to be grown. In these countries, 80% of the annual precipitation occurs between December and March, with the remaining 20% distributed over the rest of the year. The driest month is July. In the Andean zone of Ecuador, the rainiest months are from March to May. Rainfall is slightly greater than in Peru and Bolivia and has a more uniform distribution both along the Pacific and the Atlantic slopes, with 1 000 mm isohyets on both flanks of the cordille-

ra.⁷ At altitudes over 1 800 metres above sea level in the Cordilleras Occidental, Central and Oriental and the Sierras de Santa Marta in Colombia, there is a tropical mountain climate with a better distribution of precipitation throughout the year than in Peru and Bolivia, there being two periods of maximum rainfall from May to June and from October to November, and two minimum periods from December to March and from July to September. The driest season is from December to March. Precipitation in upland areas fluctuates around 1 000 mm per year, as in Bogotá (2 560 metres above sea level and approximately 985 mm of rain yearly).⁸

(b) *Watercourses*. The rivers and streams in the upper Andes are fed from the melting snow and precipitation on the altiplanos ('punas', or wide barren plains). In the relatively flat highlands, the rivers form meanders and lakes, and then pour down narrow ravines or canyons, depending upon the volume of water and the size of the basin, until they reach lower levels and flow into relatively flatter areas.

In areas with these characteristics, the régimes of the rivers vary with the precipitation and thaws. The rivers on the Pacific slope in northern Chile and in central and southern Peru are torrential and seasonal; their discharge may range, as in the River Cañete in Peru, for example, from a few m³/s to 800 m³/s in basins measuring 5 000 km².

In the intermediate stretches of these rivers, between 2 500 and 3 000 metres above sea level, crops are grown almost exclusively with irrigation since rainfall is less than 500 mm and is concentrated in the months of January, February and March. The rivers which supply water for irrigation usually have to be regulated. This characteristic is common from the north of Chile to northern Peru. In contrast, the basins of the

⁵ Medardo Molina and Eduardo Seminario, *Estudio hidrológico de la cuenca del río Santa*, Lima, Instituto Geofísico del Perú, 1975.

⁶ Instituto Nacional de Preinversión, *Información necesaria en Bolivia para planificar, ejecutar y administrar la utilización de los recursos naturales, principalmente hidráulicos*, La Paz, 1979.

⁷ INAMHI-Ecuador, *Anuario meteorológico 1979*, Quito, 1981.

⁸ United Nations, ECLA, *The water resources of Latin America, III. Bolivia and Colombia*, New York, 1964.

Table 1

ANDEAN COUNTRIES: MEAN PRECIPITATION, BY MAJOR BASINS

Country	Cuencas							
	Caribbean		Pacific		Amazon		Titicaca	
	Area (km ²)	Mean precipitation (mm)	Area (km ²)	Mean precipitation (mm)	Area (km ²)	Mean precipitation (mm)	Area (km ²)	Mean precipitation (mm)
Venezuela	191	1 330	—	—	43	3 320	—	—
Colombia	116	2 690	78	4 970	330	2 840	—	—
Ecuador	—	—	134	1 640	150	2 310	—	—
Peru	—	—	279	200	956	2 180	57	720
Bolivia	—	—	—	—	718	1 380	149	220
Chile	—	—	757	1 030	—	—	—	—

Source: ECLA, on the basis of the country reports for the United Nations Water Conference and other publications (1977).

Atlantic slope generally have a permanent albeit irregular régime. In Peru, the floods begin in October and end in March, reaching their high point in January and February and their low in July or August.⁹

As could be expected, the discharges fluctuate with the variations in rainfall. Thus, in Bolivia and Peru the peak floods occur in February and March (the rainy season), while the water is at its lowest level from May to September. In Ecuador, however, "the seasonal distribution of the minimum flows is more complex: in some central zones of the inter-Andean corridor (the Riobamba, Ambato, Latacunga and Quito areas) some rivers have their lowest flows in July, August and September, while in other sectors, which may be very close by, where the régime is related to easterly air masses, the minimum flows are in December".¹⁰

In Colombia the régimes are also very closely related to the rainfall on the three slopes (Pacific, Atlantic and Caribbean). As with the rainfall, there are two maximum and two minimum flow periods in most of

the rivers. In the Cauca area, the peak discharges occur in May and November, and the lows in February and September. This varies slightly in other major basins, such as that of the River Magdalena.¹¹

(c) *The Andean lakes.* In the Andean high plateaux, or 'punas', there are a great number of lakes which serve to regulate surface water. Tables 2 and 3 provide information on the lakes of Ecuador and Peru, respectively.¹²

(d) *Groundwater.* Groundwater is a very important source of water for human consumption and irrigation during periods of low water levels; on the hillsides of the inter-Andean valleys it forms what are known in Peru as 'puquiales' or 'manantiales' (springs). The flow of a spring can range from a few litres up to several cubic metres per second, primarily depending upon its location. The springs in the lower valleys have a greater flow because they are also fed by the irrigation water from the terraces. However, a spring is most highly valued for its flow during the low-water period, when that discharge is less because it coincides

⁹ National Office of Natural Resource Evaluation, *Inventario y evaluación nacional de aguas superficiales*, Lima, 1980.

¹⁰ PRONAREG, *Elementos básicos para la planificación de los recursos hídricos en el Ecuador*, Quito, 1981.

¹¹ United Nations, ECLA, *The water resources of Latin America, III...*, op cit.

¹² UNESCO, Second Meeting of Subregional Co-ordinators for the Preparation of the Hydrological Map of South America, Quito, Ecuador, 21-24 July 1981.

Table 2
ECUADOR: SUMMARY OF LAKES AND LAGOONS

Water surface (km ²)	Number of lakes	Recharge area (km ²)
Less than 1.0	172	0.10 – 203.8
1.0 – 5.0	17	
5.0 – 10.0	6	
Greater than 10.0	2	
Total	197	

Source: INERHI, "Recursos hidrológicos superficiales del Ecuador, Primera Evaluación", *op. cit.*

Table 3
PERU: SUMMARY OF LAKES AND LAGOONS

Slopes	Lakes under exploitation		Lakes under study		Additional capacity in existing dams		Lakes with basins	
	Total number	Regulation capacity (millions of m ³)	Total number	Regulation capacity (millions of m ³)	Total number	Regulation capacity (millions of m ³)	Greater than 4.0 km ²	Total inventoried
Pacific	105	1 378.6	204	616.6	34	98.8	336	3 896
Huarmicocha	3	41.0	1	185.0	1	144.0	4	23
Atlantic	76	1 604.4	133	3 006.4	9	836.6	461	7 441
Titicaca	2	4.1	4	145.0	...	...	65	841
Total	186	3 028.1	342	3 953.1		1 079.4	866	12 201

Source: ONERN, *Inventario nacional de lagunas y represamientos, segunda aproximación*, Lima, 1980.

Note: The lakes are sources of water for human consumption and irrigation in low-water periods.

with the reduced flow of the rivers in rainless periods. In general, the possibility of utilizing groundwater has not been studied very much in Latin America in connection with the high mountain regions, but efforts are now being made to make up for this lack of information.

In the high Andean regions, drainage problems are also common, especially in the highlands and 'pampas', such as in the Anta pampa in Cuzco, Peru.¹³ The cross-section shown in figure 1 illustrates the various

forms in which water appears along the slopes of an inter-Andean basin in Peru.

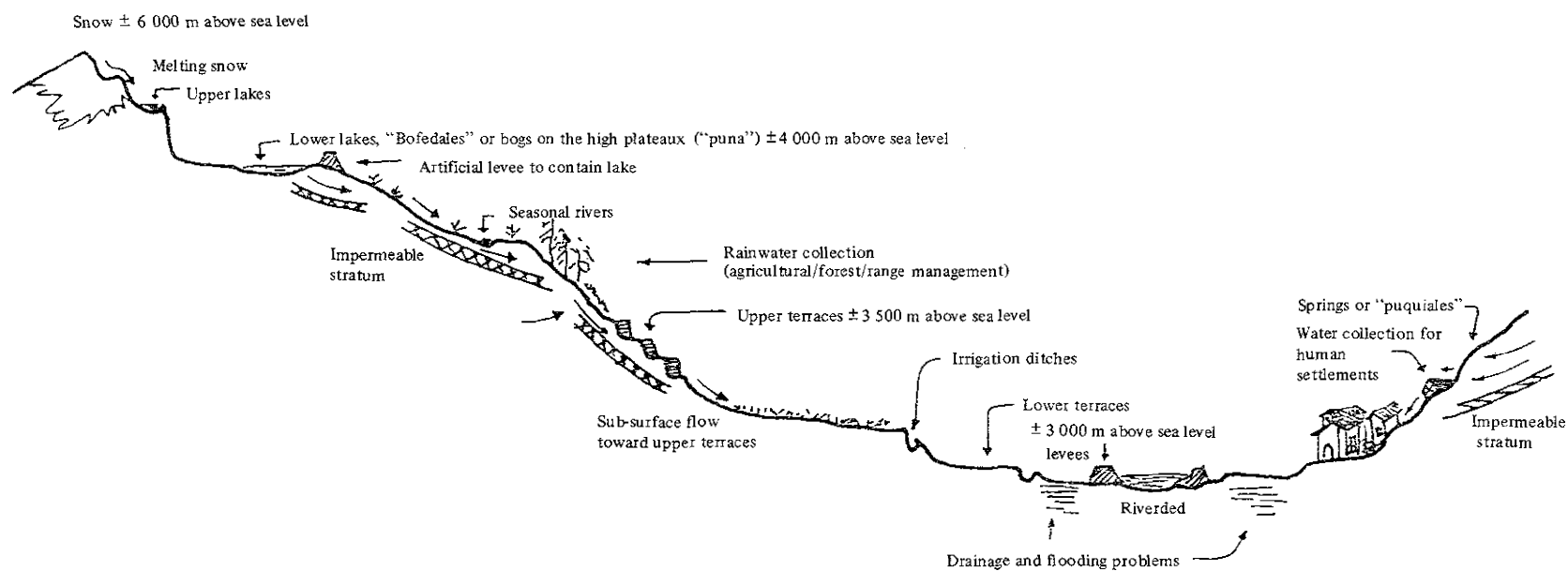
(e) *Evaporation*. Due to the different combinations of temperature, altitude, latitude and dryness of the atmosphere, evaporation in the Andean region is highly variable. Thus, in the altiplano region it is estimated at 1 660-2 110 mm per annum.¹⁴ Evaporation in the Cuzco region has been found to vary from 780 mm in Anta (3 435 metres above sea level) to 1 500 mm in

¹³ Ministry of Food and Agriculture of Peru, *Diagnóstico de la Cuenca Alta del Río Vilcanota*, Lima, 1979.

¹⁴ ECLA-Ministry of Planning and Co-ordination, *Proyecto de prefactibilidad para el desarrollo del Altiplano*, La Paz, 1977.

Figure 1

FLOW AND USE OF SURFACE WATER AND GROUNDWATER ALONG
THE SLOPE OF AN INTER-ANDEAN BASIN



Typical cross-section of an inter-Andean basin in the central zone of Peru with indication of average elevations above sea level.
ECLA/A. Dourojeanni and M. Molina, 1982.

Table 4

ECUADOR: EXAMPLES OF EVAPORATION AT VARIOUS SITES, 1979

Site	Altitude (metres above sea level)	Evaporation (mm)
El Angel	3 055	1 357
San Gabriel	2 860	692
Otavalo	2 556	916
Quito	2 818	904
Rumipampa	2 628	1 040
Pirayambo	3 615	650
El Labrado	3 260	732

Source: INAMHI, *Anuario meteorológico 1979*, Quito, 1981.

Calca (2 926 metres above sea level).¹⁵ Observations made in Ecuador in 1979 are given in table 4.

(f) *Snowfall*. Starting at 4 500/5 000 metres above sea level, there are perpetual snows in the Andes chain which constitute reserves of water of excellent quality and are the source of springs and lakes. Statistical data on the volume of the water reserves in

the form of snow are not available.

4. Water quality

All the water in the Andes is generally of good quality for irrigation. The springs can be used without treatment to supply the peasant population;¹⁶ however a problem of river pollution from tailings does exist in basins where mining is taking place.

II

Historical development of water resource management in the high Andean region

History provides some useful lessons for planning the future and, as Sherbondy says, "...before all the agricultural land (of Cuzco) goes dry; before all the water is polluted, let us learn from the experiences of the past 500 years in order to formulate adequate solutions for the next 500 years".¹⁷ The varied historical experience of

land and water development in the high Andean region which is described below may contribute to the formulation of such solutions.

(a) *Pre-hispanic period*. The Andean inhabitant had two basic concerns regarding water management: (i) the management of surface run-off and (ii) the development and conservation of the hillsides. This management was part of an integral approach involving the need for vertical control of the various ecological levels, starting with the highest peaks.¹⁸ The focus was therefore not

¹⁵ Ministry of Food and Agriculture of Peru, *Diagnóstico de la cuenca alta del río Vilcanota*, op. cit.

¹⁶ Medardo Molina, *EL agua en la comunidad de Aucará*, Lima, Universidad Nacional Agraria "La Molina", 1975.

¹⁷ H. Villanueva and J. Sherbondy, *Cuzco: Aguas y poder*, op. cit.

¹⁸ Stephen Brush, "Estrategias agrícolas tradicionales en las zonas montañosas de América Latina", Proceedings of the Seminario Internacional sobre Agricultura de Ladera

limited to water and land control, but was instead equivalent to modern concepts of basin management.¹⁹ Nevertheless, it is evident that the control of at least these two resources was of paramount importance, as is attested to by the numerous water works and ancillary modifications noted in the Andean region. Three fundamental features of this stage should be retained:

(i) *Community participation* in the execution of projects, which not only made it possible to plan and execute projects, but also provided for the operation and maintenance of the facilities constructed and proper conservation of renewable natural resources in general.²⁰

(ii) *Technological and scientific development* which permitted the rational management of different ecological levels and the development of advanced technologies²¹ for water management and even weather prediction,²² for the purpose of protecting the population from droughts or floods through the use of such varied options as the appropriate siting of towns, the processing and storage of agricultural products, and diversification of crops and genetic resources, as well as aspects directly linked to water management.

(iii) *The minimum land area, measured both horizontally and vertically, necessary*

for them to control the various ecological levels and thus to manage the water as well as the various crops they relied on for their livelihood during the annual and inter-annual climatic periods.

(b) *Colonial era.* One of the effects of the presence of the Spaniards in Latin America was the disruption of the harmonious and integrated management of renewable natural resources.

At the outset, the prevailing communal system was altered by the introduction of coercive measures or by eliminating those people who, according to our present-day concepts, would be local resource conservation leaders. In other words, the groups which directed the management of natural resources, as well as the interdisciplinary groups which implemented the plans for their utilization, were destroyed. This, as Warman indicates,²³ was probably the result of "an understanding of the communal territory only in quantitative terms and in its horizontal dimension. For the conquistadores, property was a block of land, whereas for the indigenous population it was an aggregate of differentiated and complementary resources...". The aspect of the colonists' actions worth retaining is the care which they always took in operating the water systems which had been constructed, as is evidenced by various documents which illustrate the importance assigned to water distribution.

In one of those documents, "La repartición de las aguas del Cuzco de 1659", the authors say "...the importance of the 'Repartición' of 1659 is that it was a redistribution of water after a 54-year interval; during that time substantial changes had taken place in the zone's system of irrigation, cultivation and in the ownership of agricultural land itself, and these circumstances had created problems which required an immediate solution. This 'Repartición' was carried out by the famous Dominican, Friar Domingo de

en América Tropical, held in Turrialba, Costa Rica, 1-5 December 1980.

¹⁹ The management of a basin, according to current concepts, is essentially an aggregate of administrative activities (in a business sense) which man plans and implements in order to develop and protect the natural resources contained in a geographic area which is demarcated on a hydrological basis. From A. Dourojeanni and L. Oberti, "Principios para elaborar un plan de protección de cuencas", *Boletín Técnico* No. 11 of the General Directorate of Water and Soil of the Ministry of Agriculture of Peru, Lima, 1979.

²⁰ Luis Millones, "Etnohistoriadores y etnohistoria andina: Una tarea difícil y una disciplina heterodoxa", in *Socialismo y participación*, Lima, June 1981, p. 77.

²¹ I.S. Farrington, "Un entendimiento de sistemas de riego prehistóricos en el Perú", in *América indígena*, Vol. XL, No. 4, Mexico City, October-December 1980, p. 691.

²² S. Antúnez de Mayolo, "La predicción del clima en el Perú precolombino", *op. cit.*

²³ Arturo Warman, "Tenencia y uso del suelo: Una visión histórica", Proceedings of the Seminario Internacional sobre Agricultura de Ladera en América Tropical, held in Turrialba, Costa Rica, 1-5 December 1980.

Cabrera Lartaun, *Juez Visitador General* for the indemnification of the Indians and the assessment, sale and disposition of the lands of the region by special command of the Viceroy of Lima, don Luis Enríquez de Guzmán, and it demanded no little effort of the intelligent and wise official, who acted with a true sense of equity and with an unwavering will to protect the Indians, as his primary mission was to make amends to them".²⁴

The fact which this official unfortunately failed to realize (like many others today) is that no matter how well water is distributed, good intentions accomplish very little if the management and conservation of the basin from which this natural resource flows are neglected. Hence, although the Spaniards, of necessity, concerned themselves with water distribution, on the other hand, they forgot about where it came from. Thus the upper and lower sections of the slopes progressively diminished in importance as regulators of surface run-off and agricultural zones; they became over-exploited livestock and forest areas, resulting in the erosion and abandonment of existing terraces due to a lack of the sub-surface water flow which had previously made their utilization possible.

In short, alterations were made in the basic requirements for the integrated management of resources (including water) which had existed in the pre-hispanic era: namely, community participation, a minimum management area, and the technical know-how to carry out such management.

Fortunately, communities have survived in many areas which even today fulfil those requirements to a certain extent (as will be seen further on), and this allows solutions to the above problem to be put forward. Furthermore, in other mountainous regions of the world, such as the People's Republic of China,²⁵ the application of integrated

methods of natural resource management can currently be observed in areas which had previously suffered severe degradation, thus providing an opportunity to witness examples of truly integrated basin management.

(c) *Post-colonial period.* The independence of the Andean countries changed the Andean peasants' situation very little as regards the use and management of natural resources, particularly water and land. The systems prevailing in the colonial era continued to predominate throughout almost all of the high Andean zone. Fortunately, however, communal practices also continued to survive, despite the lack of effective support.

Nevertheless, the gradual changeover to private ownership of the land and water, together with the exploitation of the high Andean peasants, exacerbated social, economic and technical problems. All of this generated political movements concerned with improving the peasants' lot, as is illustrated by the number of activities initiated in recent years to aid mountain residents.

Thus, measures began to be taken as regards agrarian reform, technical assistance for peasants, State ownership of water, implementation of regional development and water management projects, and other efforts which have had varied results, primarily depending upon their effect on the three factors already mentioned as being essential to natural resource management in the Andean region: (i) communal participation and organization; (ii) land area (both surface area and vertical space); and (iii) scientific and technological development adapted to local conditions.

Probably the most important efforts made recently are those directed toward river basin management and the integrated management of hillsides which enlist the active participation of area residents, using systems such as that promoted by the Inter-American Centre for Integrated Land and

²⁴ H. Villanueva and J. Sherbondy, *Cuzco: Aguas y poder*, op. cit.

²⁵ The best known example is the reclamation and terracing initially carried out by the commune of Tachai,

which later spread throughout modern China. The projects are very similar to those undertaken during the pre-hispanic period in Peru.

Water Resource Development (CIDIAT).²⁶ In this respect, governments that have taken significant steps to consolidate the financial and institutional systems which guarantee the continuity of such activities are materially contributing to the solution of environmental management problems in the high Andean zone.²⁷

Another important line of progress is connected with the promotion of administrative improvements in environmental management activities, particularly those which place special emphasis on institutional factors such as organization, the development of suitable working methods and the like.²⁸

III

Water in the life of the Andean peasant

1. Main characteristics of water use

The water problem in the Andean environment has forced the local peasant to use this resource efficiently and carefully in order to cope with periods of low water or dry spells, as well as to protect himself from the destructive effects of the rainy season. In general terms, it can be said that the Andean peasant:

(i) tries to manage surface water at its source, seeking to regulate and collect it in the highlands and to guide it through canals or natural streams to the sites where it is used;

(ii) makes every possible use of rainwater and, in particular, tries to control surface run-off by modifying the slope of the land and by constructing catchment systems;

(iii) has a highly developed sense of communal labour in the construction and organized management of water development systems, which continues to be a driving force in water management in the Andean region today;

(iv) has differential priorities for water use, depending upon its original source, preferring to use groundwater (springs) or surface water for the population's water supply, and the water from rivers and streams for irrigation, mining, the generation of power and fish culture.

As a result of the alteration in their forms of organization and the poor distribution of their land, Andean inhabitants have lost the ability to manage their water resources and/or lack the technical means needed to do so. This has created a heavy demand for technical assistance to solve their problems, and to a greater or lesser degree, they primarily look to the State for the satisfaction of this demand. This indicates that the peasants are not unaware of the importance of managing water resources, but it also shows that they have lost the bases for self-sufficiency in areas which they had mastered in the past.

The greatest demand for water resources in the high Andes is for agricultural use—either through irrigation works or improved rainwater collection—and drinking water; these are followed in importance by the demand for uses related to power generation, mining and fish culture.

There is no doubt as to the importance of improved agricultural water use in the

²⁶ Pedro Hidalgo and Jacobo Duek, "Estudio de los conflictos en la planificación de las cuencas hidrográficas", unpublished paper of the Reunión Regional Temática de Cooperación y Coordinación Interagencial sobre Ordenamiento Ambiental de Cuencas Hidrográficas, CIDIAT, Mérida, Venezuela, January 1982.

²⁷ ECLA, *Manejo de cuencas y desarrollo de zonas altas en América Latina*, document E/CEPAL/L.253, Santiago, Chile, October 1981.

²⁸ Axel Dourojeanni and Terence Lee, *La gestión ambiental y las grandes obras de infraestructura hidráulica*, document E/CEPAL/PROY.6/R.2, Santiago, Chile, October 1981.

high Andean region, at least in countries such as Peru and Bolivia, in order to increase agricultural yields per unit of area, to create more jobs and to reduce the risk of erosion.²⁹ The value of irrigation was clearly demonstrated by a study conducted on the upper Vilcanota river basin, located in the Department of Cuzco in Peru.³⁰ This basin, which has a surface area of some 715 000 ha upriver from the town of Pisac, contains some 47 000 ha of farmland, 25% of which is irrigated, while the remainder is used for dry farming. The more intensive use of irrigated land was demonstrated by the fact that during a year of normal rainfall, only 14% of the area under irrigation was left fallow, compared with 60% of the rain-fed cropland. Upon comparing the yields of rain-fed and irrigated crops, it was found that the yield of the latter was 19%-56% higher in a year of normal rainfall. Moreover, rain-fed crops are only produced once yearly and unirrigated fields are generally left fallow for several years at a time. The important role played by altitude was also confirmed. At elevations between 3 000 and 3 900 metres it was seen, for example, that maize production with irrigation dropped by 140 kilos for every 100 metres of altitude (local yields range from 700 kg/ha at 4 000 metres to 2 400 kg/ha at 3 000 metres above sea level).

Although the value of irrigation has been established, the importance of

improving the utilization of rainwater should also be stressed. In countries such as Peru and Bolivia, on average no more than 20% to 25% of the highlands can be irrigated; the remainder must be used for dry farming, and this is precisely the area in which the greatest rural development and soil conservation problems exist due to the steeply sloping land. In these locations, community participation is even more important than in irrigated areas as far as the introduction of new techniques for hillside water and land management is concerned. This work is carried out at the farm level and requires a great deal of manpower, so that it is of direct benefit as a source of employment. Unlike irrigation projects, which are seasonal, this type of work is constant and must be carried out directly by the peasants; hence the need for technical and financial assistance from the State.

With respect to the rural population's drinking water requirements, in general the situation is critical. This can be seen from table 5, which indicates that:

(i) Rural communities (including Andean settlements) principally use water from the primary or natural source (wells or springs, collected and stored rainwater, rivers, streams, lakes);

(ii) A small percentage have access to piped water, which may even be connected to the dwellings. In the case of peasant communities, the pipes most frequently terminate at key spots in the town which serve as the public water supply centres;

(iii) Rivers or streams are an important water supply source. Andean peasants make use of the water from rivers and streams in many ways; they use it not only for drinking and cooking, but also for washing clothes, personal hygiene and watering livestock.

For the most part, the inhabitants of the Andean zone who wish to resolve problems regarding the fulfillment of their water needs lack known and effective local channels for requesting technical assistance and they therefore address their requests directly to the central government (ministries or the President's office). A community's requests usually cover a number of

²⁹ Peru, according to the statistics of the National Office of Natural Resource Evaluation (ONERN) uses some 2 800 000 ha for farmland, of which more than 1 500 000 ha are located in the high Andean region. In this zone, which is called the Sierra, 17% of the land is irrigated and the rest is used for dry farming. It is estimated by the National Statistics and Census Office (ONEC) that in Peru active production takes place on 2 200 000 ha, 69% of which is in the Sierra (the discrepancy between that figure and 2 800 000 ha corresponds to the periods in which land is left fallow). It is indicated that at least some 2 500 000 rural inhabitants of the Sierra are jobless or underemployed due to a lack of sufficient land, or because the land is poorly used or in an advanced stage of degradation due to water erosion. (Carlos Zamora, *El potencial de los suelos del Perú*, internal document, ONERN, Lima, Peru, October 1979.)

³⁰ Ministry of Food and Agriculture of Peru, *Diagnóstico de la Cuenca Alta del Río Vilcanota*, op. cit.

Table 5
SOME FACTORS RELATED TO RURAL DRINKING
WATER SUPPLY^a
(Percentages)

	Ecuador	Peru	Average
Death rate among children under one year of age due to enteritis and other diarrheic diseases (1973-1976)	1.55	1.50	1.52
Access to piped water, % of population (1977)	9.0	10.0	9.5
House connections, % of the population (1977)	6.0	3.0	4.5
Self-obtained water supply:			
— wells	41.5	19.6	
— rainwater	1.1	—	—
— rivers	37.3	79.6	
— other	5.0	2.0	

^a Adapted from Terence Lee, "Rural drinking water supply and sanitation in Latin America", in *Natural Resources Forum*, New York 5 (3), July 1981, pp. 282-290.

needs. With regard to water, it is common for them to request assistance simultaneously for the construction of irrigation, drinking water and energy facilities. If the government lacks the machinery to conduct a thorough study of the various needs, it opts for dividing up the request by distributing it to a number of sectors or ministries, which subsequently act independently of one another. At times, this creates serious conflicts as regards water development. Although this might seem easy to avoid with proper integrated planning, it is not so easy to do in practice. It seems that the most satisfactory solution would be to give greater weight to the local water authority, who should maintain a record of all current water uses and commitments to future uses in the basins for which he is responsible. There should be a single and respected local water authority who at the same time works directly with the users and serves as a link between them and the various projects scheduled in the basin, whether these are related to irrigation,

rainwater management, drinking water, hydropower, fish culture or other areas. The users' requests or the government's actions should be channelled solely through that person. This reaffirms the important role of good decentralized national organization and of promoting local participation in sound natural resource management.

2. *Extreme hydrological phenomena and the life of the peasants*

The climatic, geographic and physiographic characteristics of the Andean region make it prone to extreme hydrological phenomena which seriously affect the lives of the Andean peasants. Some of the most notable phenomena are torrential rains and the resulting flooding and landslides, droughts, hailstorms and frosts.

Torrential rains can have violent effects which completely disrupt peasant life. Such was the case recently in a region of the Peruvian mountains where very heavy and prolonged rains caused great loss of human

life and property. In connection with a recent storm, it was reported that "...In the Lucre district, 40 km from the city of Cuzco, the picture is one of devastation. More than 3 000 of a total of 4 800 inhabitants have been left out in the streets... nearly 80% of the dwellings have been flooded. Not all have fallen as a direct consequence of the violence of the flood, but one after another they have begun to collapse eroded away by the two metres of muddy water which is flooding more than 300 houses... In Cuzco there have been seven deaths, the number of houses destroyed verges on one thousand, and there is a latent danger of the imminent overflow of several lakes..."³¹

Droughts,³² for their part, are a phenomenon which primarily and most frequently affects the altiplano region. Their aftermath, although not so spectacular as in the case described above, seriously affects agricultural and livestock production, at times provoking massive migrations.

Hailstorms and frosts can also cause a great deal of damage to the peasant economy, as they may ruin many crops when they occur at crucial stages in the plants' growth. For this reason, the central portions of the pampas —inter-Andean valleys which are more prone to frost damage than the adjacent hillsides— are usually reserved for pasture land.

3. Integrated water use in an Andean peasant community

Figure 2 is a schematic illustration of the integrated use of water resources by the community of Aucará in the Department of Ayacucho, Peru. This community, the residential centre of which is located 3 200 metres above sea level, possesses rain-fed croplands at an elevation of 4 000 metres,

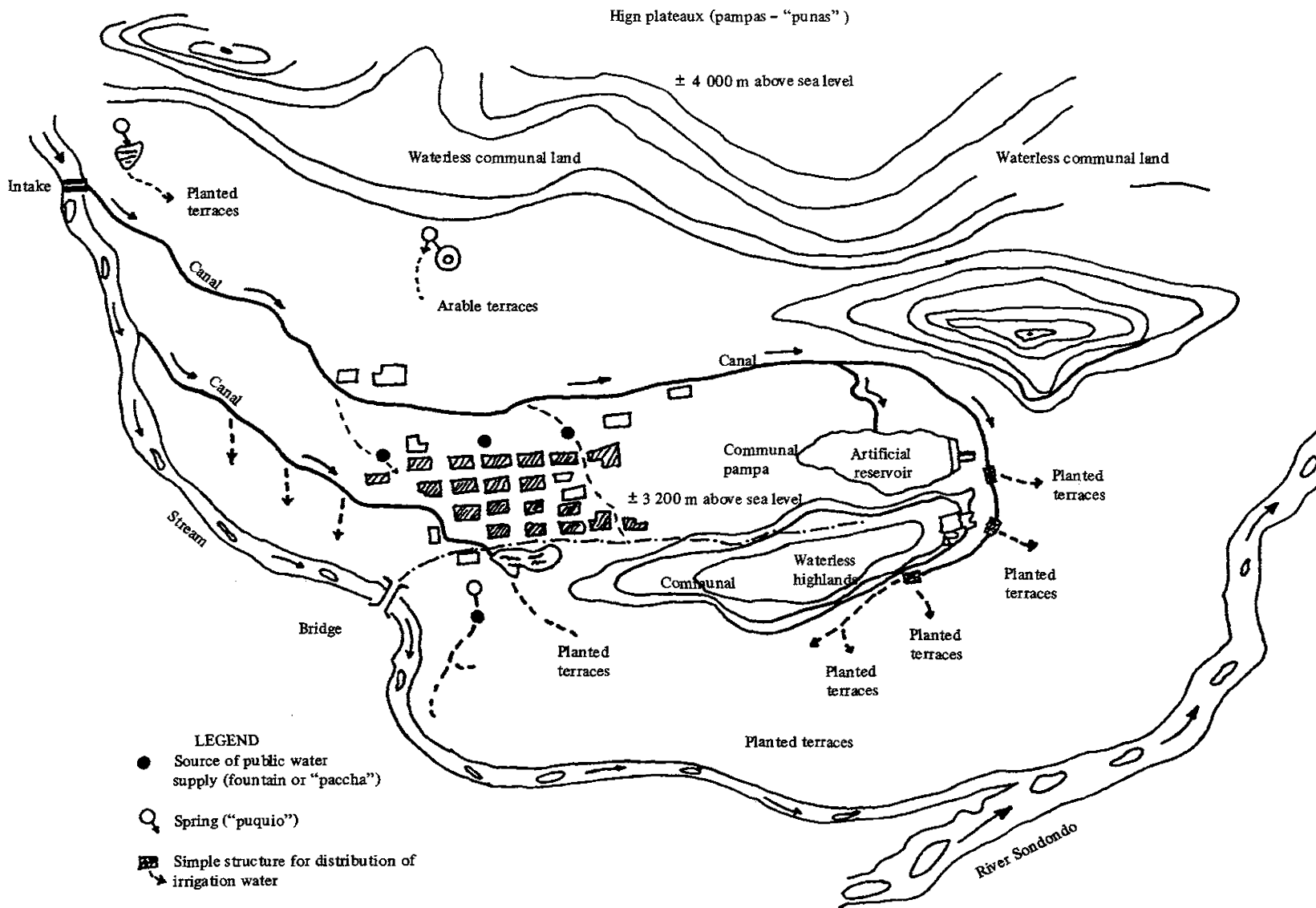
where any member of the community may grow any crop he wishes. The irrigation system comprises two intakes off a permanent river, two reservoirs (one for annual regulation and the other for daily regulation), and a network of primary and secondary canals for irrigating terrace crops (which are spread out at altitudes ranging from 3 200 to 2 500 metres above sea level). A series of springs whose waters are stored during the night for daytime irrigation is also used, making possible permanent crops such as alfalfa. The population's water supply comes from a spring located in the lower part of the village, a communal channel, and a network of pipes which carry stored water collected from a spring in the town's heights.³³ This latter use has, however, created conflicts because many villagers used this water to irrigate approximately 100 ha of terraced fields. In such cases, the solution might be to construct reservoirs at approximately 4 000 metres to store rainwater in the relatively flatter zones; this would allow for a larger water storage area even though the catchment area would be smaller. Due to its complexity, however, this would obviously be an expensive solution, and thus could not be implemented without government technical assistance. Unfortunately, the means of access to the government are unsatisfactory and the procedures slow and tedious; obtaining State assistance is therefore unlikely. Even if the government is contacted, the State will first attempt to investigate whether there are other communities also requiring assistance before conducting the relevant studies, and all this may cause years of delay in the execution of projects needed immediately by the village. This is one of the major water development problems which the Andean peasant faces when his village does not come under a specific plan for State support.

³¹ A. Bermúdez and A. Solimano, "Cuando las lluvias matan", in the magazine *Oiga*, phase V, No. 62, February 1982, pp. 18-22.

³² Alan D. Hetch, "The challenge of climate to man", *EOS Transactions*, American Geophysical Union, Vol. 62, No. 51, New York, December 1981, p. 1193.

³³ Medardo Molina, "El agua en la comunidad de Aucará", *op. cit.*

Figure 2
 DIAGRAM OF WATER-USE SYSTEM IN THE AUCARA COMMUNITY, DEPARTMENT OF AYACUCHO, PERU



IV

The State's role in managing the water resources of the high Andean basins

1. *Factors to be considered in water management*

In the semi-arid Andean zone, water is an essential resource for the development of its communities, and promoting its proper management is therefore an obligation. The basic features of such management can be deduced from past experiences, and may be summed up as follows:

(i) Water resource management is not an isolated activity separate from the management of the other natural resources in a basin, nor can it be approached piecemeal. It must be undertaken in co-ordination with other activities, especially proper land use at the different ecological levels or slopes and riverbeds, which are the water's origin and path.

(ii) The inhabitants of the Andean slopes or basins are the focal point of, and directly responsible for, the management of the basins and their natural resources, especially the soil, plant life, water and wildlife. For this reason, technical assistance from the State or any other source should tend to reinforce the organization, participation and training of the inhabitants with respect to the proper use of those natural resources.

(iii) In order to manage the water resources of the high Andean region properly, a certain minimum extension of land, both in terms of surface area and vertical space, is required in order to make the simultaneous control of several ecological levels possible. The ideal management units are river basins or, lacking that, entire slopes along which the flow and use of water can be controlled.

(iv) State action in the management of water resources and natural resources in general in an Andean basin should be based, as indicated previously, on promoting the participation of inhabitants and users. To this end, solid decentralized and permanent

financial and institutional systems should be created which make it possible to ensure the coverage and continuity of government assistance and thus to make the rural inhabitant self-reliant.

There are various programmes and projects in Latin America for the management of water, soil, forests and wildlife in the upper basins which take into account either all or some of the considerations discussed above. The most suitable approach would be for these programmes to be duly institutionalized, with national coverage, so as to enable ongoing technical assistance and guidance regarding integrated natural resource management to be provided to users. This would mean dividing the country into administrative units for natural resource management and organizing the users to draw up and implement management plans at the individual unit level for those resources with the government's technical and economic assistance.

In practice, this has been achieved only partially in Latin America. In Peru, for example, irrigation districts³⁴ have been created which encompass the area of a basin or system of basins. These districts are under a single water authority whose duty it is to ensure the rational use of that resource whatever the user sector concerned. In Peru, in other words, the irrigation district is the equivalent of a water and soil district, since its sphere of action is not circumscribed by the perimeters of irrigated land within a basin nor limited to a single water use, but rather covers the entire area of the basin and all water uses. In each district a board of users has been created which performs the task of operating and maintaining water

³⁴ Republic of Peru, *Ley General de Aguas y sus Reglamentos*, Decree Law No. 17752 of 24 July 1969, Lima, Peru.

works, particularly irrigation facilities. However, resource management and conservation activities in non-irrigated areas, especially those located in the upper portions of the basins, have not yet been developed. The Peruvian government is currently working on this task. In Venezuela, a basin conservation programme exists at the national level, but its emphasis at present is on the management of upper basins with the participation of the users, rather than on irrigation (the reverse of what is happening in Peru). Both the Peruvian and the Venezuelan programmes are of national scope, encompass the whole of each basin, and are based on user participation. These programmes could serve as the starting point for increasingly integral management of renewable natural resources, which, in addition to water and soil, would include forests, pasture land and wildlife, as appropriate.

Unfortunately, these are isolated and often incomplete examples. In general such programmes suffer from a lack of State support since, for various reasons, the governments of Latin America do not assign the necessary importance to national-scale management and conservation activities. They choose instead to direct their investments, at best, toward specific programmes for the integral development of a few basins or, more commonly, toward highly sectoralized programmes for water, soil, forest or wildlife development, without basing such programmes on an integral plan for natural resource development, without taking in the minimum land area—such as a basin, an entire slope or several ecological levels—and without satisfactorily enlisting the participation of the users at all times, from the plan preparation to the implementation stage.

Hence with regard to water, for example, there are often national programmes for small and medium-sized irrigation projects, national programmes for the construction of small hydroelectric plants, national rural drinking water supply programmes, etc., which literally plant water projects in basins without any co-ordination. In addition, their activities are customarily limited to the construction phase of these works: they neglect the subsequent stages of

the operation of the systems built, as well as those of water management and conservation, and, what is more, fail to enlist sufficient participation by basin users. The same thing may occur in plans for reforestation, wildlife management or the promotion of specific crops, when they do not constitute an integral plan for natural resource development and management.

If users participate in these programmes, they are faced with the problem of having to deal with different government agencies, depending on the sector to which they belong or the resource which they are attempting to manage. In addition to the technical difficulties involved in carrying out projects in an orderly manner without an integral plan, this creates a lack of concern or an inability on the part of local residents to involve or identify themselves with programmes which the government is trying to establish in the area where they live. It is therefore important for the State to be sufficiently well organized to provide its assistance in a well-planned way, seeking to facilitate and promote the users' contribution, in order to ensure the long-term management of renewable natural resources in mountainous areas.

2. Water resource management programmes and projects involving community participation

One very positive element in Latin America in general and in the Andean area in particular is the long list of programmes and projects aimed at promoting community participation and integrated use of renewable natural resources. Some of these programmes and projects, including those of Venezuela and Peru, are described below. In the aggregate, they represent a very important body of experience which has still not been shared and used to the fullest extent possible. An adequate study of this experience could produce valuable conclusions which would be of general benefit to the countries of the region. The most important programmes include:

- (i) The National Plan for Improvement

of Irrigation in the Sierra (the MERIS plan) of Peru. This plan is aimed at furnishing technical assistance and financial support to local communities for the development of small irrigation projects in the Peruvian sierra. Its approach is based on a previous evaluation of major Andean basins in order to identify their principal physical and socio-economic characteristics and to discover potential irrigation sites, as well as on planning and executing the respective projects with local participation and user training. Activities have been conducted in the inter-Andean basins of Cajamarca, Upper Mantaro and Upper Vilcanota. It provides a good example of a plan of action for the development and sectoral management of water at the basin level.³⁵

(ii) The Social Infrastructure and Conservation Programme of the Venezuelan Ministry of the Environment and Renewable Natural Resources. This is a national programme which has a specific subprogramme for the conservation-oriented management of upper basins. Its major contribution is its integral basin-by-basin focus, its institutionalization and ongoing consolidation, the systematic training of State personnel, and its encouragement of participation by basin users.³⁶ Technical support for this programme is provided by the Inter-American Centre for Land and Water Resource Development (CIDIAT) of Mérida, Venezuela.

(iii) The National Programme for Soil and Water Conservation in River Basins of Peru's Ministry of Food and Agriculture. The starting point of this programme, which began only recently, was the creation of management and conservation departments in Peru at the irrigation-district level. Under the country's general water law, these districts cover an area which includes the whole of one or more river basins. The pro-

gramme's objective is to organize and institutionalize the functions of these departments for the performance of those activities having a particular bearing on the upper basins. It includes plans to develop methodologies and manuals for national distribution based on experiences with pilot areas and projects already completed. It also receives technical support from the United States Agency for International Development (AID).

(iv) The River Basin Management Programmes of the Corporación Autónoma Regional del Valle del Cauca (CVC) of Colombia. The objectives of this effort are the evaluation, planning and implementation of a series of programmes dealing with, *inter alia*, a realignment of basin uses, conservation, reforestation, mining development and the improvement of rural housing in the sub-basins of the Upper Cauca valley. Its goals are: to achieve short-, medium- and long-term increases in the water supply for domestic, agricultural and industrial uses; to boost agricultural and forestry productivity without damaging natural resources; and, in general, to raise the standard of living of the basin inhabitants.³⁷

Other important programmes of a similar nature, although they do not necessarily concern the Andean region, are under way in a number of countries:

(i) The Sierra Plan of the Dominican Republic, whose objective is to promote rural development in a mountainous area of 2 000 square kilometres in the Central Cordillera of that country;³⁸

(ii) The Programme for Institutional Strengthening for Control of Erosion and Improvement of Agriculture in Haiti, which is being carried out by that country's Department of Agriculture, with assistance

³⁵ Ministry of Food and Agriculture of Peru, *Diagnóstico de la Cuenca Alta del Río Vilcanota*, *op. cit.*

³⁶ Ministry of the Environment and Renewable Natural Resources, Department of Basin Management, *Conservación de cuencas - Programa básico*, Sociedad Venezolana de Ingenieros Forestales, Jornadas Técnicas Forestales, Caracas, Venezuela, 1978.

³⁷ Corporación Autónoma Regional del Valle del Cauca (CVC), "Plan de ordenación y desarrollo de la cuenca del río Aguatacal", *Informe CVC*, No. 79-17, Cali, Colombia, November 1979.

³⁸ Blas Santos, "El Plan Sierra: Una experiencia de desarrollo rural en las montañas de la República Dominicana", Proceedings of the Seminario Internacional sobre Agricultura de Ladera en América Tropical, held in Turrialba, Costa Rica, 1-5 December 1980.

from the United States Agency for International Development (AID);³⁹

(iii) The Executive Programme for Land Reclamation in Tarija (PERTT) of Bolivia, aimed at preventing the rapid environmental deterioration of the basins in this region, which is part of the upper basin of the Bermejo River;

(iv) The River Basin Management Programme of Honduras, initially directed at the reclamation of the basins devastated by hurricane "Fifi" and later modified to create technical and institutional bases for the management of the basins of the Sierra de Omoa in north-eastern Honduras. This project has produced technical manuals and regulations on basin management, primarily for application in tropical zones.⁴⁰

There are other such programmes in a number of Latin American countries which can supply valuable information, even though some of them are carried out under diverse names and have varying scopes, which often creates confusion among people attempting to exchange information on the subject of basin management (see table 6).⁴¹

It should be recognized that the long list of programmes and projects aimed at the management of high mountain zones in Latin America has permitted significant steps to be taken in the exchange of experience and know-how among the persons responsible for projects as well as the publication, at least at a local level, of many manuals and working methods for high mountain regions.⁴²

³⁹ USDA/PASA, "Institutional strengthening for control of erosion and improvement of agriculture in Haiti", *Report* for AID, Washington, D.C., February 1979.

⁴⁰ UNDP/FAO, *Ordenación integrada de cuencas hidrográficas*, internal report to the Government of Honduras, Document FO:DP/HON/77/006, UNDP/FAO, Rome, 1981.

⁴¹ In order to avoid these difficulties, it appears necessary to classify programmes, projects or activities according to the criteria set forth in the annex, which are derived from the above considerations.

One of the most significant efforts is the creation of a Latin American River Basin Network. This network was initially promoted by the work of FAO⁴³ and is in full operation. The proposal to organize an international association of experts on hillside agriculture in tropical America, which resulted from a recent seminar on the subject held in Turrialba, Costa Rica,⁴⁴ should also be mentioned, as well as the goal of preparing a manual for the development and management of the upper basins of Latin America.⁴⁵

These advances seem to point to a heightened awareness of the importance of the management of highland zones in general and of the need to pool the efforts being made to achieve such management through machinery for horizontal co-operation among countries, institutions and experts.⁴⁶ It is to be hoped that in the near future the attempts to benefit these very needy zones in the region will prosper.

⁴² Some examples are the following: Ministry of the Environment and Renewable Natural Resources (MARNR), *Instructivo de la Dirección de Manejo de Cuencas*, Caracas, Venezuela; Ministry of Food and Agriculture (MAA), *Manual de conservación de aguas y suelos*, General Directorate of Water and Soil, Lima, Peru, January 1980; T. Michaelsen, *Manual de conservación de suelos para tierras de ladera*, Project HON/77/006, working document No. 3, Tegucigalpa, 1980.

⁴³ H.R.H. Haufe and A. Patino, "El intercambio de experiencias en el manejo de cuencas hidrográficas a través de la red latinoamericana de cuencas hidrográficas", unpublished document of the Reunión Regional Temática de Cooperación y Coordinación Interagencial sobre Ordenamiento Ambiental de Cuencas Hidrográficas, UNEP/CIDIAT, Mérida, Venezuela, January 1982.

⁴⁴ Tropical Agriculture Research and Training Centre (CATIE) and The Rockefeller Foundation, *Proceedings of the Seminario Internacional sobre Agricultura de Ladera en América Tropical*, Turrialba, Costa Rica, 1-5 December 1980.

⁴⁵ UNEP/ROLA, *Informe de la Reunión Regional Temática de Cooperación y Coordinación Interagencial sobre Ordenamiento Ambiental de Cuencas Hidrográficas*, Mérida, Venezuela, January 1980.

⁴⁶ ECLA, *Manejo de cuencas y desarrollo de zonas altas en América Latina*, *op. cit.*

Table 6

TENTATIVE CLASSIFICATION OF DIFFERENT TITLES OF ACTIVITIES
WHICH INCLUDE OR FORM PART OF THE INTEGRAL
DEVELOPMENT AND MANAGEMENT OF
RIVER BASINS

Integral development and management of natural resources

Regional development
Microregional development
Integrated rural development
Integral development of major basins and/or upper basins
Environmental management for purposes of development
Management of reserves and natural parks
Land management/basin management

Sectoral development and management of natural resources

Integral basin management
Soil and water conservation
Agricultural/forest/range management
Management of forests, range management and soil management
Hillside planting
Treatment of slopes
Combating desertification

Specific development and management of water resources

Collection, regulation, piping and drainage of water from rain, snow or fog, and of surface, sub-surface and ground water
Basin management for purposes of discharge regulation
Protection of basins, control of erosion, control of landslides
Torrent control
Canalization of rivers and riverbank protection
Control of run-off and flood control
Control of pollution in general, control of salinity and drainage problems
Drought control

Source: Manejo de cuencas y desarrollo de zonas altas en América Latina, document E/CEPAL/L.253, October 1981.

V

Conclusions and recommendations

1. The inhabitants of the Andean zone are the only persons who can guarantee the proper management of the basins and the water of the high Andean region; the State should therefore direct all its efforts toward helping them to acquire the organization and knowledge required to move toward self-sufficiency, at least as regards their basic technical needs.

2. In the pre-hispanic era, at least three factors were considered essential to ensure basin and water management: (a) the organi-

zation and co-ordinated participation of the community in projects; (b) the use of technologies and work methods adapted to the zone; and (c) control over a sufficiently large land area to permit different ecological levels to be managed simultaneously.

3. To date, there are still relatively few programmes and projects which embody a clear idea of the above elements and devote their efforts primarily to providing technical and financial assistance to the inhabitants and users of the basin resources —principally

water and land. Nevertheless, the programmes which have already been begun can and should serve as the basis for making their experience known to other countries through inter-institutional horizontal co-operation machinery.

4. It is recommended that, in line with the foregoing, the inter-institutional co-operation and co-ordination networks already in existence or being created should be consolidated, and that the formation of new channels for the transfer of knowledge and experience in the field of high mountain basin management should be encouraged. To this end, it is recommended that a survey be conducted which would permit a systematic listing to be compiled of the programmes and projects concerned with the management of the high Andean zones of Latin America.

5. It should be noted that water management in the high Andes has special characteristics due to the occurrence of prolonged annual and inter-annual droughts, abruptly interrupted by periods of heavy rainfall which, in combination with the high altitude and steep slopes, makes its control extremely complex.

6. In general, the upper basin projects developed in Latin America are mainly of a sectoral nature, being concerned, for example, with water development for residential or agricultural use, or the development of a given crop. Although this provides a valuable source of information for more integrated projects, it is evident that there is still a lack, except in rare cases, of more complete projects combining, for example, agricultural, forest and range management of wildlife management with the construction of major water works as part of an integrated basin development scheme.

7. An important task to be undertaken is the strengthening of institutions of national scope responsible for the integrated management of basins or natural resources through user participation. Some countries are now gaining experience in this regard which may serve as an excellent frame of reference for other Latin American countries. It is recommended that a study of the

progress made in this area be carried out in the region.

8. Although scientific research and experimentation are obviously necessary in order to conduct basin and/or water management projects in the Andean region, it is felt that the mere observation of what has already been done or is being done in the various countries working along these lines would make it possible to identify and develop widely applicable methods which would require only minor adjustments to permit their adaptation to other locations.

9. It should be emphasized that water is a part of the environment and that therefore its conservation and, particularly, its ready availability and control are a function of the way in which its natural collection sources and later successive uses are managed.

10. It should be stressed that a close parallel exists between modern concepts of basin management—understood as an administrative activity directed toward developing and protecting the natural resources present in a basin—and the age-old concept of vertical control of different altitudinal or ecological levels which was already known to the Andean inhabitants of pre-hispanic times.

11. It should also be understood that the Andean peasant is generally a person with team spirit and a sense of association with the environment and that, therefore, there is a basis in his own community underlying his self-motivated actions in connection with natural resource management. This is why it is stressed here that the State should—at least initially—encourage this self-sufficiency with respect to the development and management of the water and land resources, with a view to eventually broadening that management to include other resources such as plant and animal life and steadily reducing the inhabitants' reliance on outside assistance as they gradually regain an awareness of their own capabilities.

12. It is recommended that great emphasis be placed on the training, in line with a uniform approach, of national personnel responsible for promoting the proper development and integrated management of

upper basins. In order for this to be done, manuals and methods must be developed which permit the wide dissemination and application of the technical and administrative know-how applicable to mountain areas as well as techniques for promoting the participation of rural inhabitants. There could even be a single manual for the Andean area if the countries concerned wished to join forces in order to prepare it. 13. Finally, it is recommended that local water and land management authorities for the river basins of the upper Andes, re-

presenting both the State and users, should be created or strengthened. Such authorities should be backed by concrete support from the government, given the fact that they are the agents of, and directly responsible for, the management and conservation of the water and land and hence of an important phase of environmental management. The State water authority at the level of basins must, however, be a single entity which is respected by all sectors using that resource in order for development to be both rational and efficient.

Annex

Criteria for the classification of development and management projects for high-mountain river basins*

1. Criteria regarding participation by basin residents

(a) The project is carried out by the residents on their own initiative and with their own resources.

(b) The project is carried out by the residents with State or private technical and economic assistance.

(c) The project is carried out by the State or private companies, but local manpower is used.

(d) The project is carried out by the State without enlisting the participation of basin residents.

(e) Only some of the basin residents participate in the project.

2. Criteria for territorial coverage

(a) The project includes the entire area of one or more basins or hydrographic units.

(b) The project includes only part of the area of a basin, but it is a manageable hydrographic unit, generally an entire slope or the upper sections of a basin.

(c) The project covers only part of the

hydrologically manageable area of the basin: the lower section, middle section, right bank, left bank, bed or a reach of a river, a human settlement, or other areas demarcated by non-hydrological boundaries.

3. Criteria for sectoral and technical coverage

(a) The project covers aspects which include all sectors of development: agriculture and livestock, forests and wildlife, energy, transport, communications, fishing, recreation, education, health, etc.

(b) The project covers only one sector of development, but that sector is dealt with integrally, e.g., farm, forestry, range and wildlife management within the agricultural sector.

(c) The project covers only one sector of development, and within that sector, is limited to a single activity such as the development of a crop, the improvement of irrigation or the protection of a slope.

(d) Regardless of its sectoral coverage, the project encompasses one or all of the technical phases required for its execution, i.e.: (i) *studies* (inventories, surveys, appraisals and assessments); (ii) *preparation* (project design and preparation); (iii) *ex-*

* Prepared by A. Dourojeanni.

ecution (main, secondary and auxiliary projects and follow-up work); (iv) *operation and maintenance* (organization of the users for the operation, maintenance and repair of the facilities constructed); and (v) *management and conservation* of resources (systematization of the use of basin resources; management, protection and preservation of those resources; and reclamation or recovery of degraded resources).

4. *Criteria regarding project orientation*

The project's objectives are:

- (a) To direct and carry out the development of a given basin or area.
- (b) To institutionalize the actions of the agencies responsible for basin management or similar activities.
- (c) To investigate and test techniques and to develop manuals and methods.
- (d) To provide technical assistance to users.
- (e) To provide financial assistance for basin management activities.
- (f) Other.

5. *Institutional/operational criteria*

(a) The project organization is directed toward promoting the development and/or management of a number of basins simultaneously, either at a national or regional level, and a network of agencies is available for this purpose.

(b) The project organization is specifically for the performance of activities in a single basin or part of one.

(c) The project organization is: (i) permanent, (ii) temporary, (iii) provisional, and is intended to cover all or only some of the technical phases required.

(d) The project organization is subordinate to a specific State system in the (i) administrative, (ii) technical, or (iii) financial area or areas.

(e) The project organization is autonomous, and its administrative, technical and financial systems are its own direct responsibility.

(f) The project receives technical and/or financial assistance for its operations from external sources, the government, or private bodies.

(g) The basin management project is part of a specific sectoral project —e.g., an energy or agricultural (irrigation) project— and its administration comes under the authority of the sectoral project administration.

6. *Other criteria*

In addition to the criteria outlined above, others may be included regarding the project's location, duration, the results desired, the technical personnel involved, its organizational structure, supporting legislation, the degree of inter-institutional coordination, the publications, manuals and methods produced, the training and extension systems employed, the technologies developed, the sources of funding used and, in general, the features of the managerial systems which make the promotion and execution of basin management programmes in Latin America feasible.

These would permit the possible preparation of a survey to classify and assess basin management projects in high-mountain areas of Latin America, such a task being considered a necessary step toward increasing co-operation among countries.

Microelectronics and Latin American development

*Eugenio Lahera**
*and Hugo Nochteff***

According to OECD, the electronics complex will be the main pole around which the production structures of the industrial societies will be reorganized in the next quarter of a century. The dynamism of this complex in such societies, its impact on trends in investment and international trade, and the growing incorporation of its products and technologies in the Latin American countries are influencing to different extents and in different ways the national economies of the region. Among the potential repercussions of the electronics complex on Latin America, special mention may be made of increases in the differences of productivity with respect to the developed countries; changes in the comparative advantages of the various economies, in employment, and in ways of public administration; growing asymmetry in international information flows; and the threat to personal privacy and security, *inter alia*.

In view of the foregoing, the authors maintain that the action of the Latin American countries with respect to microelectronics should be aimed at overcoming the exogenous nature of the present form of incorporation of such technology. Efforts should be made to reverse the passivity and lack of discrimination which currently characterize this process, orienting it instead towards the satisfaction of the region's needs. In this way, microelectronics could become an endogenous factor generating development which would permit these countries to progress more rapidly towards their goals. This endogenization should be selective, both because of the diversity of national situations and goals and because of the disparity of resources and the impossibility of achieving simultaneous development in all aspects of such technology.

The priorities determined, for their part, will depend on the appraisal made of the problems which microelectronics can help to solve, such as the solution of priority social problems or the application of these technologies in sectors of the economy where there are 'bottlenecks' or where they can strengthen existing comparative advantages.

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Introduction

During the last decade, people have begun to talk of a new industrial revolution, brought about by the widespread application of electronics, which is the industry with the highest growth rate in the world since 1945 and whose innovations have spread to the other industries and the main services. The impact of electronics is based mainly on the development of microelectronics technology, but also on other technologies closely linked to it.¹ These technological advances, together with the sectors of industry which manufacture the products and the highly specialized human resources required by this activity, constitute what has been called the electronics complex, regarding which the OECD has said that it will become the main pole around which the production structures of the advanced industrial societies will be reorganized during the next quarter of a century.² The effects of the incorporation of microelectronics may extend from the improvement of a product (automobiles) to the radical transformation of its composition, cost and performance (computers) or even the creation of totally new products (word processors). In some cases there has not only been a transformation in the composition of the product, but also in the industry producing it at the world level, as has happened with watches.³

These transformations take place through changes in the products and in the capital goods with which they are made. Great progress has been made in the replacement of parts and mechanisms, and integrated circuits have replaced many of the functions of springs, levers, stepping motors and gear assemblies.⁴

The replacement of components and mechanisms makes possible a significant

¹ Examples of this are lasers, fibre optics, print-out and display technologies, etc. See D.H. Roberts, "Microelectronics and its applications", in *GEC Journal of Science and Technology*, vol. 46, No. 3, 1980.

² OECD, *Interfutures*, Paris, 1979.

³ Juan Rada, *The impact of microelectronics*, ILO, Geneva, 1980.

⁴ S. MacDonald, D. Callingbridge and E. Braun, "The case of semiconductors", in *Bulletin of Science and Technology Society*, vol. 1, Pergamon Press, U.S.A., 1981.

reduction in the number of parts in a product, with multiple effects on direct and indirect costs, the size of the plant, the amount of energy used and the reliability of the products themselves. The miniaturization deriving from this process makes it possible to introduce new functions and/or increase the spread of existing products. There is an ever-increasing degree of differentiation in such traditional products as automobiles, television sets and telephones. All this affects the production process in different ways, as less skilled labour is needed, there is a drastic reduction in the number of specialized supplier enterprises, and there is a lessening of the capacity of the terminal producer to "untie the technological package". This latter feature is due to the fact that for the terminal an integrated circuit is a 'black box' which takes the place of dozens and sometimes hundreds of parts involving more traditional technology. On the other hand, information on the characteristics of existing integrated circuits and their applications and on the ways of making proper use of them is increasingly important. The penetration of microelectronics in capital goods is having considerable repercussions on the manufacturing process: integrated circuits are now being applied in such tasks as the controlled movement of material and products; the control of process variables such as temperature, humidity and pressure; the cutting, shaping, mixing and moulding of materials; the assembly of components and sub-assemblies; quality control, and the organization of the production process.⁵

Generally speaking, the effects are similar to those already referred to regarding changes in products and those associated with increases in the level of automation. At all events, mention may be made of some more specific effects, such as the reduction of design time and of the lag in feedback between design, production, quality control and management; often, a simultaneous increase in the productivity of capital and of

labour; and the introduction of greater flexibility in the capital goods through the growing incorporation of 'intelligence'.

One of the central features of the electronics complex is that it is bringing about a complete change in the automation of office work, which was until now unaffected by earlier technologies; this is due not only to the availability of office machines (including computers) with growing capacity to store, process and distribute information, but also to the no less important reduction in the cost and size of the equipment.⁶

The close relationship which exists between telecommunications and informatics has a number of effects which are so important and varied that this subject has taken up a considerable proportion of the publications in the field. In the present article, consideration will be given to only a few of these effects, such as the growing international flow of services and the tendency towards their concentration in the most highly developed countries; the possibilities opened up by the new technologies to countries with large rural sectors, especially as regards education and information; and the growing availability of cheaper, quicker and more detailed data on weather conditions, harvests, monetary flows, international prices, etc. Although these facilities could in theory be enjoyed by all the countries of the region, the evidence shows that so far they have been used to a much greater extent by the developed countries and the transnational corporations.

A feature of the electronics complex whose effects and potential with regard to development have not been sufficiently appraised is that the main motive force behind the advances in microelectronics was originally—and continues to be to a large extent—the demand of the military and aerospace sectors and the big corporations linked directly or indirectly to these. This creates a gulf between the technical possibilities of integrated circuits and the actual

⁵ J. Bessant, E. Braun and R. Moseley, "Microelectronics in manufacturing industry: The rate of diffusion", in Tom Forrester (ed.), *The Microelectronics Revolution*, Basil Blackwell, Oxford, 1980.

⁶ Juan Rada, *op. cit.* This reduction was from a weight of 2 542 to 0.30 kilogrammes and from a cost of US\$ 200 000 to US\$ 300 in 23 years, for almost equal performance, as between the IBM 650 and TI-59 calculators.

applications of them in other activities. This gulf even today continues to be large, and its main significance is that a lag in microelectronics does not necessarily mean an equivalent lag in their applications, which, in many cases of interest to the region, call for much smaller investments than those of the microelectronics industry proper.

From the point of view of public policies, it should be emphasized that the large number of sectors affected by the electronics complex, the importance of its effects, and the complexity of the intersectoral relations

created tend to make it increasingly difficult to evaluate the costs and benefits of investment. Consequently, this calls for ever-increasing availability of technological information, continual planning work, consideration of the indirect and long-term effects of economic policy decisions and, finally, close coordination of public policies. These problems and needs are repeated in private business management, thus giving important advantages to transnational corporations producing goods and services, which can only be made up for by suitable public policies.

I

The regional situation

(a) *The Latin American point of view*

The dynamism of the electronics complex in the developed countries, its impact on trends in investment and international trade, and the growing incorporation of its products and technologies in the Latin American countries are influencing the national economies of the region to different degrees and in different ways.

Most of the publications on this matter refer to the countries of highly advanced industrialization, and it is rapidly discovered that their conclusions cannot simply be transferred mechanically to Latin American conditions. This fact, together with the diversity of national problems, indicates the need to make an effort of research and analysis in order to understand the regional situation.

(b) *The incorporation of microelectronics*

The incorporation of microelectronics and of the products and technologies connected with it has constituted and still constitutes a process which is heterogeneous, sporadic and disordered in the region.

Moreover, the form and extension of this process vary from country to country. While some have reached advanced positions among the developing countries, in others the capacity for the production of goods and the

handling of technologies in the electronics complex is either incipient or almost non-existent. Equally significant are the differences as regards imports, exports, availability and consumption. The incorporation of microelectronics has had a markedly exogenous origin, in which a decisive role has been played by the transnational corporations.

In order to make up the total supply, Latin America's imports are accompanied by locally produced goods which incorporate much less microelectronics and in whose production the transnational corporations are generally of great importance and nearly always dominate the market. In the case of informatics in Mexico, for example, six such corporations control the market, and one of them, IBM, accounts for 55% of the total, followed by Honeywell with 15%.⁷ In Chile, the seven main transnational corporations control almost 95% of the market, with IBM at the head, accounting for 25%.⁸

The public sector is the main customer for the products of the electronics complex in the region, this being explained by its decisive

⁷ Ministry of Planning and the Budget, *Política informática gubernamental*, Mexico City, 1980.

⁸ The Economist Intelligence Unit, *Quarterly Economic Review of Chile*, Third Quarter, London, 1980.

importance in telecommunications, by the fact that it is the biggest purchaser of data processing equipment (in Mexico, for example, over 50% of computer sales are made to the public sector),⁹ and by the significance of military expenditure in most of the countries of the region.

The private sector, both national and foreign, is also of importance in the demand for electronic consumer durables and for capital goods in the industrial, financial and services sector.

The characteristics of the main suppliers and purchasers mean that in practice both are outside the market in the traditional sense and this determines the characteristics and dynamics of the relationship.

(c) *Differences in productivity*

The disparity between the developed countries and those of the region as regards the speed of incorporation of the innovations of the electronics complex and the capacity for the adaptation of these to the national economy may further increase the distance currently separating them as regards productivity. These distances are attributable to the increase in productivity through the application of capital goods which incorporate microelectronics in the manufacturing sector, but they are also –and perhaps even more so– due to the possibilities of spectacularly increasing productivity in the services sector and the global impact of the improvement of information processing and communications systems.

It is also necessary to take into account the consequences of the improvement and differentiation of existing products through the incorporation of devices based on microelectronics. The greater productivity of the factors and the differentiation of products may displace goods produced in the region from the market, with a consequent reduction in national income. These are some of the reasons most often brought forward in the developed countries for promoting the incor-

poration and development of the electronics complex in their economies.

(d) *Comparative advantages*

Microelectronics can have an important effect on comparative advantages by reducing those based on low cost of labour and accentuating those originating from higher scientific and technological development.¹⁰ Examples of these are the increasingly intensive use of capital in industries and processes which up to now involved high labour density, or the decline in the share of wages in the cost of capital goods.¹¹

This transformation already seems to have begun in some activities. As was to be expected, microelectronics itself has been the first to take full advantage of its own innovations: thus, the transfer of semiconductor encapsulation work from the more developed countries to those where labour is very cheap has been halted, and certain electronic assembly industries have returned to their countries of origin.

(e) *More or less employment?*

In publications on the repercussions of microelectronics, repeated mention has been made of the unemployment generated by this new labour-saving technology both in the developed and developing countries. The information on the Latin American countries, however, is only scanty and partial.

There can be no doubt about the unemployment-inducing effect of this technology in those cases where what is sought is to rationalize the production process or expand the volume of production. The

¹⁰ See for example, R. Kaplinsky, "Microelectronics and the Third World", in *Radical Science Journal*, 10, 37, 1980 and K. Hoffman and H. Rush, "Microelectronics, Industry and the Third World", *Futures*, August 1980.

¹¹ In telephone switchboards the share of wages in manufacturing costs drops from 40% to 20% when electronics is substituted for electromechanical technology, and in the case of lathes it drops from 30% to 17% when ordinary control equipment is replaced with numerical control devices. See S. Jacobsson, *Strategy Problems in the Production of Numerically Controlled Lathes in Argentina*, Buenos Aires, 1981 (unpublished).

⁹ See "Entering the microcomputer age", in *Latin American Weekly Report*, London, 20 November 1981.

automatic cabin welding machine installed by Ford in Brazil uses four operatives to do the work previously carried out by 60, and it is very probable that the same will occur on an even larger scale with the introduction of robots on the Volkswagen production line in 1984. It may be noted that this is an industry which has problems and is in the midst of a process of reorganization not only in Latin America but all over the world.

However, there are also sectors where the introduction of microelectronics could simultaneously raise productivity and employment, as for example, in small and medium-sized enterprises which could increase the demand for labour if they had a better supply of producer goods which are relatively cheap, simple and easy to maintain and repair,¹² as already occurred with the introduction of electrical machinery. The same could be said of a considerable part of the informal sector, especially if suitable applications are developed, for example, for the improvement of hand tools.

The applications of microelectronics may have differing influences on the different levels of training of the labour force; generally speaking, it may be said that there will be changes in the qualifications demanded. The introduction of microelectronics technology brings about a polarization of employment between semi-skilled operatives and highly qualified technical staff, with a reduction of employment for skilled manual workers.¹³ It is also claimed that it will bring about some lowering of the status of manual labour, which will become more repetitive and frustrating.

An important consideration when evaluating this problem is the economic growth that can be obtained by introducing microelectronics. This is because, in certain conditions of appropriation of the fruits of technical progress, the rapid growth of an economy can raise the standard of living of the popula-

tion as a whole. Moreover, the displacement of labour must be evaluated within a broader context which takes account of the reduction in investment and material costs, the characteristics of scale involved, the greater flexibility, and the higher quality of the goods and services.¹⁴

(f) *The public sector*

Microelectronics offers solutions for a number of problems which arise at the different levels of public administration, especially as regards the massive processing of information on its different functions and the planning process. The introduction of microelectronics with this objective should be carried out in a carefully planned and rational manner, but in an alarmingly large number of cases this has not occurred. In the case of Mexico, for example, over 20 data processing firms installed over 340 different models of data processing machines—many of them mutually incompatible—up to the end of 1979.¹⁵ The same situation is repeated, with some variations, in the other countries.

Modern data processing systems have not necessarily improved the services provided by public administration. In practice, they only speed up existing procedures, without getting rid of old bureaucratic practices. The costs of the data processing are frequently passed on to users, who also usually experience difficulties in correcting possible errors in the information fed into the systems. Moreover, there is an increasing possibility that such errors will occur, because of the tendency of administrations to place their confidence in the information already incorporated in the system.¹⁶

Nor has proper use been made of the enormous potential offered by microelectronics technology for planning processes, and indeed in some cases there has even been a

¹² G. Friederichs, *Microelectronics. A New Dimension of Technological Change and Automation*, 1979 (unpublished).

¹³ ETUI, *The Impact of Microelectronics on Employment in Western Europe in the 1980s*, Brussels, 1980.

¹⁴ Rafael Kaplinsky, *op. cit.*

¹⁵ Ministry of Planning and the Budget, *Diagnóstico de la Informática en México*, Mexico City, 1980.

¹⁶ Klaus Lenk, *Societal Implications of Information Technology*, International Social Science Council (undated).

deterioration in the level and quality of the information published. Economic and social information is tending to become of an increasingly private nature, so that differential opportunities for securing benefits through its use are being created.

Microelectronics technology is a fundamental part of modern military equipment. The marginal superiority of this equipment is frequently based on the incorporation of more advanced microelectronics, with high levels of technological obsolescence. This contributes to the expenditure by governments of large sums on the purchase of armaments and military equipment, the vast majority of which is imported from a few centres producing such goods.

Such imports increased between 1967 and 1976 from US\$ 270 million to US\$ 770 million (in 1975 dollars), thus bringing Latin America's share in the world total from 3.4% to 6% over the same period.¹⁷ Even in those cases where progress has been made in the local production of armaments with electronic components, the latter are almost exclusively of external origin.

(g) *Misuse of the electronics complex*

The under-utilization of the goods and technology of the electronics complex is one of the main problems deriving from the conditions in which the latter tends to be incorporated in Latin America. The situation is even clearer in the case of informatics, since the existence of specialized centres in many countries of the region provides details which permit a fully documented appraisal of the problem.

Computers and related systems were introduced in Latin America as a result of impulses which may be considered to be exogenous. The suppliers of computers set themselves to conquer the market and pressured customers into buying products for which there was no local demand by claiming that they provided solutions for 'problems'

¹⁷ U.S. Arms Control and Disarmament Agency, *World Military Expenditures and Arms Transfers, 1967-1976*, Washington, D.C., 1978.

which the salesmen themselves identified. This process¹⁸ produced a very high level of demand compared with the real needs of the users and the objectives for which the systems were to be used; a marked gap between the equipment and the human resources required for it; and a heterogeneous collection of informatics equipment involving a number of models which was out of all proportion to the scale of use: thus, in one of the largest consumer countries in the region, 142 models were purchased for 230 public administration bodies, and most of these models were mutually incompatible.¹⁹

As a result of all this, the three biggest purchasers in the region (Argentina, Brazil and Mexico) found themselves faced with serious problems in making proper use of their equipment. On the one hand, there is a heavy degree of quantitative under-utilization, amounting in a considerable number of cases to 45/55% of the capacity,²⁰ as well as enormous maintenance difficulties. In the case of Mexico, it has been observed that the impossibility of independent maintenance brought about by the number of different models constitutes a serious limitation on the local informatics industry.²¹ On the other hand, this had led to restrictions on the possibilities of finding new applications, especially those aimed at the "real needs of users and the possibilities of the community",²² in spite of the three countries' potential for creating software.*

¹⁸ Department of Informatics, *Situación actual y tendencias futuras de la informática en el sector público*, Buenos Aires, 1982.

¹⁹ Ministry of Planning and the Budget, *Política informática gubernamental*, Mexico City, 1979.

²⁰ See *Recursos computacionales brasileiros, Computadores instalados*, January/February 1981; Ministry of Planning and the Budget of Mexico, *op. cit.*, and also Department of Informatics of the Argentine Republic, *op. cit.*

²¹ Ministry of Planning and the Budget of Mexico, *op. cit.*

²² Department of Informatics of the Argentine Republic, *op. cit.*

* Originally, the term 'software' was applied to the instructions given to a computer to carry out certain tasks (such as complex mathematical calculations or payroll operations, etc.), while 'hardware' was the term used for a piece

The limited level of local software is perhaps the most negative consequence of the way in which the technology has been incorporated, not only because it frustrates the possibilities of adapting the systems for users, but also because software now represents close to 90% of the total cost of informatics systems at the world level.²³

The advantages deriving from the incorporation of capital goods from the electronics complex or the incorporation of devices based on integrated circuits into existing capital goods are offset in the countries of the region by the rising cost of utilization of this equipment, including the cost of acquisition, installation, adaptation, training and maintenance.²⁴

The lower the level of knowledge of the technologies and products connected with the electronics complex is, the greater this cost will be, so that it tends to be higher in the countries of the region than in the countries of origin of the technology, thus reducing the marginal effectiveness of its incorporation.

(h) *Transnational corporations*

The introduction of microelectronics into products and production processes may

of equipment or a set of items of equipment made up of electronics components, mechanical parts, etc. More recently, the meaning of software has been extended to include in general terms the entire technological activity needed to obtain a result from an integrated circuit or a set of integrated circuits, or even a system based on conventional equipment. In this article, the term software will be used in this broad sense and the term 'utilization software' will be used in the more restrictive sense. It should be noted that the limits between software and hardware are not rigid. In the case of certain integrated circuits (microprocessors), for example, the instructions are recorded physically.

Due to the rapid reduction in the cost of integrated circuits and the rise in the cost of producing software, efforts are being made to incorporate increasingly complex instructions in integrated circuits so as to mass produce them with the largest possible amount of software already physically included. This has led to the creation of the term 'firmware' to designate integrated circuits which incorporate more of the 'intelligence' provided by software.

²³ William Baker, *Analysis of microprocessors business*, National Semiconductor Company.

²⁴ This concept, together with its importance in the case of the electronics complex, have been defined in INTI and BMFT, *Estudio sobre el desarrollo de la industria electrónica argentina, Conclusiones, Fase 2*, Munich, 1981.

bring about significant changes in the international division of labour in the transnational corporations, which may in turn significantly affect the host countries.²⁵

In the case of office machines, these corporations show a high degree of regional specialization expressed through international agreements on production and marketing and even through regional integration mechanisms such as the complementation agreements.²⁶ Thus, for example, in the early 1970s Olivetti specialized its installations in Argentina in the production of mechanical calculating and accounting machines, while it reserved typewriter production of its facilities in Brazil and Mexico. When the pressure exerted by microelectronics on the office machinery industry increased in the second half of the decade, the Olivetti Corporation reserved the production of new lines for its plant at Harrisburg (United States), while traditional production was transferred to the satellite plants, which were to supply the regional market under the integration schemes. By the end of the decade, the demand for mechanical office machines disappeared, and in 1980 the Olivetti Corporation decided to practically eliminate its facilities in Argentina, limiting them to the production of electronic calculators for the local market with only a small content of nationally produced parts; finally the plant ceased activities altogether in 1981. The number of staff employed had already gone down from 1 840 to 150 people.²⁷

²⁵ Latin America's share of direct foreign investment went down from 14% to 13% in the case of Germany (1977-1979) and from 18% to 15% in that of Japan (1975-1979). In the case of investment from the United States, in contrast, the region's share increased from 18% to 19% between 1975 and 1979. Sources: *Survey of Current Business*, Ministry of the Economy of the Federal Republic of Germany, and Ministry of Economic Co-operation of Japan.

²⁶ Eugenio Lahera, "La división internacional del trabajo de las empresas transnacionales y los Convenios de Complementation de ALALC", in *Problemas del Desarrollo*, 39, Mexico City, 1978.

²⁷ Edgardo Cohen, *Modificaciones provocadas por la microelectrónica en el rol de las empresas transnacionales electrónicas en los países en vías de desarrollo. Análisis de dos casos en el área de máquinas de oficina*. First Latin American Seminar on the Socioeconomic Impact of Microelectronics Technology, UNESCO/FLACSO/Vienna Centre, Buenos Aires, 1981.

From another point of view, the concentration of strategic decisions at headquarters may assume new dimensions as a result of the incorporation of microelectronics in transnational corporations, thus accelerating the potential loss of national control over the activities of the subsidiaries.

(i) *External trade in electronic products*

The quantitative effect of the spread of the electronics complex may raise problems for the region's external merchandise balance, as may be seen particularly clearly in the case of the trade in electronic products. Thus, on the one hand imports tend to grow rapidly: between 1974 and 1978, they rose from US\$ 1 391 to US\$ 2 172 million, which represents an increase of 52.2% in only four years. On the other hand, the trade balance shows a marked deficit: in 1977 the region's external trade in electronic goods came to US\$ 2 139 million and the deficit was US\$ 1 469 million or 69% of the total trade.

The quantitative results of the external trade vary widely, depending on the degree of electronic development of the countries, and especially their industrial and technological capacity, as may be seen from comparison of the aggregate data for Argentina, Brazil and Mexico with those for Latin America as a whole. In 1979, these three countries imported 92% of the integrated circuits purchased by the region,²⁸ which is a clear indication of their relative industrial and technological capacity. In 1977, the same three countries accounted for 96% of Latin American electronic exports, 57% of total trade, 50% of imports, but only 40% of the deficit.

The difference in impact according to the degree of capacity for making use of microelectronics is not only quantitative but also qualitative. The countries with the most capacity in this field of technology devote a much larger percentage of their imports to capital goods.

²⁸ Calculation based on data from United Nations, *Bulletin of Statistics on World Trade in Engineering Products, 1979*, New York, 1981.

In 1979, the three countries in question accounted for 76% of imports of data processing equipment, 72% of imports of telecommunications transmitters and receivers, but only 44% of the main electronic consumer goods.²⁹

(j) *International information flows*

There are various aspects in relation with which the outflow of information to the exterior may raise problems for the countries where it originates, and this may affect production and markets as well as financial transactions. The benefits of timely and systematically processed information – which constitutes a form of merchandise capable of producing profits – are generally enjoyed by the transnational corporations through their own information systems or by using other mechanisms.

The United States enterprise Penwait, for example, uses a system of data transmission by satellite to keep a permanent watch on the value of the currencies of the countries where it carries on activities in relation to the dollar, thus optimizing its profits with respect to fluctuations in such values. Another United States transnational corporation, ARMCO, uses the same type of information system so that it can buy or sell the foreign exchange required at the right time.³⁰

There are between 100 and 150 of this kind of information networks.³¹ Furthermore, in the financial sphere proper, in addition to the networks of the big banks, there is a Society for Worldwide Interbank Financial Telecommunications (SWIFT) of which only five Latin American countries, together with Singapore and Hong Kong, are members among the developing countries.³²

From another point of view, mention

²⁹ *Ibid.*

³⁰ Andrew Lloyd, "Précieux atouts pour les sociétés multinationales", in *Le Monde diplomatique*, Paris, December 1980.

³¹ Jean Pierre Chamoux, "Monopoles nationaux et contraintes extérieures", *ibid.*

³² Armand Mattelart, "L'informatique dans le Tiers-Monde", *Le Monde diplomatique*, April 1982.

may be made of the case of the United States Commodities Corporation, a futures marketing enterprise for such commodities as hog-fat and cattle, of which it may not hold any stocks itself: its main resources are the modelling and forecasting capacity of its staff and the basic information it receives from Reuter's Worldwide Commodities Service, which transmits 5.1 million bits per second (a conventional telephone line can only handle 4 800).³³

Moreover, when the outflow of information is not subject to any restriction and this permits the indiscriminate use of telesoftware (the transmission of software through the use of telecommunication systems) the possibilities for the national development of software practically disappear.

(k) *Personal privacy and security*

There is great concern at the international level over the various ways in which microelectronics can affect personal security and the right of individuals to keep certain information confidential. The OECD, the Council of Europe and the European Economic Community, for example, have adopted agreements to protect privacy.³⁴

Within Latin America, the authorities in charge of informatics are responsible for safeguarding personal privacy and confidentiality only in Ecuador and Venezuela.³⁵

There are various angles to this problem. The first is that social control may become exaggerated and be placed at the service of totalitarian régimes. Moreover, much information regarding individuals which is perfectly innocuous as long as it is dispersed may become prejudicial to them when it is correlated by a central information processing system, in such cases as looking for work, taking out insurance, access to loans or institutions, etc.³⁶

Another type of problem arises from the difficulty which exists in correcting possible errors or instances of out of date information in the case of data which are completely confidential or to which ordinary citizens have difficulty in gaining access. Moreover, the control of information incorporated in data processing systems may be difficult and/or costly.

A fourth type of problem is connected with the possibility of misuse of the information, especially by those in charge of computers and data banks.³⁷

II

Possibilities for action

(a) *The general framework: selective endogenization*

Whatever type of action the Latin American countries take with regard to microelectronics should be aimed at overcoming the exogenous nature of the present form of incorporation of such technology. It is necessary to overcome the passivity and lack of discrimination which currently characterize

this process and to orient it towards the satisfaction of the region's needs. If this is done, microelectronics can become an endogenous factor which generates development.

This endogenization process must be selective, both because of the diversity of local situations and national objectives and because

³⁵ Based on information provided by the Department of Informatics of the Argentine Republic.

³⁶ Arthur J. Cordell, *The Content and Control of Future Traffic Patterns in Telecommunications*, Ontario Ministry of Transport and Communications, 1981.

³⁷ Hideo Myyashita, "The information society: what will it bring?", *Journal of Japanese Trade and Industry*, No. 2, 1982.

³³ Shawn Tully, "Princeton's rich commodity scholars", in *Fortune*, 9 February 1981.

³⁴ María Elena Hurtado, "Tug of war over computers", *South*, January 1982.

of the disparity between the resources available and the impossibility of achieving simultaneous development in all aspects of this technology.

(b) *Criteria on priorities*

The focal point to be borne in mind when establishing criteria for priorities is the current disparity between the technological possibilities of the integrated circuits offered on the world market and the existing range of applications. A fundamental objective in this respect should be to identify more applications which can be carried out on the basis of available microelectronics, by producing the engineering skills needed to solve national problems.

This section will set forth some considerations on possible alternative forms of action. It does not, of course, pretend to take the place of the necessary analysis of particular national situations, but merely seeks to suggest the basic elements of such alternatives.

The priority given to particular applications will depend on the appraisal made of the problems which microelectronics can help to solve. In very general terms, however, mention may be made of some interesting objectives such as applications to particular sectors of the economy which will help to solve problems of high social priority or strengthen existing comparative advantages. These applications should seek to make better use of the existing conditions available within the electronics complex and back-up national strategies which have already brought about some degree of consolidation of a particular sector of it.³⁸ They should also give pref-

erence to those applications which involve a closer approach to the basis of this technology, that is to say, integrated circuits.

There are, however, certain limitations on these possibilities deriving from the development of product engineering and software. If the activities are concentrated on 'utilization software', for example, this significantly reduces the possibility of changing the orientation of their applications, which is one of the central objectives of the proposed approach. On the other hand, the introduction of firmware in integrated circuits reduces the flexibility of application for those who have not advanced to the stages of the technology and production of such circuits in which the software is designed and printed.

Once the sectors where the introduction of microelectronics is a matter of priority have been determined, it is necessary to consider also the possibility of taking simultaneous action on other parts of the electronics complex which serve as support sectors. This is because a strategy concentrating on engineering cannot leave out of the reckoning either the development of electronic hardware or the limitations inherent in the whole area of industrial development; otherwise, this would tend to "produce intelligence" for subsequent transfer to the exterior on extremely disadvantageous terms.

(c) *The role of the State*

In most of the countries which are leaders in microelectronics, public financing accounts for over 50% of the total amount spent on research and development.³⁹ The

³⁸ As an example of the first of these, it would seem desirable that Argentina should opt for the production of goods which require human resources of a high level of skill, especially professionals, by developing medical electronic goods or measuring and control equipment. As an example of the second approach, mention may be made of Brazil's decision to give priority to informatics as the sector of the electronics complex to be especially promoted by the State. See Hugo Nochteff, "Electrónica. Una industria cerebro-intensiva", in *Competencia*, Buenos Aires, October 1976 and "Electrónica. La industria electromédica argentina", in *Medicina y Sociedad*, Buenos Aires, 1979; Philip Maxwell, *Consi-*

deraciones sobre las ventajas comparativas de la industria electrónica argentina, INTI, Buenos Aires, 1979 (unpublished); Silvia Helena, *A indústria de computadores: Avaliação das decisões governamentais*, and Iván Da Costa Marques, "Computadores: parte de un caso de sobrevivencia e da soberania nacional", in *Revista de Administração Pública*, Getulio Vargas Foundation, Rio de Janeiro, October-December 1980.

³⁹ In 1980, the United States produced 64% of the total output of integrated circuits of the whole group of market-economy countries, while Japan produced 25%; they were followed by the Federal Republic of Germany, France and the United Kingdom. When the remainder of Western Europe is added, this brings the figure up to 99% of the total output of integrated circuits by the market-economy coun-

participation of the State as the executing agent of research and development projects, however, is much less, thus indicating the importance of public financing in this branch of public activity. In the United States, for example, 51% is financed by the State, but the latter only executes 16%⁴⁰. In addition to the support it gives to research and development, the State plays an important role through the planning of purchases and their orientation towards domestic firms.⁴¹ In the United States, the State has also been a key factor in microelectronics training. In the leading countries, the State action with regard to the electronics complex includes specific project and sectoral policies, the long-term planning or execution of strategic activities, the establishment of co-ordination bodies, the maintenance of close links between the industry and the government, support through direct aid and purchases, and promotional measures.⁴²

Although there are no quantitative estimates for appraising State support to local electronic development in Latin America, the available information reveals a marked contrast between the attitude of the leading countries and those of the region. The United States *Buy American Act*, for example, gives United States products a preference margin in State purchases which is double that given in Argentina.⁴³ Although public bodies do exist

in the countries of the region which have direct or indirect competence in the field of the development of the electronics complex, all of them suffer from insufficient financing, inadequate linkages with the private sector and with other bodies in the country, insufficient access to high levels of government or capacity to influence economic policy, or all these shortcomings at the same time.⁴⁴

The main exception to the above remarks is Brazil, both because of the high administrative level and wide competence of the Special Secretariat for Informatics and its influence on the computation industry of the country and because of the set of policies which have contributed to the rapid development of its electronics industry since the mid-1960s. The change in the relative positions of Brazil and Argentina is due fundamentally to the differences between the public policies of the two countries.

The orientation of public sector purchases has an effect on the electronics complex which is difficult to exaggerate.⁴⁵ State purchases influence the technology, the development of the industry's suppliers, and the equipment of the private sector which uses public services. When an administrative decision regarding telecommunications is taken which provides for the supply of a new service, State purchasing policy determines, on the one hand, the demand and technology of the central systems and, on the other, that of the peripheral equipment of users and its interfaces with the public system, with which it must be compatible. In this way, the State orients the technology in use towards that of the suppliers which it chooses and gives them other competitive advantages in the domestic market, such as

tries, according to the Nora Report, quoted in John Bessant, *Microelectronics and Information Technology: An Overview of the European Experience*, prepared for the First Latin American Seminar on the Socioeconomic Impact of Microelectronics Technology, already referred to.

⁴⁰ These percentages refer to the whole of research and development activity, but they are considered to be the same or higher in the case of microelectronics. In 1975, the five leading countries were responsible for 60% of total world spending on research and development; see Fabio S. Erber, "Desenvolvimento tecnológico e intervenção do Estado: um confronto entre a experiência brasileira e a dos países capitalistas centrais", in *Revista de Administração Pública*, Getulio Vargas Foundation, Rio de Janeiro, 1980.

⁴¹ The Japanese telephone administration (NTT) reserved 100% of the market for Japanese enterprises up to the year 1980, by which time Nippon Electric was the second world producer in the telephone field. See *Business Week*, December 1980, and John Bessant, *op. cit.*

⁴² John Bessant, *op. cit.*

⁴³ See Fabio S. Erber, *op. cit.*; Decree No. 5340/63, and Law No. 18875 of Argentina.

⁴⁴ See Pradeep Bhargava, *Report of the visit to Venezuela and Mexico under the UNDP Fellowship*, Government of India, Department of Electronics, New Delhi, 1976 and Juan Rada, *The Impact of Microelectronics and Information Technology with Reference to Brazil, Argentina and Bolivia*, UNESCO, October 1980.

⁴⁵ In 1975, the purchases by public administrations amounted to more than 40% of the overall demand for electronics in the world. Although no exact estimates are known for Latin America, the proportion here would appear to be even higher; see OECD, *Interfutures. Final Report*, Paris 1979, table 53.

the prestige and the 'critical mass' for competing in the private sector.

In actual fact, hardly any use of this power is to be perceived (although one way or another it is already being exerted) in favour of the development of the electronics complex in the region. This is largely due to the lack of departments specializing in technology which can increase the capacity for developing technological options in public sector enterprises and bodies. This same limitation makes it technically impossible to 'untie packages', with a consequent tendency towards turnkey purchases, thus strengthening for very obvious reasons the exogenous nature of the incorporation process. Moreover, it may be noted that public service enterprises take into account as their objectives only the provision of the service and the cost of the equipment, thus neglecting purchases which could favour the local development of the electronics complex.

Any policy which aims to develop the electronics complex in the region must take account of the above considerations. The present structure of public administrations makes the process of selective endogenization more difficult because of, *inter alia*, the already mentioned tendency towards turnkey purchases and the reduction of technological decisions to the minimum possible.⁴⁶

In order to establish a strong interaction between the public and private sectors, along the style of that existing in the leading countries, some mechanisms should be established in order to link public bodies and enterprises with local private firms and with technological institutes and universities. With the same objective, a co-ordination and planning body should be set up on which the private sector is represented.

In Brazil, efforts have been made to progress in this direction through the establishment of the Industrial Linkage Nuclei (NAI), of which 113 —reporting to a co-

ordinating commission— had been set up by 1978. It has been considered, however, that their objectives were only partially fulfilled because of the "lack of a policy giving preference to domestic enterprises" and the "frequent distance of the NAI from the decision-making centres of enterprises".⁴⁷ All this shows that the development of the electronics complex calls for integral and suitably co-ordinated treatment, as well as an institutional system which tends to facilitate this.

The 'Buy Argentine' and 'Buy National' system may be noted as another example of action in this field.⁴⁸ Although it contained many of the purchasing policy elements which are to be recommended ('untying of packages', design and planning as a function of domestic supply, price preferences for local equipment, etc.), it has not had a substantial effect on the development of the electronics complex in Argentina because the aforementioned limitations militated against its proper application.

The effect of such action on the development of enterprises may be decisive, because it provides a 'critical mass' which helps technological development and competition on the private market; because it produces a demonstration effect typical of public purchases; and because it generates an interaction fostering the search for technological options which are different from those offered by the transnational corporations. Moreover, the impulse given to these local enterprises would substantially improve their possibilities of supplying large private users.

Certain markets are directly influenced by the State even when the public sector is not a significant purchaser. Thus, even when telecommunications services are not provided by the State, for example, there is nevertheless a tendency for the State to lay down the regulations for the services and the technical specifications of the equipment to be marketed. This is due to the application of

⁴⁶ See A. Araoz, J. A. Sábato and O. Wortman, *Compras de tecnologías en el sector público: el problema del riesgo*, Buenos Aires, July 1974, and J.A. Sábato, *El rol de las empresas públicas en el desarrollo científico-tecnológico*, CACTAL, OAS, Washington, D.C., 1972.

⁴⁷ Fabio S. Erber, *op. cit.*

⁴⁸ Based on Decree No. 5340/63 and Law No. 18875 of Argentina.

criteria aimed at the rationalization of the radioelectric spectrum and other considerations of national defence and consumer protection.

This intervention does actually influence the technologies adopted and the possibilities of local development, so that it can be used to rationalize the incorporation of technology and to try to ensure that it is the most suitable for the needs and possibilities of users. Furthermore, it should be borne in mind that this intervention takes place in respect of equipment and systems for which there is an important development potential in the region,⁴⁹ and in respect of which it is most necessary to adapt the type of goods supplied by developed countries (in rural areas or small towns). In addition to the example of telecommunications, there are those of the market for health and educational equipment, which have similar problems and potentials.

Decisions on industrial protection and promotion in the electronics field must take into account the international context and national and regional requirements. The use of the international prices of goods and systems as a parameter for taking decisions on purchases and investments, for example, is of very dubious justification for three main reasons. The first is that these prices are largely determined by the public financing of research and development in the leading countries and the reduction in risk brought about in those countries by the public sector purchases and the direct and indirect protection of national markets. Secondly, this blurring of the price as an indication of efficiency and private costs is made worse at present by the trade war between the developed countries, which is particularly intense in the case of electronic products. Finally, the purchase price is only a part of the final cost of a piece of equipment or system, which is determined above all by the level of utilization and the cost of use. Consequently, decisions should not be based on the purchase cost of goods so

much as on an analysis of their suitability for national needs and possibilities and the indirect effects of each option on development as a whole.

(d) *Technological training and information*

The transfer of technology can be a very important channel of technological training and information, but only if the technology really is transferred, that is to say, if the country paying for it really does come to master its substantive and operational aspects. In reality, what is usually described as the transfer of technology is quite different: it may refer to payments by subsidiaries to the headquarters of transnational corporations, or payments in respect of the marketing of a particular good. With regard to the first of these cases, it should be noted that it is difficult to justify such payments, because the corporation has already amortized the technology in question, and it may be recalled in this respect that the legislation of some Latin American countries does not permit such transactions. As regards the second case, it may be considered that such payments should only be authorized when they are really justified.

With regard to the technology which is incorporated in the equipment, special care needs to be taken, as this often constitutes the starting point of chains of technological determination of ever-increasing cost. The relation in this case would also be of a continuous nature, but increasingly onerous for the recipient. This is probably what will happen with the new telephone systems now being installed in the larger countries of the region.

A specific form of the search for technology is 'technological intelligence'.⁵⁰ In the case of microelectronics, this way is particularly suitable, because commercially available technology exists and there is a possibility of making use of it on the basis

⁴⁹ J. Mauro and H. Nochteff, *Informe sobre el sector de radiocomunicaciones*, Buenos Aires, 1980 (unpublished).

⁵⁰ These observations are based mainly on the statement delivered by Ward Morehouse, *The Third World in Silicon Valley*, at the First Latin American Seminar on the Socioeconomic Impact of Microelectronics Technology, Buenos Aires, 9-11 December 1981.

of the development of engineering capacity in the countries of the region. Specifically, in the developed countries there are academic and research institutions which provide technological services in the electronics area and small consultancy enterprises formed by ex-members of the semiconductor industry who provide technological and marketing information on a commercial basis. There is also a possibility of acquiring technology directly from small or medium-sized but technologically-intensive enterprises.

In order for the bargaining capacity of the enterprises of the region to be successful, it should be increased through the economic and technological support of governments, as well as international co-operation action.

The technological centres of the region have insufficient links with the major users of electronics and local producers. This is due largely to the very limited demand for technology deriving from the exogenous nature of its incorporation, which makes it difficult to co-ordinate the efforts of the centres, as there are no poles of demand sufficiently important to influence trends in the supply of technology. One of the fundamental ways of reversing this process would be to concentrate efforts to set up technological centres among major public users and bodies which take decisions on matters directly linked with priority areas of the electronics complex, such as the centres dealing with technical regulations regarding information services, communications, education or health, or those dealing with policy on the electronics industry. In order to be effective, these centres should have decision-making power or be closely linked with those responsible for taking decisions, and they should establish formal relations with the private sector so that interaction with local supply possibilities is a central and not a residual function.

These centres would influence incorporation into the private sector only indirectly, so that a policy on technological and productive information is indispensable in order to increase the potential advantage derived from the electronics complex in the private sector, speed up its incorporation, improve

its utilization and, in certain cases, orient demand towards local industry.

The brain drain in connection with the electronics complex is particularly intense because of the growing disparity between the development of the electronics complex in the developed countries and in the countries of the region, as well as the relative scarcity of software in the developed countries, which leads them to increase the offers designed to secure the migration of skilled personnel.⁵¹

In the case of Argentina, it may be estimated that approximately 25% of the electronics professionals who have graduated since 1950 have emigrated.⁵²

The reversal of this flow can be one of the ways of incorporating technology, since the available data give grounds for assuming that a considerable proportion of the professionals who have emigrated are currently working in research and development, either in industry or in the academic institutions of the developed countries.

(e) *The role of the transnational corporations*

The assignment by the transnational corporations to different countries of the roles of producers, exporters or mere consumers of microelectronics is frequently decisive, especially in the absence of national policies in this respect.

The transnational corporations must be brought in line with national development policies, objectives and local priorities, to the achievement of which they must make a positive contribution, as well as helping to create scientific and technological capacity in the host countries. In order for this to take place, it is essential that the countries should define their objectives and priorities and specify in them the particular contribu-

⁵¹Hugo Nochteff, "El efecto Mateo", *Informe Industrial*, Buenos Aires, 1981.

⁵² Estimates based on data from A. Dmitruk, E. Elisette, A. Godel and N. Prieto, *Recursos humanos en electrónica*, presentation made at the Congreso del Programa Nacional de Electrónica, Buenos Aires, September 1981.

tion of the transnational corporations. Once the role assigned to such corporations has been defined, their co-operation can be actively sought, both in the case of firms already installed in the country and in that of other enterprises of different size and origin.

Negotiations with the transnational corporations are usually complex and not necessarily easy, but they are nevertheless important points of coincidence between those enterprises' desire to optimize their profits and the fulfilment of national objectives. The establishment of clear priorities and rules for each case makes it easier to come to an understanding on such co-operation.

The centralization of the national negotiating position is of great importance and saves time and avoids misunderstandings; the various problems involved in negotiations with transnational corporations should, as far as possible, be dealt with and solved simultaneously.

(f) *International co-operation*

Microelectronics is a particularly promising field for international co-operation between countries and institutions of the Third World in general and of Latin America in

particular. The similarities between the problems facing the different groups of countries and the need to achieve the necessary scales and 'critical masses' should help such co-operation, both as regards the development and the incorporation of this technology.

National policies should stimulate international co-operation on these matters between the countries of Latin America and those of other developing areas. They should also promote the exchange of information, the establishment of pilot programmes and the conclusion of technology agreements with developed countries.

The transfer of technology and know-how between countries of different levels of electronics development should be systematically explored and steps should also be taken to organize joint development projects in connection with specific problems of the countries involved.

Common treatment of transnational corporations could gradually be introduced so as to ensure the achievement of certain minimum objectives in this respect. In order to do so, the Latin American countries should reach some degree of consensus on a more general strategy for the development of the electronics complex.

The real cost of the external debt for the creditor and for the debtor

Carlos Massad*

In this article the author analyses the real cost of external debt servicing and reaches the conclusion that the cost in question is different for the creditor and for the debtor. The former will normally take into account his own country's financial market as a basis for evaluating the alternative use of his resources. In contrast, the debtor will have to take into consideration the real resources that he needs to use in his own country in order to generate foreign exchange for paying the debt.

In the first case, the nominal rate of interest in foreign currency payable on the loan may legitimately be compared with the rate of inflation in the creditor's market (or in the United States). If the former rate is higher than the latter, there will be a transfer of real resources to the creditor, as he sees it; otherwise, the creditor will incur a loss on the real value of the loan. The data show that during the decade 1961-1970, the real interest paid abroad by Latin America reached 2.1% per annum if the United States Consumer Price Index is used as a measure of inflation; but this figure rises to 3.3% per annum if the United States Wholesale Price Index is employed. For the decade 1971-1980, the corresponding figures are 0.9% and -0.6%.

In the debtor's case, a comparison of the nominal rate of interest with the external rate of inflation becomes meaningless; for what matters is the social (and private) cost of generating foreign exchange. This cost depends, *inter alia*, upon the terms of trade and the changes therein. In view of these considerations, the author proposes a method of measuring the real cost of debt servicing, as seen by the debtor.

Lastly, he analyses various factors which play a part in determining the aforesaid cost, together with the relative importance of each. As was to be expected, the terms of trade carry the greatest weight in the determination of the cost of debt servicing. What is of least importance is the increment in amortization, while the effect of increases in the debt and in the interest paid varies greatly from one country to another.

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Introduction

The external debt of the non-petroleum-exporting developing countries, and, more recently, even that of the petroleum exporters, has been growing very fast.¹ A start has only just been made however, on systematic research into the real cost of the debt measured in terms of the transfer of real resources required to service it. One of the problems posed by evaluation of the real cost of debt servicing stems from the fact that the points of view of the creditor and of the debtor do not necessarily coincide. What matters to the debtor is to ascertain the amount of real resources that will have to be allocated to the generation of means with which to pay the debt. For example, if the international price of its export products falls, *ceteris paribus*, the burden of debt servicing will be heavier for the debtor country; it will have to earmark a larger proportion of its products for payment of the debt and a smaller share for imports.

The creditor, on the other hand, is concerned with the purchasing power of the sum loaned and of the interest on it in his own market. The aim of the present article is to explore these two points of view and propose methods of measuring the real cost or benefit of the external debt both for creditors and for debtors.

I

The creditor's point of view

The creditor will normally take into account the alternative use of his financial resources in his own country's market. Albeit this does not appear valid for creditors located in financial centres where the non-financial market is small (such as Panama or Hong

¹ For a first study in this field, see C. Massad and R. Zahler, "Inflación mundial y deuda externa: el caso del deflactor impropio", in *Dos estudios sobre endeudamiento externo*, Cuadernos de la CEPAL series, No. 9, Santiago, Chile 1977.

Kong), it often happens that the leading creditors are really institutions with their head offices in the United States and other industrial countries.

The range of options for the use of financial resources outside the creditor country's market is enlarged as the proportion of total loans represented by international loans increases. Nevertheless, despite this enlargement, loans abroad still constitute only a modest fraction of the total loans issued by financial institutions in industrial countries.

For example, of the total amount of credit granted by banking institutions located in the United States, less than 10% represented external assets at the end of 1981.² This figure includes assets placed all over the world outside the United States.

Thus, the option of lending abroad, although open, is probably not regarded as an alternative possibility for permanent use of their financial resources by individual loan institutions operating in the international market. It seems more reasonable to suppose that such institutions, individually considered, will invariably take into account the option of using their resources in their own market; and this notwithstanding that in the aggregate they may always keep a certain volume of funds placed abroad.

Now, if the annual rate of interest charged on a loan is equal to the corresponding rate of inflation, the purchasing power of the capital lent will remain constant. And in so far as the rate of interest diverges from the rate of inflation, a loss or gain will occur in the purchasing power of the capital lent by the creditor country.

The debtor countries, for their part, do not only obtain loans from the creditor countries but also leave in them large sums on deposit, on which they earn interest. The purchasing power of the capital deposited is of course also affected by inflation.

From the standpoint of the creditor, inflation in his own market reduces the purchasing power of the deposits in question.

Thus, while the creditor loses on loan capital through inflation (with a given rate of interest), he gains on the foreign capital deposited. Although the rates of interest charged on a loan are generally different from those payable on deposits, a first approximation whereby the two foregoing considerations can be taken into account consists in subtracting from the total amount of loans extant at a given date the deposits existing at that same time. This difference will be called here the Global Net Debt (ND, or, for the purposes of the following formulae, DN).

1. *The method*

If the growth of the Global Net Debt in the course of the year is linear, it may be assumed that the annual interest paid corresponds to a level of debt midway between those recorded at the end of one year and at the end of the next. The difference between the two end-of-year figures constitutes the annual increase in the debt or net flow of annual indebtedness (F).

The average between the two end-of-year figures will represent the Mean Net Debt on which interest is payable (DNF).

$$DNF_t = \frac{DN_{t-1} + DN_t}{2}$$

or again

$$DNF_t = DN_{t-1} + \frac{F_t}{2}$$

where the subindex 't' represents the year concerned.

If the interest paid in each year by the debtor country, minus the interest received on its deposits abroad, or effective net interest (IEF), is divided by the Mean Net Debt, the result obtained is the average net interest rate effectively paid (iEF).

$$iEF_t = \frac{IEF_t}{DNF_t}$$

² See International Monetary Fund, *International Financial Statistics*, Washington, D.C., September 1982.

This effective rate is compared with the pertinent rate of inflation to determine whether the capital loaned by the creditor maintains its real value or whether this value increases or decreases.

Obviously, the real value of the Mean Net Debt, like other factors, will rise, remain the same or decline according to whether the effective interest rate exceeds, exactly matches or falls below the rate of inflation.

A change in the real value of the Mean Net Debt signifies a variation in the debtor's commitment to transfer real resources to the creditor in payment of the debt. The method employed here measures this commitment in terms of the purchasing power which is of interest to the creditor, but which does not necessarily correspond to the cost in terms of real resources that is implied for the debtor by the generation of external resources for payment purposes.

In accordance with Fisher's equation ($1 = p$) ($1 = e$) = $1 + i$, where 'p' is the expected rate of price variation, 'e' the real interest rate and 'i' the nominal rate,

$$e = \frac{1 + i}{1 + p} - 1$$

where 'e' would represent the real transfer of resources from or to the creditor country. Positive values for 'e' would indicate a transfer of resources to the creditor, while negative values would correspond to a transfer from the creditor to the debtor, as the creditor looks at it.

Application of the rate 'e' to the Mean Net Debt will give the amount of resources transferred annually (R_t).

The total amount of resources transferred in the past will represent the cumulative sum of the annual values of 'R', duly adjusted year by year in accordance with price variations. This procedure assumes that over the long term the real interest rate is zero; otherwise, real interest would have to be added to price adjustments in order to determine the value of the cumulative transfer of resources.

Should the said real rate be positive, the procedure used underestimates the cumulative amount of resources transferred.

2. The data

An attempt has been made to cover the twenty-year period ending at the close of 1980, with reference to the Latin American countries, excluding the four Caribbean countries (Guyana, Trinidad and Tobago, Barbados and Jamaica), Venezuela and Panama. The last-named country was left out because it is a financial centre where the economic significance of the 'external debt' is completely different from what it means for the other countries. A sub-group of countries has been set apart as comprising the region's major debtors, i.e., Argentina, Brazil, Chile, Colombia, Mexico and Peru.

To calculate the Global Net Debt, the short-, medium- and long-term debt was taken, irrespective of whether it was or was not officially guaranteed; and from this were subtracted the deposits, both public and private, maintained abroad by the debtor countries. The latter data were obtained from the 1974 to 1980 publications of the Bank for International Settlements, Basle (BIS), and for earlier years the foreign exchange reserves maintained by debtor countries, according to information supplied by IMF in *International Financial Statistics*, were taken as deposits abroad.

This procedure underestimates the amount of deposits abroad prior to 1974, although this underestimation approaches zero as one goes farther back in time; the reason is that private holdings of foreign exchange abroad acquire significance only from the end of the 1960s onwards.

The figures for the global debt from 1974 to 1980 are those estimated by ECLA, on the basis of information furnished by the World Bank and by BIS. For previous years World Bank figures were used for the medium- and long-term debt, and the short-term debt was calculated as the cumulative sum of the net flows of such loans annually recorded in each country's balance of payments. For the purposes of this accumulation it was assumed that there were no short-term loans before 1950.

For the rate of inflation use was made of the data on the consumer price index and wholesale price index of the United States,

since this country is the leading creditor in the case of the debtor countries analysed. The rates of inflation represent average annual rates (percentage variation between annual price indexes).

3. Results

Tables 1 and 2 reflect the results obtained with two alternative measurements of inflation: the United States consumer price index and the wholesale price index for the same country. The total period has been subdivided into quinquennia and decades so as to show trends rather than sporadic short-term variations.

The columns in the two tables show the difference between the two measurements of the rate of inflation and the interest rates effectively paid. If inflation is measured by the variations in the consumer price index, it will be noted that both Latin America as a whole and the six major debtor countries transferred real resources abroad in the course of the borrowing process, through payments of interest; the remaining countries, on the other hand, paid out net real resources during the first decade and received them in the second.

During the twenty-year period ending in 1980, the transfer of accumulated real resources to Latin America's creditors represented an amount equivalent to 7.6% of the debt at the close of 1980; this figure is even higher for the six major debtor countries, rising to 9.3% of their external debt at the same date.

It makes little difference to these results if variations in the United States wholesale price index are applied as the measure of inflation. In the case of Latin America as a whole, and also in that of the six major debtor countries, transfers of real

resources abroad for payment of interest on the debt continue to occur, and the cumulative figure at the end of December 1980 reaches 4.1% of Latin America's debt and 6.4% of that of the six major debtor countries. In this case, however, the situation in the quinquennium 1971-1975 appears unfavourable to the creditors, since the tempo of the upward movements in the United States wholesale price index is speeded up, whereas interest rates do not yet exhibit the marked increases subsequently observable.

All this is only another way of saying that in the period 1961-1980, both the rate of interest received by the external creditors of the Latin American countries as a whole (excluding the four Caribbean countries, Panama and Venezuela), and the rate obtained by the creditors of the six major debtor countries, were positive in real terms. These real rates averaged about 1.5% per annum, a figure very similar to the average recorded for the United States during the same period. In contrast, for the creditors of the Latin American countries other than the major debtors interest rates were negative, averaging about 0.8% per annum; and this notwithstanding the fact that in the decade 1961-1970 the rate was positive in real terms.

Estimates prepared for 1981 suggest that the trends indicated sharpened during that year. The real interest rates paid by Latin America as a whole were close to 5% per annum. This figure also holds good for the six major debtors, while that applicable to the rest of the region remains negative.

These trends may reflect the industrial countries' and the international organizations' policy of increasingly concentrating the available soft resources in the countries with the lowest per capita income.

II

The debtor's point of view

In order to cover debt servicing, including both amortization and interest payments,

the debtor country needs to use present or future real resources in order to generate the

Table 1

LATIN AMERICA^a AND SIX MAJOR DEBTOR COUNTRIES: RATES OF INFLATION AND RATES OF INTEREST PAID ABROAD, 1961-1980*(Averages for quinquennia and decades, as percentages)*

Period	Rates of inflation		Rates of interest paid		
	CPI	WPI	Latin America	Six major debtors ^b	Others
1961-65	1.3	0.3	4.1	4.4	2.7
1966-70	4.2	2.7	5.4	5.7	3.5
1971-75	6.8	9.6	7.4	7.7	5.0
1976-80	8.9	8.9	10.0	10.4	7.1
1961-70	2.7	1.5	4.8	5.1	3.1
1971-80	7.8	9.3	8.7	9.1	6.0

^a Excluding the four Caribbean countries (Guyana, Trinidad and Tobago, Barbados, Jamaica), Venezuela and Panama.

^b Argentina, Brazil, Chile, Colombia, Mexico and Peru.

Table 2

LATIN AMERICA^a AND SIX MAJOR DEBTOR COUNTRIES: REAL INTEREST RATES PAID ABROAD, 1961-1980*(Averages for quinquennia and decades, as percentages)*

Period	Latin America		Six major debtors ^b		Others	
	CPI	WPI	CPI	WPI	CPI	WPI
1961-65	2.8	3.8	3.1	4.1	1.4	2.4
1966-70	1.2	2.7	1.5	3.0	-0.7	0.8
1971-75	0.6	-2.2	0.9	-1.9	-1.8	-4.6
1976-80	1.1	1.1	1.5	1.5	-1.8	-1.8
1961-70	2.1	3.3	2.4	3.6	0.4	1.6
1971-80	0.9	-0.6	1.3	-0.2	-1.8	-3.3

^a Excluding the four Caribbean countries (Guyana, Trinidad and Tobago, Barbados, Jamaica), Venezuela and Panama.

^b Argentina, Brazil, Chile, Colombia, Mexico and Peru.

necessary means of payment in foreign exchange. It uses present real resources when it provides for the servicing of its debt out of a trade-balance surplus. In contrast, it uses future real resources when it serves its debt by means of a surplus on capital account, i.e., by increasing its external debt, which it will repay in future periods. In

conditions of equilibrium, the present value of the future real resources required to pay the debt, discounted at the social discount rate, will have to be equivalent to the value of the resources needed for payment of the debt at the present time. The same thing is true of present or future debt servicing.

The problem to be resolved is that of

determining how much it costs the economy, in terms of real resources, to generate one unit of foreign exchange. This cost will represent the real social price of foreign exchange, or social exchange rate,³ the magnitude of which will depend upon such factors as external export and import prices, the level of international reserves, the degree of resource mobility as between tradeable and non-tradeable goods, etc.

When external import and export prices show appreciable variations which are maintained throughout long periods, they tend to take a predominant place among the various factors that help to determine the social exchange rate, and, consequently, the cost of external debt servicing measured in terms of real resources.

Accordingly, a first approximation to the real cost of debt servicing, from the debtor's point of view, consists in looking for some way of taking export and import prices into account in the valuation of debt payments.

1. The method

Obviously, a rise in the external prices of a country's exports will reduce the cost of debt servicing. Such an increase would mean that for every unit of real resources allocated to production for export more foreign exchange will be obtained than before, so that to generate one unit of foreign exchange fewer real resources will be required.

On the other hand, a rise in the external prices of imports implies that to maintain the same level of imports in real terms, more foreign exchange must be expended than before, and therefore more real resources must be earmarked for generating it, at progressively higher costs in terms of sacrificing production of other goods and services.

Thus, *ceteris paribus*, an improvement in the terms of trade will bring down the cost of debt servicing measured in internal

real resources, in relation to the base period. A deterioration in the terms of trade will of course produce the opposite effect.

Debt servicing comprises amortization and interest, so that

$$(1) \quad S = A + I$$

where debt servicing, S , is measured as the sum—in terms of United States dollars—of the nominal values of amortization A , and interest I , paid abroad. To measure the terms of trade, an index of the unit value of the country's exports is divided by an index of the unit value of its imports, both expressed in United States dollars

$$(2) \quad T = \frac{V_x}{V_m}$$

where T represents the terms of trade index and V_x and V_m the indexes of unit values of exports and imports, respectively. If $T < 1$, this implies that the unit values of exports increased more than those of imports, so that the cost of debt servicing, measured in terms of real resources, will be less per unit than in the base year.

The difference between the cost of debt servicing assessed in terms of real resources in the debtor country and the nominal amount of the service will be a measure of the increase or decrease in this cost generated by the terms of trade, VC .

$$(3) \quad \frac{S}{T} - S = VC$$

or again

$$(4) \quad \frac{S(1-T)}{T} = VC$$

Lastly, to express this variation per unit of debt, it follows that

$$(5) \quad \frac{S}{D} \cdot \frac{(1-T)}{T} = \frac{VC}{D}$$

where D is the average nominal global debt for the corresponding year.

The term $\frac{VC}{D}$ has a dimension compara-

³ See C. Massad and R. Zahler, *op. cit.*

ble to an interest rate, and may be interpreted as a surcharge or relief in respect of the nominal interest rate, caused by variations in the terms of trade in relation to a given base period.

This interpretation calls for certain reservations. In the first place, the variation in the terms of trade measures changes in average export and import prices; it is therefore very strongly influenced by the staple and often traditional products which each country trades on the international market. In all probability, the marginal variation of the terms of trade, which will generally correspond to that of the non-traditional products traded, will be different from the mean, and it is this variation that should more properly be considered in the present analysis. In other words, an index of the marginal terms of trade would need to be defined and calculated as a means of more accurately reflecting the changes in the cost of external debt servicing measured in terms of real resources.

In the second place, the calculation would show the cost of debt servicing if the debt were effectively serviced. As the stock of debt generally tends to be enlarged, the new sum borrowed obviously more than covers the amortization payments and on occasion even the interest on previous debts. This means that a future servicing cost is being incurred whose equivalent in terms of real resources can only be calculated at the time of its effective payment. At all events, the method proposed permits of an approximation to the calculation in question at any time; and also makes it possible to establish that it is not in a country's best interests to pay its debt when the terms of trade are unfavourable to it. In such circumstances, *ceteris paribus*, it is better to refinance or renegotiate than to pay, although the normal attitude of creditors is precisely to collect at times when the terms of trade are most disadvantageous.

2. *The data*

As in the preceding case, the twenty-year period up to 1980 is considered, and is

divided into quinquennia so that trends rather than occasional changes may be assessed. The calculation was made with reference to Latin America, excluding the countries mentioned above, and to the six major debtor countries. To determine the variation in each country's terms of trade, use was made of indexes of unit values of exports and imports, with 1970 as the base year. The terms-of-trade index figures for each year are those estimated by ECLA; debt servicing data are taken from each country's balance of payments, and the sum indicated for external interest payments is net of interest received on deposits abroad. Debt amortization figures are also net of amortization received, but the latter is quantitatively insignificant in the countries considered.

The rates of surcharge or relief in respect of the nominal interest rate were calculated year by year and the geometric average per quinquennium was then worked out for each country. To calculate the average for the six countries as a whole, unit values were obtained for the group by means of adding up their exports and imports in terms of current and constant values, the latter at 1970 prices. And the same method was applied to Latin America as a whole.

3. *The results*

Tables 3 and 4 present the results obtained by application of the method described above for estimating the surcharge or relief on the nominal interest rate for the global external debt implied by changes in the terms of trade. The overall results do not show a very heavy surcharge, although on certain occasions it has amounted to more than 35% of the nominal interest rate paid on the debt. For some countries, at all events, both the relief and, where relevant, the surcharge are on a substantial scale.

Chile is undoubtedly the country that was hardest hit, with a surcharge averaging 26.6% for the quinquennium 1976-1980. This means that in paying amortization and interest on its debt, Chile had to disburse 26.6% more in real resources than it would have had to expend if the terms of trade

had been the same as in 1970. If the incidence of copper prices on the terms of trade is eliminated, the surcharge is 15.5%; at all events nearly four times as much as the corresponding figure for Brazil, the country which comes next after Chile in respect of the negative effect under discussion.

At the other extreme is Mexico, with a 4% relief during the quinquennium 1976-1980.

On the basis of these results, an estimate can be made of the real rate of interest looked at from the debtor country's viewpoint, i.e., measured in terms of real resources required to pay debt amortization

and interest in relation to the nominal global external debt outstanding. As regards the six countries considered apart, the maximum rate -38.1%— is shown by Chile in the quinquennium 1976-1980, while the minimum -1%— falls to Argentina in the first quinquennium of the period under study. In the six countries as a whole, the rate follows an upward trend throughout the four quinquennia, reaching almost 12% in the last five-year period analysed. This reflects several factors, including the variation in the debt and in its amortization, the increase in nominal interest rates and the deterioration of the terms of trade.

Table 3

LATIN AMERICA—SIX MAJOR DEBTOR COUNTRIES: RATE OF SURCHARGE
OR RELIEF IN RELATION TO THE NOMINAL INTEREST RATE
(Averages for quinquennia and decades, as percentages)

Geometric averages	Argentina	Brazil	Chile ^a	Colombia	Mexico	Peru	Six countries
1961-65	-1.6	0.8	6.3	0.8	1.3	4.6	1.6
1966-70	0.9	1.8	1.1	1.2	1.0	2.4	1.0
1971-75	-3.2	1.2	5.8	0.8	-0.5	0.3	0.3
1976-80	3.2	4.1	26.6	-3.9	-4.0	-1.2	1.4

^a If copper is excluded from the calculations relating to Chile, the figures are: 4.8; 3.6; 4.0; 15.5.

Table 4

LATIN AMERICA—SIX MAJOR DEBTOR COUNTRIES:
REAL RATE FOR DEBTOR
(Averages for quinquennia and decades, as percentages)

Geometric averages	Argentina	Brazil	Chile ^a	Colombia	Mexico	Peru	Six countries
1960-65	1.0	5.4	11.4	5.3	7.2	7.7	6.0
1966-70	5.2	8.0	5.1	6.4	7.0	9.2	6.7
1971-75	6.5	10.3	11.2	6.7	6.4	8.3	8.0
1976-80	13.1	15.0	38.1	3.6	6.9	7.0	11.8

^a If copper is excluded from the calculations relating to Chile, the figures are: 9.9; 7.6; 9.4; 27.0.

III

Factors intervening in the real cost of debt servicing, from the debtor's viewpoint. A provisional analysis

To measure the relative importance of each of the factors intervening in the determination of the real cost of debt servicing, from the debtor's viewpoint, the following procedure was adopted.

If it is recalled that

$$(6) \frac{S}{T} - S = VC$$

is the additional cost of debt servicing attributable to the terms of trade, the following expression may be formulated:

$$(7) \frac{\frac{S}{T} - S + I}{D} = \frac{VC + I}{D} = \ell$$

where ℓ represents the real cost of debt servicing, per unit of debt. This can also be expressed as follows, in accordance with (1):

$$(8) \ell = \frac{I}{D} + \frac{A + I}{TD} - \frac{A + I}{D}$$

and, if we differentiate (8) completely,

$$(9) d\ell = \frac{\partial \ell}{\partial D} \cdot dD + \frac{\partial \ell}{\partial A} \cdot dA + \frac{\partial \ell}{\partial T} \cdot dT + \frac{\partial \ell}{\partial I} \cdot dI$$

By virtue of equation (9), the increase in the real cost of debt servicing per unit of debt, $d\ell$, can be broken down by the various factors intervening in its determination.

It was assumed that debt D , in a given period, is a function of the amortization paid during the period in question, A , so that $\frac{\partial D}{\partial A} = -1$.

Amortization in future periods will of course be a function, *inter alia*, of the debt at the present time. This relation has not been considered, since what has to be

determined is the real cost of serving the debt now, not in the future. It must be taken into account, however, if the future behaviour of service payments is to be investigated; a substantial present increase in the debt implies, *ceteris paribus*, a steep rise in amortization in the future.

Totally differentiating equation (8), as indicated in (9), we have:

$$(10) d\ell = \left[\frac{I}{D^2} - \frac{A + I}{TD^2} + \frac{A + I}{D^2} \right] dD + \left[\frac{1}{TD} - \frac{1}{D} + \frac{I}{D^2} + \frac{A + I}{TD^2} - \frac{A + I}{D^2} \right] dA + \left[-\frac{A + I}{T^2 D} \right] dT + \left[\frac{1}{D} + \frac{1}{TD} - \frac{1}{D} \right] dI$$

$$(11) d\ell = \frac{1}{TD} \left[\frac{AT - (A + I)}{D} dD + \frac{(A + I) + D(1 - T) - AT}{D} dA + \frac{A + I}{T} \cdot dT + dI \right]$$

and, lastly, if it is recalled that $A + I = S$, we have

$$(12) d\ell = \frac{AT - S}{TD^2} dD + \frac{S + D(1 - T) - AT}{TD^2} dA + \frac{S}{T^2 D} \cdot dT + \frac{1}{TD} \cdot dI$$

This last equation (12) can also be written as follows:

$$(13) \, d\ell = \frac{AT - S}{TD} \cdot \frac{dD}{D} + \frac{S + D(1 - T) - AT}{TD} \cdot \frac{dA}{D} + \frac{S}{TD} \cdot \frac{dT}{T} + \frac{1}{T} \cdot \frac{dI}{D}$$

or again:

$$(14) \, d\ell = \frac{AT - S}{TD} \cdot \frac{dD}{D} + \frac{S + D(1 - T) - AT}{TD} \cdot \frac{A}{D} \cdot \frac{dA}{A} + \frac{S}{TD} \cdot \frac{dT}{T} + \frac{1}{T} \cdot \frac{1}{D} \cdot \frac{dI}{I}$$

where changes in the debt, in amortization, in the terms of trade and in the interest paid are expressed as percentages.

Thus equations (12), (13) and (14) make it possible to distinguish the incidence of these factors on the variations in the real cost of debt servicing, by combining the terms-of-trade effect with the impact of changes in the amount of the debt and in the flows of amortization and interest payments.

If the results obtained in (13) are applied to the figures for the group formed by the six major debtor countries of the region, for the whole of the period under consideration, the following equation is obtained by regression:

$$d\ell = 0.073 \frac{dD}{D} + 0.010 \frac{dA}{A} + 0.077 \frac{dI}{I} - 0.240 \frac{dT}{T}$$

All the coefficients are significant and the signs conform to expectations.

The increase in the debt bears a negative sign, i.e., it reduces the value $d\ell$ and, therefore, represents a relief in respect of the cost of debt servicing. But for the increment in amortization the sign is

positive, so that when the growth of the debt generates increases in amortization, the cost of servicing it will rise. The same thing will happen in the case of interest payments, with the result that the relief afforded by the augmentation of the debt is a very short-term business.

These results once again confirm the conclusion that the variation in the terms of trade plays an important part in the cost of debt servicing, from the debtor's point of view. In some individual countries, however, its influence varies substantially within each of the periods considered.

Table 5 shows the results obtained for each of the countries in the Latin American 'major debtors' group.

The cost relief effect produced by the increase in indebtedness was more important for Chile than for the other countries. At the other extreme stands Colombia, where the coefficient is practically 0. The rest of the countries range between these two extremes, their coefficients being very close to the average for the six major debtors.

The increase in debt amortization in all countries has a regression coefficient equivalent or very close to 0.

The impact of the rise in the interest paid was severest in the cases of Peru and Mexico, whereas in Colombia its effect was much less. The coefficient for the remaining countries was close to the average for the six major debtors.

The terms of trade carried most weight in the determination of the cost of debt servicing. Mexico and Brazil were the countries in which its cost was most affected by this concept, while the coefficient was lowest in Colombia.

It is important to bear in mind that inherent in the cost per unit of debt there is a relief, or negative cost, by virtue of the increase in the size of the debt. This is a genuine fact, but, as previously remarked, it must be handled with caution. A debt whose growth has been very marked will be bound to generate a considerable subsequent rise in amortization and interest; when the level of the debt is stabilized, this upswing will cause an increase, which may be substantial, in the cost of servicing it.

Table 5
REGRESSION RESULTS

$$\text{General formula } d\ell = \alpha_1 \frac{dD}{D} + \alpha_2 \frac{dA}{A} + \alpha_3 \frac{dI}{I} + \alpha_4 \frac{dT}{T}$$

	α_1	α_2	α_3	α_4	R	D.W.
Major debtors (six)	-.073 (-6.479)	.010 (1.444)	.077 (9.818)	-.240 (-17.479)	.9850	2.1365
Argentina	-.107 (-4.499)	.003 (.619)*	.071 (3.649)	-.209 (-5.196)	.9110	2.1765
Brazil	-.075 (-3.855)	.007 (.544)*	.079 (6.744)	-.305 (-11.031)	.9649	1.8897
Chile	-.263 (-4.393)	.023 (.864)*	.075 (4.513)	-.196 (-7.188)	.9208	.7601
Colombia	.022 (.167)*	.005 (2.258)	.055 (6.286)	-.130 (-13.055)	.9768	2.6164
Mexico	-.080 (-3.757)	-.010 (-2.298)	.093 (6.606)	-.351 (-17.294)	.9765	2.3966
Peru	-.127 (-7.773)	-.004 (-.352)*	.097 (7.008)	-.293 (-12.637)	.9802	2.4999

Note: The numbers in () correspond to the value of the t-statistic.
* Not significant at the 90% level of reliability.

IV Conclusions

Table 6 summarizes the results obtained. Obviously, real interest rates, from the standpoint of the debtor, have greatly exceeded those envisaged by the creditor, in consequence of the steep deterioration of the terms of trade during the period under consideration.

This discrepancy in the real cost of the debt from the two points of view may account for some of the facts observed. In the first place, the debtor countries have been more concerned about the level of

their debt than the creditors.⁴ The latter have not supported the proposals put forward by some debtor countries for the improvement of the institutional mechanisms that deal with the debt problem: proposals which include the possible establishment of a special refinancing service in the International Monetary Fund. Nevertheless, some

⁴ Mexico's recent problem has made a notable difference to this situation.

Table 6

**LATIN AMERICA AND SIX MAJOR DEBTOR COUNTRIES:
REAL INTEREST RATES FOR CREDITORS AND DEBTORS**
(Averages for quinquennia and decades, as percentages)

Period	Rates for creditors		Rates for debtors
	CPI	WPI	
1961-65	3.1	4.1	6.0
1966-70	1.5	3.0	6.7
1971-75	0.9	-1.9	8.0
1976-80	1.5	1.5	11.8
1961-70	2.4	3.6	6.4
1971-80	1.3	-0.2	9.9

creditors are beginning to show signs of concern as to the 'debt servicing capacity' of the debtor countries. This capacity must not be measured by the traditional indicators—such as the relation between debt servicing and exports or between the level of the external debt and the national or domestic product—, since these have serious shortcomings.⁵ In contrast, there is a 'direct relation between 'debt servicing capacity' and the cost of servicing the debt in terms of real resources, as seen by the debtor. The greater this cost, the less will be the debt servicing 'capacity', and the stronger the incentive to put off net payments abroad to better days, through renegotiation or refinancing operations.

The approach adopted to the determination of the real cost of debt servicing from the debtor's point of view represents a social rather than a private valuation. This is because the currencies of the debtor countries are not reserve currencies; accordingly, for the payment of the external debt a process of currency conversion is required which in the end involves the monetary authority. It is the latter that in the last analysis has to face the problem of supplying or withholding the foreign ex-

change required to cover balance-of-payments disequilibria, even if these disequilibria stem from transactions conducted by the country's private sector.

The fact that an increasing proportion of the external debt is a private-sector debt with no State guarantee does not alter this circumstance.

Again, only two of the four variables taken into consideration in the determination of the real cost of debt servicing can be directly affected by the economic policy of the debtor countries: the growth rate of the external debt and the growth rate of debt amortization. The former is affected by the internal interest rate compared with the external, as well as by expectations of devaluation and by the element of risk, both private and national; it is also often influenced by direct regulations. The second is particularly affected by regulations such as those relating to compulsory cash reserves, differentiated according to the length of time for which the credit is granted, guarantees of access to the foreign exchange market, etc. The object of all these regulations is to change the debt maturity profile, and thereby they affect amortization payments.

On the other hand, apart from the effect on interest generated by the level of the debt, the debtor country has no direct means of influencing interest, since interest rates and surcharges are determined abroad.

⁵ See Alvaro Saieh, *Un análisis sobre la posibilidad de evaluar la solvencia crediticia de los países en desarrollo*, Cuadernos de la CEPAL series, No. 36, 1980.

It does, however, have certain indirect ones, such as the granting or withholding of a State guarantee, and the overall situation of the debtor country's economy.

While for their part the terms of trade and variations therein may be affected over the short term by exchange policy, they are to all intents and purposes determined externally in the case of small economies with no monopolistic power in the world market.

The behaviour of these two variables—interest rates and the terms of trade—

although uninfluenced by the economic policies of the debtor country, may on the other hand influence them, leading them to create incentives in the appropriate directions. An increase in rates of interest that is expected to take place shortly may act as an inducement to use reserves to make external debt payments in advance, whereas a deterioration in the terms of trade should be conducive to longer-term rescheduling or refinancing of payments.

Some ECLA publications

El sector externo: Indicadores y análisis de sus fluctuaciones. El caso argentino, "Estudios e Informes de la CEPAL" series, No. 14, Santiago, Chile, 1982, 216 pages.

This study is part of the Programme which the ECLA Office at Buenos Aires is conducting on information and the short-run analysis of the Argentine economy. The objective of this programme is the development of statistical data which will make it possible to organize a system of indicators of economic activity to serve as a basis for making descriptive studies of sectoral performance in the short term.

This study is oriented towards examining the Argentine external sector and is the fourth to appear in the same series¹ for the purpose of adding to the knowledge of how the sector functions and complementing the remaining studies. In this connection, and in view of the features of the Argentine economy, it places special emphasis on examining the interaction between the industrial cycle and the external accounts situation.

Chapter I briefly describes the behaviour of the value, volume and purchasing power of exports and the volume of imports. With respect to the longer-term development of exports, different periods of evolution are defined and a distinction is made, in relation to value and purchasing power, between the quantity and price contributions. With respect to the evolution of the volume exported, the variability of the different product groups is measured; with regard to imports, their elasticity with respect to industrial production is examined over the long and short term. Lastly, the critical points of the volume of the main export and import groups are determined and typical indicators of cyclical analysis such as the duration and amplitude of expansive and recessive phases are presented.

Chapter II links the behaviour of the external variables to the industrial cycle and quantifies the fluctuations of trade in its relationship with the activity cycle, in terms of intensity and chronology. To that end, the behaviour of the export and import volumes and the trade balance during expansive and recessive phases in the manufacturing cycle are examined. The intensity of the cyclical behaviour by main product groups and—in the case of imports—their cyclical elasticity is also determined. In addition, two special topics are included. In the first place, it is shown how the industrial activity cycle and the cattle-raising cycle reinforce each other or compensate for each other with regard to their effects on the volume of meat exports. In the second place, the behaviour of international reserves during phases and sub-

phases of the industrial cycle is described, and theories are presented explaining it on the basis of the evolution of the trade balance and the expected movements of short-term capital. Finally, to offer elements for analysing the form of action of certain transmission mechanisms, a systematic description of the chronology between the critical points of different series is presented.

Chapter III describes the sources and methods used for the construction of the basic statistical series, especially with respect to the reconciliation of partial series available for different historical periods and with respect to the obtaining of quarterly data.

Finally, an annex is given which contains quarterly series on the value, volume and prices of exports and imports—total and by groups—; purchasing power of exports; terms of trade; trade balance, and international reserves. The export statistics cover the period 1953-1980 and the import statistics, 1958-1980.

Ingeniería y consultoría en Brasil y el Grupo Andino, "Estudios e Informes de la CEPAL" series, No. 15, Santiago, Chile, 1982, 320 pages.

The main purpose of this study is to provide background information on the Brazilian experience in the sale of services to the exterior, and elements for analysis of the possibilities of co-operation between Brazil and the countries of the Andean Group in the area of consultancy and engineering services.

The exporting of consultancy and construction engineering services is a topic that has not been extensively explored in the developing countries, while co-operation in this area has been even less covered, so that the research effort has been particularly intense and without many points of support on which to base it. This gives the study a preliminary nature, which calls for the subject to be gone into more deeply, especially in the search for elements of a type of co-operation which will prove to be of mutual benefit for all parties. The natural tendency, when links are produced between nations of very different sizes and economic and technical capacities, is towards global and sectoral imbalance in the product of that relationship. It is, therefore, a considerable challenge to find mechanisms which, at least in the global links, attempt to achieve equitable benefits.

One important conclusion of this work is that in order to give rise to significant multiplier effects in the area of co-operation it is necessary to identify fields where the size of the joint projects will be sufficiently large to justify bringing together a full complement of factors of different natures (human, financial, physical, etc.), as well as mobilizing the executive, administrative and technical capacities of the Governments of the interested parties. One relevant example of this type has been the construction of the binational Itaipú hydroelectric power station between Brazil and Paraguay.

This does not mean that international co-operation can only take place in large projects: on the contrary, it helps break down existing limitations so as to join efforts among the countries of the region, and therefore makes it possible to amplify the space for joint actions in projects of insufficient size.

Another interesting result is that connected with the question of the source of the resources for the execution of investment projects. There is no doubt that international financing is currently the main element making viable the investment process in basic industries and infrastructure sectors, and this situation will have to be taken into account in developing initiatives for co-operation. It is essential to make up 'financial packages' that are not compromised with the direct interests of the enterprises providing capital goods

¹ The following documents have been published up to the present: Daniel Heyman, *Las fluctuaciones de la industria manufacturera, 1950-1978*, Cuadernos de la CEPAL, No. 34, Luis Guccia, *Tendencias y fluctuaciones de la actividad del sector agropecuario argentino: indicadores del ciclo ganadero*, E/CEPAL/BA/L.1; Luis Beccaria, *Margen bruto y distribución del ingreso: un análisis de corto plazo de la industria manufacturera argentina*, E/CEPAL/BA/R.1.

and consultancy and construction engineering, in order to ensure participation by local or binational enterprises or consortiums in these categories from the countries associated in the respective projects.

The work is divided into four chapters and five annexes; the latter consist of national monographs on all the countries of the Andean Group, with detailed information on the supply and demand of consulting and engineering services.

Five studies on the situation of women in Latin America, "Estudios e Informes de la CEPAL" series, No. 16, Santiago, Chile, 1983, 178 pages.

In recent years, the question of women has become a topic of public discussion, which has caused a substantial increase in the number of essays and studies on it.

This document falls among those which attempt to secure the integration of women into development, although it does not accept the idea that there is something as general as 'women' or 'the situation of women', but attempts to attribute a more precise meaning to those expressions. Neither does it consider that it is a question of effecting a transition from a lack of participation or integration to a state of participation or integration. Rather, it takes as starting point the fact that women do participate and are integrated into development in some way or another but that, whatever that way may be, it is proving to be unsatisfactory for large groups of women; therefore, the unsatisfactory effects of the way in which they participate or are integrated and the reasons why those effects are produced must be established. Finally, it considers 'development' to be an integral historical fact, not reduced exclusively to economic growth, which moves in the direction of social and human objectives proposed and elaborated in important United Nations General Assembly resolutions, particularly those referring to the International Development Strategy.

It has not yet been possible to resolve satisfactorily the difficulties which prevent activities designed to improve the situation of women from being incorporated in a valid way into global, national and regional development programmes and strategies. As long as that incorporation is not achieved and the situation of women continues to be considered in an isolated way, any action proposals and activities which may be developed will continue to be of an erratic nature and have only a marginal place in planning systems, and consideration of them will be viewed as appropriate or to be recommended, but not essential, in the national and international fora concerned with development.

The magnitude of the information contained in this document and the analyses and range of topics it encompasses make it a contribution which needs to be taken into account in studying the topic. Besides being useful for researchers and students of the status of Latin American women, this text might also be of use to planners for the elaboration of social policies in their countries.

Maintaining internal unity among the works comprising it, this publication begins with a conceptual study of the most general relationships shaping the situation of women. It continues with the elaboration of specific patterns involving women and families in the development process of the region. It then gives special attention to analysing aspects connected with the family, education and employment, which have been considered as having priority in the various General Assembly mandates and which constitute the main fields of social action by women. Finally, it presents some guidelines for establishing priorities, strategies and policy measures which could help improve the situation of women.

Cuentas nacionales y producto material en América Latina. Comparabilidad de ambos sectores, "Estudios e Informes de la CEPAL" series, No. 17, Santiago, Chile, 1982, 129 pages.

Economic, national and social accounting schemes have been established for the purpose of ordering and bringing together the copious amount of economic statistics in indicators which are synthetic, but coherent among themselves, which display the features of each economy and, at the same time, make it possible to carry out comparative analyses between countries and regions.

Since the main purpose of social accounting systems is to record and reflect the economic reality existing in each country, they must be designed in accordance with the institutional organization and the mode of operation of each society. To this end, two systems of national accounts have been developed and are being applied internationally: the System of National Accounts (SNA), in countries with market economies, and the System of Material Product Balances (MPS) in countries with centrally-planned economies. In Latin America, Cuba applies the MPS and the rest of the countries the SNA.

Both systems accomplish the same purpose of measuring all the important economic flows taking place in a country within a coherent scheme. The accounting structure and the way of recording and presenting the information is different in each system: the SNA does so through accounts and the MPS through balances. However, this difference is not a basic one, since there is no major difficulty in passing from one form of record to the other. The basic differences between both systems lie, in the first place, in the delimitation of the frontier of economic production, and in the second, in the criteria applied for defining and considering a few particular transactions.

The scope of the economic activities is practically the same in both systems. But whereas in the SNA all these activities are considered to be productive, that is, to be part of economic production and the generation of income, in the MPS the only activities considered within the area of economic production—and therefore, as activities generating primary income—are economic activities relating to the production and distribution of material goods. The MPS therefore divides economic activities into two spheres: the material sphere, which comprises activities considered to be productive, and the non-material sphere. In principle, the material sphere encompasses all the goods-producing sectors and the services sectors connected with their distribution; the non-material sphere covers all the remaining services.

The basic measuring units of the economic process are the gross domestic product in the SNA and the net material product in MPS. One problem which has been a subject of concern and inspired many efforts at the international level in recent years is that of determining the similarities and the differences between the two concepts and making explicit the adjustments and information required to go from one concept to the other and to reconcile the group of categories in which these concepts are classified by production, cost composition and generation of income. A proper explanation of this would make it possible to achieve a conceptual link between the two systems and, as a practical result, establish comparable estimates between countries and regions. In Latin America, these efforts began with the Regional Seminar of Experts on Comparisons of the System of National Accounts and the System of National Economy Balances, organized by ECLA. The document analysed here was prepared for that purpose and in order to serve as a support for the seminar; its first chapter summarizes the basic features of the two systems, its second chapter discusses the main similarities and

differences between the two systems, and its third chapter presents the necessary steps, as a first practical experiment, for converting the current estimates of Cuba on supply and utilization of goods and services and composition of aggregate value, carried out according to the MPS, to the SNA system.

CEPAL-ILPES-UNICEF, Probreza, necesidades básicas y desarrollo, Santiago, Chile, 1982, 478 pages.

The per capita gross domestic product in Latin America more than doubled in the 25 years between 1950 and 1975. This undoubtedly appears as an economic success on the part of the region; nevertheless, the social picture was not encouraging. In the middle of the last decade around 120 million Latin Americans still were not able to cross the threshold out of poverty: that is to say, they could not satisfy their basic material needs. Moreover, around 55 million were living at the level of downright indigence, since even if they had devoted their entire income to food they would not have attained the level of calories and proteins necessary for their normal development.

This historical period has made it obvious that economic growth has not been a sufficient condition for overcoming extreme poverty in Latin America. However, the experience of recent decades makes it possible to state that, from an economic point of view, the resources which it would be necessary to transfer to the poor population in order to overcome their current declining situation constitute a relatively small percentage in comparison with the annual product generated in the region. Considering the region as a whole, it has been estimated that the deficit for satisfying basic needs is the equivalent of less than 6% of the disposable income of the persons whose income is over the poverty level. This means that in many countries, the obstacle to overcoming poverty does not lie in the limitation of resources but in the way in which the results of economic growth and well-being are distributed. In order to correct the structural inequalities which are reproduced in the market, corrective action on the part of the State is needed.

Of course, the current poverty situation cannot be corrected merely by transferring income from non-poverty groups to the poor. The problem is actually more complex and has structural roots of a social, political and economic nature, the changing of which involves, among other things, aggravating conflicts of internal and external interests, overcoming cultural obstacles, altering traditional behaviour in the State administration, correcting discrimination against poor groups, and risking the effects of the energy generated by awakening the hopes of those who have so far been passive subjects of historical events.

In view of the complexity of the task, the first requisite is that governments must have the political will to combat poverty. But political will is not enough: they also need the political capacity to overcome the obstacles which will be raised by those who have habitually enjoyed the benefits of economic growth.

Furthermore, in addition to political will and capacity, efficiency is required: that is to say, familiarity with means of achieving the proposed objectives, in order to avoid the wasting of resources or unnecessary conflicts with other objectives, such as that of economic growth.

The contribution of international bodies lies precisely in collaborating with the countries in order to improve current knowledge of the phenomenon of poverty and to seek the most effective forms of overcoming it. For a number of years past, various United Nations specialized agencies have been conducting research and technical assistance

programmes designed to accomplish this great common task.

This book seeks to describe some of the efforts carried on by the staff of United Nations bodies and projects and external consultants hired by them.

A considerable proportion of the studies presented have been prepared by staff of the United Nations Children's Fund (UNICEF) the Latin American Institute for Economic and Social Planning (ILPES), the Economic Commission for Latin America (ECLA), the Latin American Demographic Centre (CELADE), the United Nations Development Programme (UNDP), the Inter-agency Project on Critical Poverty in Latin America, and the Regional Employment Programme for Latin America and the Caribbean (PREALC).

PLANINDEX, Resúmenes de documentos sobre planificación, Vol. 2, No. 2, December 1981.

PLANINDEX is a twice-yearly periodical publication containing details of the documentation on planning which has been processed and entered into the CLADES data base. This data base is supplied through the joint efforts of CLADES and the Caribbean Documentation Centre (CDC) of the ECLA Port of Spain Office. For this reason, the abstracts describing the content of the documents appear either in Spanish or English, according to the information source.

In 1979 and 1980, the documentation processed was restricted exclusively to that produced by central planning offices, with the aim of creating a basic nucleus of information useful to planners and also keeping its volume manageable by the CLADES team. In this issue of PLANINDEX, however, reference is made to part of the documentation in the collections of the ECLA library, CLADES and the ECLA Documentation Centre at Port of Spain.

Since this publication is a working tool, through which a knowledge can be gained of the publications appearing on the topic of planning and the information needed by the planner may be selected on the basis of more background details, CLADES and the Caribbean Documentation Centre (CDC)² offer to make available to those interested total or partial reproductions of the documents mentioned in it, depending on their length.

As the data base is centralized at Santiago, CLADES will be able in the future to offer other services resulting from the utilization of the base, such as:

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