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… Three dots indicate that data are not available or are not separately reported.
(–) A dash indicates that the amount is nil or negligible.
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(.) A point is used to indicate decimals.
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The word "tons" means metric tons and the word "dollars" means United States dollars, unless otherwise stated. References to annual rates of growth or variation signify compound annual rates. Individual figures and percentages in tables do not necessarily add up to the corresponding totals because of rounding.

S U M M A R Y

Policies for economic
diversification

Dani Rodrik

This article begins by showing that not all developing countries concentrate their exports in products which make intensive use of natural resources or cheap labour, and that those which also export some products typical of more developed countries tend to grow faster, apparently independently of their human capital endowment or the quality of their institutions. For this purpose, an index is used which measures the degree to which each country displays this type of export mix. This is an idiosyncratic phenomenon which seems to be linked with the capacity to undertake the production and export of new products. There is therefore a place for incentive policies, accompanied by the ability of the government to recognize failed attempts and to stop subsidizing them. Because of the idiosyncratic nature of the phenomenon, it is not possible to propose universal solutions, but the author does set out ten principles to be borne in mind in policy design in each country.

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I

Introduction

Great ideas never die, and in many ways some of the key ideas spearheaded by Raúl Prebisch –one of the greatest Latin American economists who ever lived– are very much back in vogue. Prebisch thought that the economic structure really makes a difference: that what countries produce –whether they specialize in primary industries or in manufacturing– makes a real difference to their economic performance. This idea, which in some respects is a very plausible one, disappeared from the consciousness of most North American trained economists in the last couple of decades, but I think it is fair to say that now it is coming back. Indeed, the main theme of this presentation will be to elaborate on that idea –that what you produce matters– and try to draw some policy implications from that proposition.

This idea is at variance with much of the economic philosophy that guided policy makers in the 1980s and 1990s, not only in Latin America and the Caribbean but all over the world. The basic idea that motivated the economic reforms made in those decades was that policy makers only had to concern themselves with the broad framework: that is to say, that once you established macroeconomic stability and provided the basic parameters of a functioning market economy, with an appropriate regulatory structure, then essentially you could leave the market economy to take care of itself and assign resources efficiently in both a static and a dynamic sense, on the assumption that the economy would generate economic growth on its own and that such growth would be automatic once macroeconomic stability was in place and the market fundamentals were in operation.

We are now learning, however, that while many of the reforms undertaken in the 1990s –especially those in the macroeconomic, fiscal and monetary fields– were absolutely necessary, in certain respects some of the other reforms may not have been particularly well targeted on the factors that really generate economic growth. In this respect, it is important to have a better understanding of how the productive structure contributes to the growth process, what that structure is, and what that implies for policy design in both the micro and macro spheres.

II

The productive structure and

the quality of the export basket

I am now going to argue that the productive structure matters for economic growth; that the kinds of goods produced are important, and that the economic fundamentals and comparative advantages in and of themselves do not really determine the productive structure: there is a certain element of arbitrariness, a certain idiosyncratic nature, in what a country actually ends up producing, and the role of public strategies, in the best of all possible worlds, is not to predetermine what a country can or can not produce, but to ensure that it ends up producing those types of goods which are most growth-generating. In fact, when we look closely at the details of how successful industries are actually generated –how they "get off the ground"– we find that in almost all such cases public intervention has played a significant role.

The basic argument in support of the above, at the most general level, is that growth strategies are needed to complement the pursuit of macroeconomic stability with a more productive economic strategy that focuses on the needs of the real sector and does not just assume

that, once the macro framework is in place, the real sector will take care of itself and will generate the dynamism needed for sustained growth. That leads us to the question of what such a policy framework consists of: a really difficult question because, on the one hand, there has been relatively little serious research, especially by economists, on what we think an appropriate industrial policy framework for low and middle income countries might be, but also because as soon as we start thinking about such policy frameworks we immediately become aware once again of the importance of the specific context and the need that such frameworks must function well. In order for this to be so they must obey some general principles: they need to be highly specific, they must take advantage of the institutional endowment that the country already possesses –which differs from setting to setting– and they must respond to the specific constraints or obstacles that the individual countries face, which likewise differ from setting to setting. Consequently, there is not really a whole lot that one can say about the nature of these policies that is very concrete or operational; all that one can do is to set forth as fully as possible the general design principles for their formulation that need to be taken into account in constructing the policy framework, so that policy makers will at least have some guidelines for this task.

I will now refer to two aspects of these general principles, one being the need to balance the "carrots" and the "sticks", the discipline and the rewards, when designing industrial promotion strategies, and the second being the need for the public authorities, and specifically the public agencies entrusted with productive restructuring, to strike a balance between insulation and embeddedness. On the one hand, they need to be sufficiently insulated from private interests, so that they cannot be captured by them and be "in their pockets", but on the other hand they need to be sufficiently embedded within those private interests, so that they can obtain enough information about where action is needed and what form it should take.

Let me start with an example which I think is quite striking, taken from an article by Imbs and Wacziarg (2003).[1] Those authors looked at what happens with regard to the concentration of production during the process of economic development, as shown in figures 1 and 2. The vertical axis of both figures is a Gini index

that relates to either the concentration of employment (figure 1) or that of production (figure 2), across different sectors of the economy. Thus, in an economy in which production is highly concentrated in a single sector, the Gini coefficient is extremely high, whereas in a very diversified economy the Gini coefficient for production or employment would be very low. The

FIGURE 1

Gini index for employment versus income level
(Non-parametric estimated curve)[a]
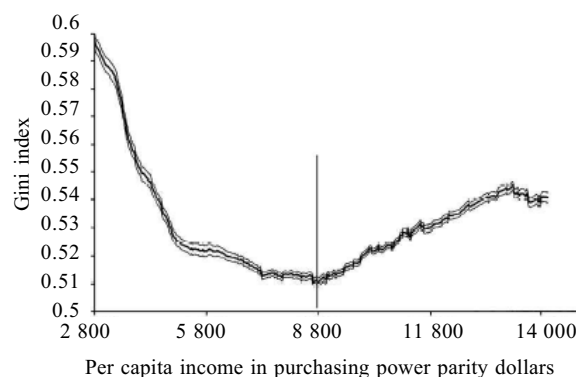
Source: J. Imbs and R. Wacziarg (2003), Stages of diversification, *American Economic Review*, Nashville, Tennessee, American Economic Association, March.

[a] United Nations Industrial Development Organization (UNIDO) 3-digit employment data.

FIGURE 2

Gini index for value added versus income level
(Non-parametric estimated curve)[a]
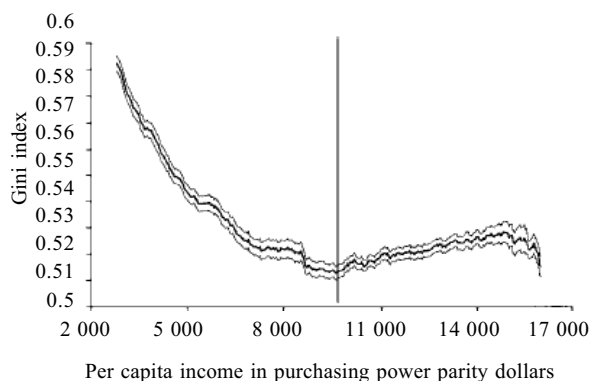
Source: J. Imbs and R. Wacziarg (2003), Stages of diversification, *American Economic Review*, Nashville, Tennessee, American Economic Association, March.

[a] United Nations Industrial Development Organization (UNIDO) 3-digit value added data.

[1] See J. Imbs and R.Wacziarg (2003), Stages of diversification, *American Economic Review*, vol. 93, No. 1, Nashville, Tennessee.

horizontal axis of both figures shows different levels of income which roughly reflect the evolution of concentration in the course of development. These two economists analyze growth across countries as well as within them over time, so the comments made below are a valid description of a dynamic and do not merely reflect a cross country regularity.

Imbs and Wacziarg found that as countries go from very low levels of income to higher levels, their production pattern becomes much more diversified, and that at sufficiently high levels of income the corresponding curve starts to turn around, which means that a process of concentration begins to take hold. If we look at the turning-point, that is to say, the level of income at which economies start to become more concentrated again, we see that this point is very high, and has not yet been reached in any country of the region. We should therefore concentrate our attention on what happens in the declining part of this curve, which indicates that as countries are becoming less poor, their production structure becomes more and more diversified, or at least if they start from being very concentrated they become less concentrated as they become richer.

From one perspective, this should not come as a surprise at all, but from another perspective, in the case of those who studied for a doctorate in economics in a North American university at any time in the last three or four decades and internalized the policy implications of what they were taught there, leaving aside everything else they might have heard, it could reasonably be assumed –without wishing to deprecate the value of that kind of education in any way– that they were told that in order for a country to get rich and free itself from poverty, it must specialize according to its comparative advantages, and that the difference between countries that were doing well and those that were doing poorly was that the former had decided to exploit their comparative advantages, that is to say, to allocate their resources where they could be best used for realizing that principle, whereas the latter set of countries had done the reverse: i.e., they had not followed the dictates of comparative advantage. Figures 1 and 2, however, show that to a first and second degree of approximation that story cannot be right as a general description of what drives development, because if it had been right, the countries that would be breaking out of the ranks of poverty would be those that were becoming more concentrated in their production structure: that is to say, the countries which were specializing, rather than those which were becoming more diversified.

The key point in this respect is that, whatever the role that trade and comparative advantage may have played in the development of those countries, the dynamic that drives growth is not fundamentally linked to any notion of static comparative advantage; on the contrary, it is a dynamic which somehow leads some countries to gradually diversify their investments into a whole range of new activities. Thus, the most prosperous countries are those where new investments are being made in new areas, while the countries that have failed are those where this has not taken place.

My own recent research –much of it jointly with Ricardo Hausmann, at the Kennedy School of Government at Harvard– takes a particular approach to this issue in order to quantify some of these relationships and to look for their implications. What we have done is to develop an indicator that measures the quality of the countries' export basket. In order to do this, we first calculated for each product traded (at a fairly disaggregated 6-digit level, so that we are really talking about thousands and thousands of different commodities) the average income level PRODY(j)[2] of the countries which have exhibited a revealed comparative advantage in that commodity. In other words, we associate with each commodity a particular income level and we take that level as the representative income level corresponding to a country which has a strong comparative advantage in that commodity. Thus, for example, jute is a very low-income commodity, while aircraft are a very high-income commodity, because the countries that have strong comparative advantages in jute tend to be lower-income countries and aircraft are a high-income commodity because the countries that export aircraft have high incomes.

Having calculated this commodity-based indicator, we aggregated across different countries by simply taking their weighted average PRODY(j), using as a weighting factor the share of each product in their export basket. We call this indicator EXPY: a quantitative indicator which is our measure of the quality of the export basket of a country, since it measures the income level associated with that basket. This is one way of quantifying what a country actually produces and the mix of products that that country has developed mastery in producing. It does this by aggregating different goods on the basis of the income levels associated with the factors giving rise to the respective comparative advantages.

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[2] PRODY(j) = average income level of countries with a comparative advantage for the production of a good *j* (6-digit Harmonized System).

It is not surprising, then, that (as shown in figure 3) a scatter plot of this EXPY measure against the income levels of different countries reveals a high correlation. This correlation is very high almost by definition, confirming that the rich countries are those that export typical rich countries' goods. What interests me most, however, is not the overall correlation, but the deviations from the regression line: why is it that some countries are significantly above the regression line and some countries are below it, and can this have actual implications for economic performance?

There are about a hundred or so countries in this scatter plot, but we will focus on India and China, because they diverge from the mean. It is very interesting that two countries which have been doing extremely well in recent decades have much higher levels of EXPY than would be expected on the basis of their income level and are thus much further above the regression line than other countries.

China, which is particularly far above that line, is currently exporting a set of commodities –most of them based on electronics, consumer electronics and so forth–

which are associated with the income levels of countries with much higher incomes than China; in fact, the income level associated with that country's export basket is six times higher than China's aggregate income level.

Let us now look at the same situation from a somewhat different angle: over time. Figure 4 shows, for a number of Asian and Latin American countries, how this index which measures the quality of export baskets has changed over time and how these different countries rank against each other. There are four Latin American countries in the figure: Argentina, Brazil, Chile and Mexico. It is interesting to note that the first three of those countries, (Argentina, Brazil and Chile) have the lowest EXPY levels in this comparison, i.e., the lowest income content of exports, whereas China's level is close to that of the Asian group and Mexico, and its gap with the latter country has closed significantly over time. This is surprising, because China is still much poorer, compared to these Latin American countries, yet it is exporting a set of goods that are much more sophisticated than those exported

FIGURE 3

Selected countries: Scatter plot of income content of exports (EXPY) versus per capita GDP, 2003
(Non-parametric estimate)

Source: Prepared by the author.

FIGURE 4

Latin America and East Asia: Income content of exports (EXPY)
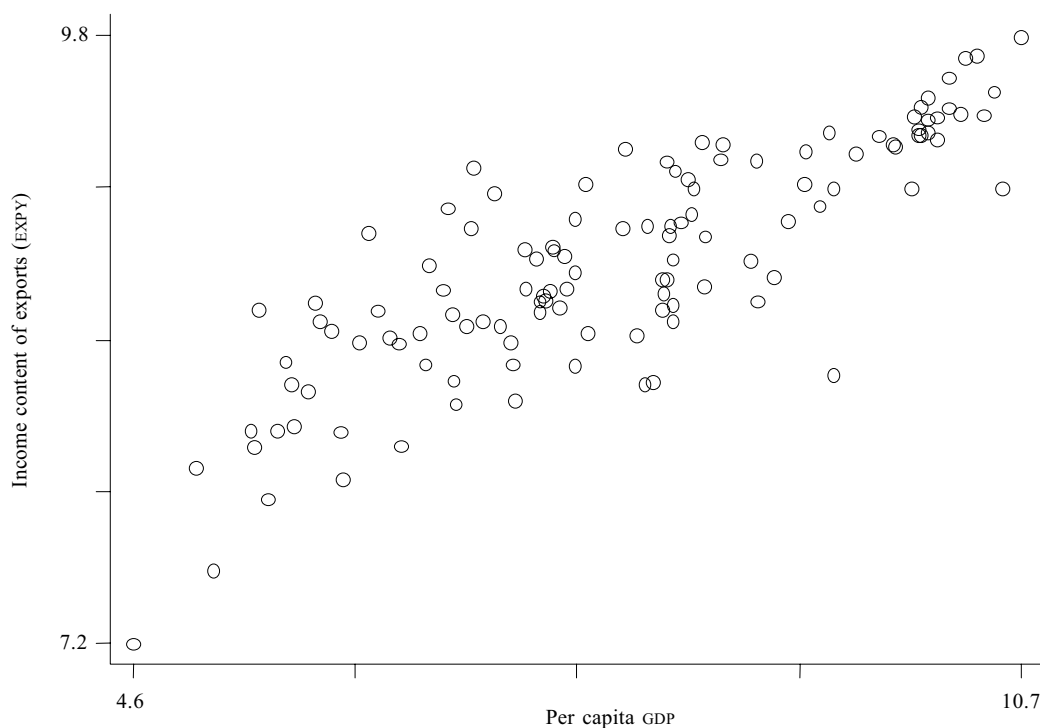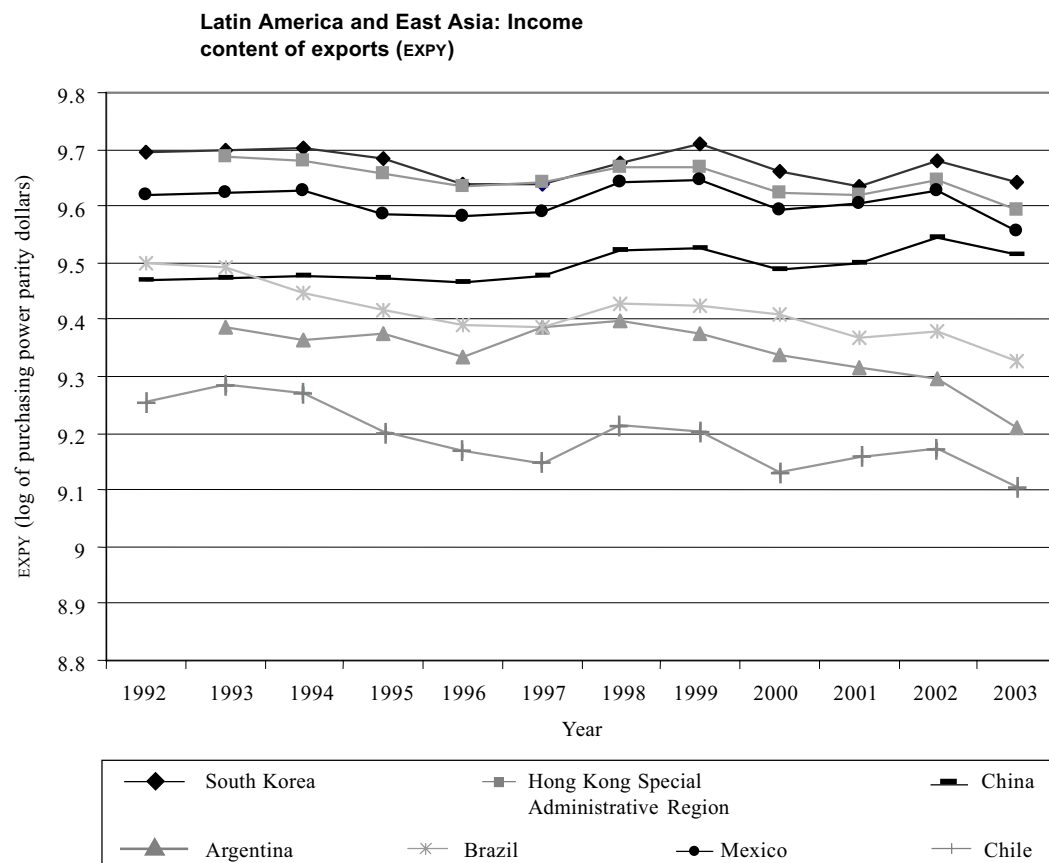
Source: Prepared by the author.

by them. This is partly because of the relatively greater natural resource endowments of the Latin American countries, but I think this is only part of the picture.

If you were to show this to your average neoclassical economist steeped in the tradition of comparative advantage, he or she would say that all that this shows is that countries like China, or South Korea, or Taiwan, or Singapore, which have developed highly sophisticated export baskets, have simply wasted resources by allocating them in areas where they do not have one of the authentic comparative advantages –that of possessing skills which have already been developed– so that in reality these export baskets have been purchased at too high a cost. Therefore, it is important to look at the implications of whether this really matters: whether this particular cross-section of export structure and production structure shows up in the figures as an important predictor of something that we care about. The answer to this question is very much "yes".

Our concentration on this particular measure of export baskets is justified because it turns out that this measure is a quantitatively significant and robust predictor of subsequent economic growth, since countries that latch on somehow to these higher-quality export baskets subsequently register much higher levels of growth than countries that do not. The partial scatter plot in figure 5 shows the growth rate of per capita GDP over a ten-year period, compared with the initial value (in 1992) of the EXPY indicator for different countries, controlling for other factors that are normally included in a growth regression. Essentially, what it shows (after controlling for the initial levels of income and human capital in different countries) is that countries which have managed to generate export baskets that are associated with higher income levels have converged much more rapidly. In other words, if you latch on to these higher-productivity goods, these productivity levels spread to the rest of the economy. That is the dynamic that really drives the process of economic

FIGURE 5

Selected countries: Per capita GDP growth, 1992-2003

(As a function of 1992 level of EXPY[a])
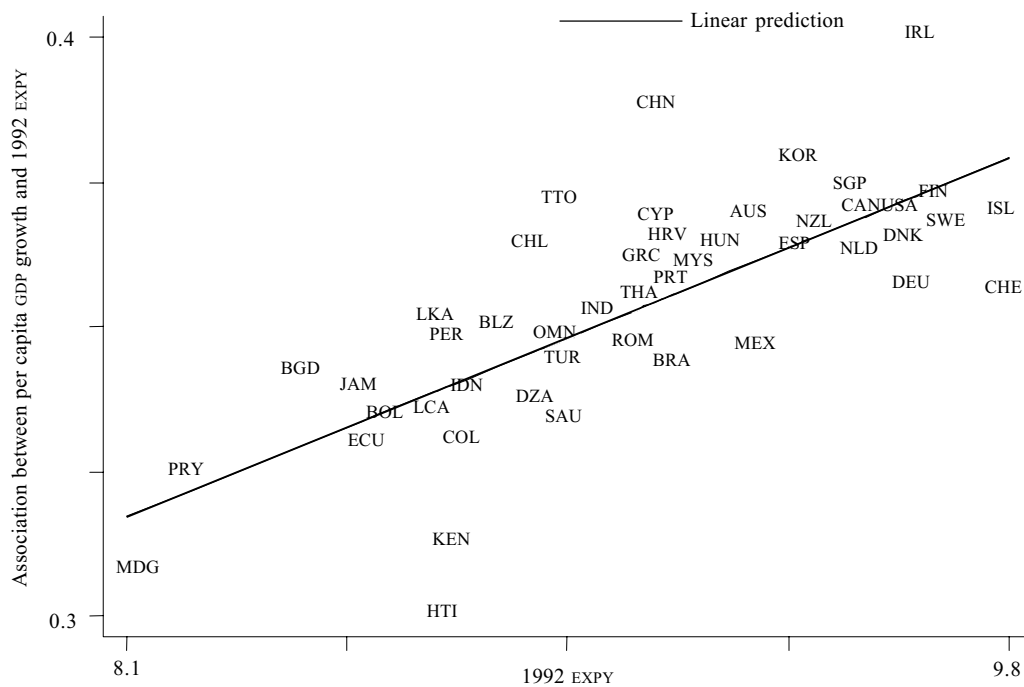
Source: Prepared by the author.

[a] Controlling for initial income and human capital.

growth; this is what explains why a country like China, by producing goods like mobile telephones, refrigerators and television sets, is able to generate much higher productivity gains and spread them to the rest of the economy than it would have been able to do if China had simply produced garments, shoes and toys. This explains the significant normative interest of this particular measure of what a country produces and exports.

Furthermore, when it is sought to explain why certain countries have much higher-quality export baskets than others, most of the factors that are usually considered do not have a lot of explanatory power. As figures 6 and 7 show, neither human capital endowment nor some measure of overall institutional quality help very much to explain why different countries have different levels of EXPY, after controlling for per capita GDP. As we already showed, there is a relationship between EXPY and per capita GDP, but that basically

summarizes practically everything that we know, since we do not get much greater explanatory power by including other measures of factor endowment or institutional quality.

It is not possible to explain why China and India have so much more sophisticated export baskets, either on the basis of their relatively high endowments of human capital, or some factor such as a better institutional environment, which may have promoted specialization in the production of more sophisticated goods through some indirect comparative advantage channel. Thus, there are many idiosyncratic elements and, I would argue, a good deal of room for suitable policies to make a difference in the creation of the basket of goods produced, which can help the country in question to grow. What a country produces and exports –the products it becomes good at exporting– depends on a lot more than the economic fundamentals.

FIGURE 6

Selected countries: Association between EXPY and human capital

Source: Prepared by the author.

FIGURE 7

Selected countries: Association between EXPY and institutional quality
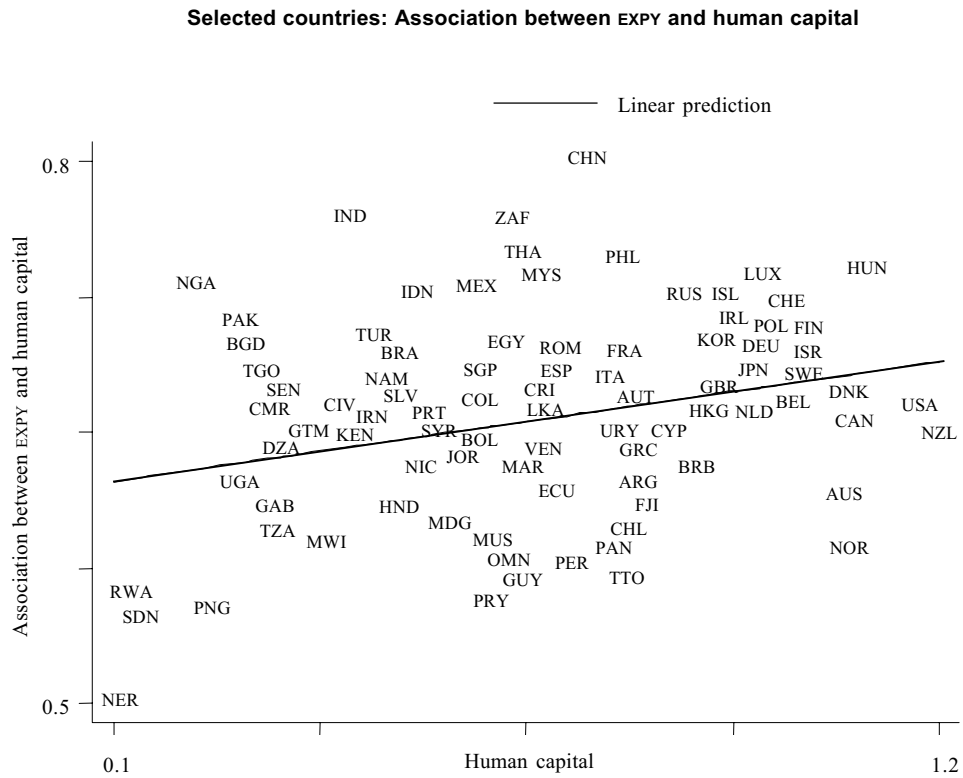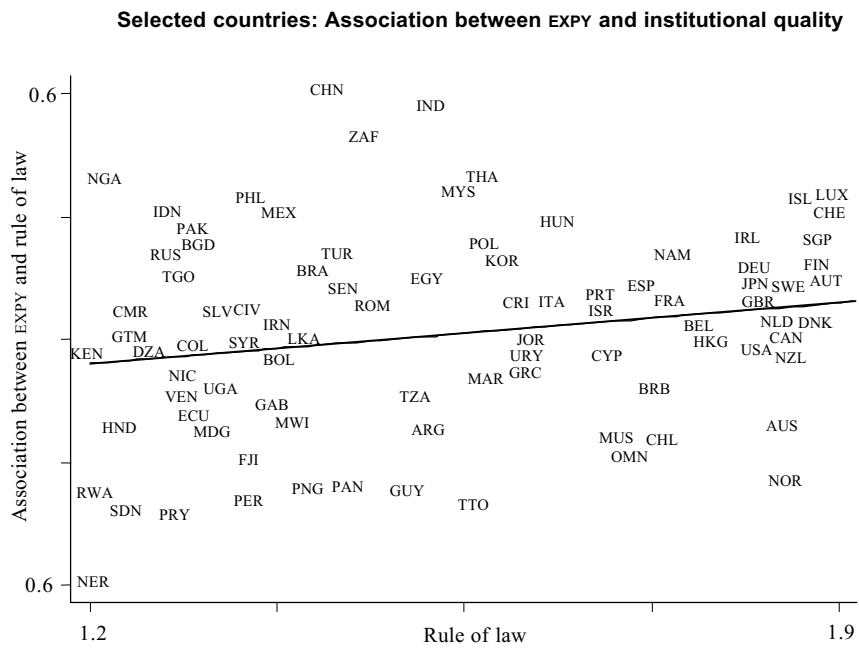
Source: Prepared by the author.

III

Patterns of specialization and
the cost discovery process

The idiosyncratic and (within certain limits) somewhat arbitrary nature of the pattern of specialization can be analyzed from a number of different standpoints. If we analyze at the detailed level what the different countries are specializing in, we see the arbitrariness of this pattern. Bangladesh and Pakistan, for example, are two countries that look virtually identical in terms of their overall endowments of factors that support comparative advantages. One would not expect these two countries to exhibit different patterns of specialization, and at a broad level that is obviously true: neither country is exporting aircraft or semiconductors. On the other hand, when we look in greater detail at the areas in which they are actually specializing, we see big differences: Pakistan specializes in the production of soccer balls, which it manufactures in large numbers, while Bangladesh does none of this, but on the other hand some of the things that Bangladesh exports are hardly found at all in Pakistan. And if one runs up or down the income chain comparing what pairs of countries export, one finds lots of puzzling situations: for example, comparing South Korea and Taiwan, why is it that South Korea is one of the world's biggest –if not the biggest– producers of microwave ovens, while Taiwan virtually does not export such ovens, and likewise, Taiwan supplies most of the world market for bicycles, except for some of the most sophisticated models, while South Korea exports virtually no bicycles.

These are the kind of idiosyncratic elements underlying the fact that some countries develop a mastery that cannot simply be explained through comparative advantages or economic fundamentals: in these cases, one needs to understand how these things happen, particularly when, as I have been arguing, they affect subsequent development. The theoretical explanation for this indeterminacy, which leaves room for these idiosyncratic patterns of specialization or arbitrary forms of specialization to occur, is the idea that, for certain economically well-grounded reasons, freely functioning markets generally fail to supply sufficient investments in new, non-traditional activities. There are many reasons for this, but the two that I would like to emphasize in particular are coordination externalities and information externalities.

Coordination externalities refer to the idea that, in order for any new activity to be profitable, it needs to be accompanied at the same time by substantial investments elsewhere in the horizontal or vertical production chain. Thus, if you are thinking of investing in pineapples in a country which has not previously had significant skills in pineapple production and export, you may also need to make sure that a pineapple packaging plant is going to be constructed. On the other hand, if you are thinking of investing in a pineapple packaging plant, you will want to make sure that a reliable supply of domestic pineapples will be grown, because without these two investments being undertaken simultaneously, neither one of them can be profitable; without some coordination of investments across these different activities you may well end up without a pineapple industry, whereas this could very well have been developed if such coordination had taken place.

There are many different types of information externalities, but the one that I am most concerned with here is the externality that attaches to what I call the "cost discovery process". One of the most important things that entrepreneurs do in a developing country is to discover the underlying cost structure of the economy: that is, how much will it actually cost to produce, say, pineapples in the local economy, once the necessary modifications in off-the-shelf technology have been made, and can they be produced profitably or not. Entrepreneurship is of course always full of uncertainties like this, but in low- and middle-income countries there is an important externality associated with the process that operates along the following lines: if you are the first entrepreneur to invest in pineapples and discover their production cost, and if it finally turns out that you have made a mistake and that you are not in an economy where you can produce pineapples profitably, your losses are entirely private, and you must bear them all yourself, but if instead you have discovered that you can in fact produce pineapples in that country very cheaply and profitably, there is then likely to be a process of entry and diffusion and imitation by other entrepreneurs: this means that you cannot retain or appropriate the full benefits of that

discovery, so the gains end up being socialized, whereas the losses are private. This is the fundamental asymmetry of any cost discovery process, and this is why cost discovery is generally under-financed in economies with a low level of diversification, so that investments in new non-traditional activities are generally under-financed too.

This means that in these kinds of settings there is a lot of indeterminacy, depending on idiosyncratic factors of luck, the quality of entrepreneurship, what the government does, what it does not do, who you are

neighbours with and who you are not, which foreign investor enters the country and which does not, and so forth. Sometimes efforts are made to fill in some of the gaps in this wide range of products which could potentially be produced but apparently are not, but in other cases big holes are left where this is not being done. The question is what public policy can do in these kinds of settings: can it play a successful role in making sure that when such investments in new activities are under-financed, the level of investment can be systematically raised through government action?

IV

The contribution of industrial policies

Policy can and often does play such a role. Let us look at a couple of examples of how policy does this in practice. Real exchange rate policy can play a very important role in this respect. The real exchange rate is the most potent form of industrial policy imaginable, because an undervalued real exchange rate is an across-the-board subsidy for industries producing internationally tradable goods: an area of activity where exchange rate-related problems are particularly severe and the benefits of discovering new tradable activities are all that much greater because you have the whole world to supply before returns and profits begin to diminish. The scatter plot in figure 8 shows the relationship between a measure of real exchange rate overvaluation during the 1994-2003 period and the quality of the export basket, as indicated by the level of EXPY at the end of the period, controlling for its initial level. The question here is: regardless of the export baskets inherited in 1994, did the levels of the real exchange rate registered after that date make any difference to the quality of those export basket some ten or twelve years later, and the answer is that they did. Once again, India and China are outstanding cases in this figure. In general, countries that are near the origin in figure 8 are countries that had relatively undervalued real exchange rates, while the countries that are far away from the origin are countries that had relatively overvalued exchange rates over this period, and indeed one of the things that stands out in China's performance is that it has been underpinned by a very competitive real exchange rate.

In the context of the theory that I have just briefly described, a competitive real exchange rate, by

increasing the relative profitability of real tradable activities (all other factors being equal), increases the number of investments in tradable sectors that become profitable and therefore probabilistically increases the number of profitable industries that get off the ground and eventually become successful. There therefore really is a relationship between the level of the real exchange rate and the quality of exports, although one might expect quite the opposite: that a highly depreciated real exchange rate is a way of lowering labour costs, thus making the country in question more competitive at the lower end of the product spectrum and leading to specialization in labour-intensive products. It turns out in practice, however, that a highly depreciated exchange rate tends to cause countries to rise in the product spectrum in the long run rather than pushing them down. I cannot emphasize this point about the exchange rate too strongly, because this is an area where we have a highly valid alternative role for the exchange rate, contrasting with the consensus that prevailed in Latin America until recently with only a few exceptions (the main one, of course, being the policies pursued by Argentina in this respect).

The argument behind this consensus was that basically the exchange rate should not be a policy variable and that Central Banks and governments should not set either a nominal or a real exchange rate target, since that rate was an equilibrium variable that should be left in complete freedom, except for perhaps just smoothing out short-term fluctuations. From the standpoint of productive diversification, this strikes me as an unsatisfactory stand because it flies in the face of the evidence that we have, which is that competitive

FIGURE 8

Selected countries: Association between overvaluation of the real exchange rate during 1994-2003 and level of EXPY in 2003[a]
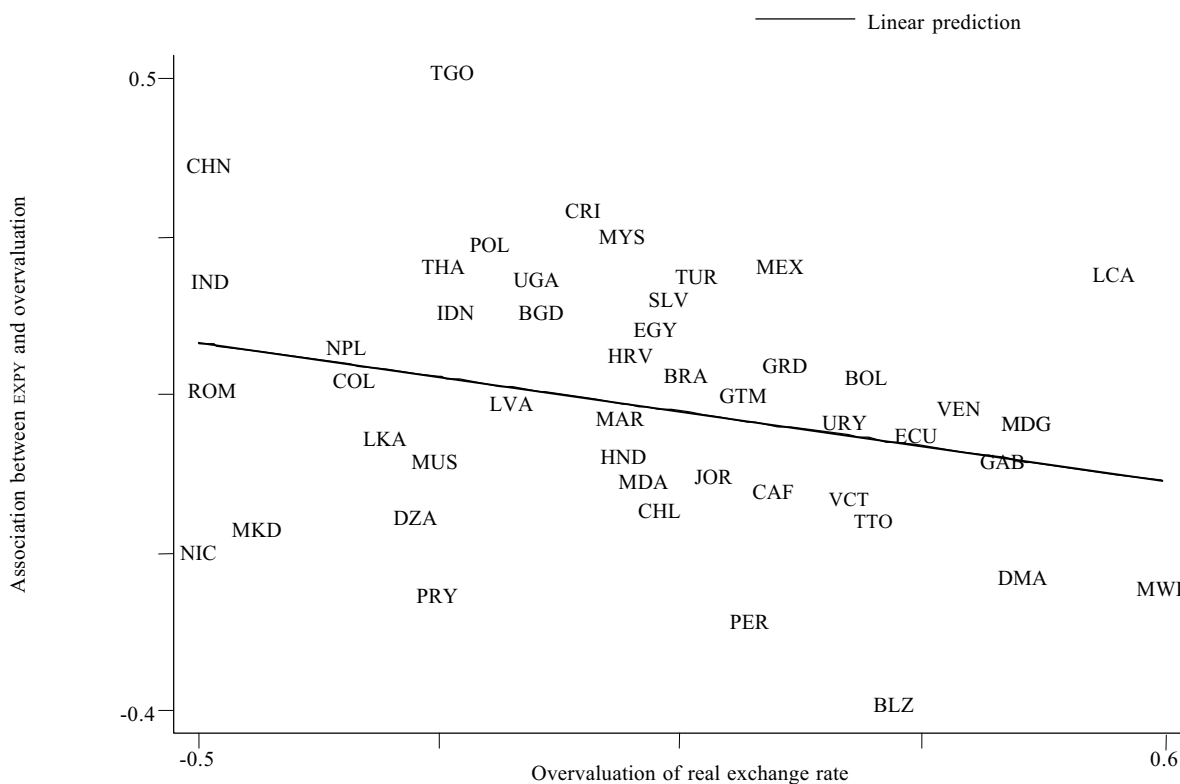
Source: Prepared by the author.

[a] Controlling for initial level of income and human capital.

real exchange rates have been a necessary if not sufficient condition for sustained economic growth in developing countries and that by leaving out the exchange rate as a policy variable, removing it from the range of policies open to governments, we are thereby obliging them to apply industrial policy in a more makeshift way, since if the real exchange rate does not assist the tradable sectors, then this increases the pressure to adopt makeshift policies of the type that I will be considering below.

Policy also matters because when we look at the non-traditional export industries which have been most successful in Latin America (leaving out natural resource-based industries and traditional export industries like garments), we find time after time that some of the most successful cases have been due to the application of various types of industrial policy, State intervention, public-private cooperation, and preferential policies on the part of some other countries.

In Chile, which is a country that is often held up, by those who do not know it well, as a sort of a free-market miracle, some of the key non-traditional, non-copper exports were the result of intelligent public strategies of very varied kinds, ranging from salmon, which benefitted from the research and development and technological assistance efforts of Fundación Chile, to forestry, which was promoted by a few subsidies in the Pinochet era: for all the market-based fundamentalism of that regime, there was one area where explicit industrial policies were applied, and that was the forestry sector.

In the case of Mexico, we should not forget the role of the preferential tariff policies applied under the North American Free Trade Agreement (NAFTA). These are simply industrial policies under a different guise, because they are really just another way of making the playing field uneven: compared with export subsidies, for example, they have the advantage that somebody

else ends up paying the price rather than the exporting country, but in many respects they work in a similar way. Thus, none of the cases listed in Box 1 are the result of markets just working on their own, "level playing fields" and the like.

A final example of how policy matters is provided by China. That country has relied extensively on direct investment, but of course it has done so in a very strategic way, and transnational corporations wishing to enter and operate in China have been required to team up with domestic firms, as shown in table 1. It is now recognized that part of the success of foreign direct investments in China is due precisely to the fact that they have been a collaborative exercise between domestic (mostly State-owned) and foreign firms. This view of corporate ownership structure is interesting because the industries are not dominated by foreign firms but are joint ventures, and an important point to note in this respect is that these firms, by being able to transfer technology and enjoying the benefits of State protection, were able to generate capabilities in the

hands of domestic investors, which would not have occurred otherwise. In this sense, China is very different from a typical Latin American country: in Latin America, there would not be this pattern of a preponderance of joint ventures, and instead wholly-owned foreign firms would be much more prevalent.

It can therefore be said that Chinese preferences, strategies and policies undoubtedly made a difference as to the kind of industries that the country would specialize in, and some of these firms eventually became extremely successful: the IBM/Great Wall joint venture shown in table 1 recently bought IBM's personal computer business, and is now one of the world's largest PC manufacturers. I hope I have put forward a reasonably interesting and convincing argument about two things so far: i) that what a country produces matters, and that the production structure should therefore be a major policy concern, and ii) that there are many ways in which policies can influence the production structure, and they can therefore play an important role in determining the pattern of specialization.

Box 1

LATIN AMERICAN NON-TRADITIONAL EXPORT SUCCESS STORIES

Brazil: steel, aircraft, and (to an important extent) shoe production are all due to import substitution industrialization, receive subsidized credit, and in the case of aircraft production, are State-owned.
Chile: salmon production was due to the efforts of Fundación Chile; the grape industry was the result of public research and development activities in the 1960s, and forestry received subsidies in the past.
Mexico: motor vehicle production was initially due to import substitution industrialization policies and later benefited from preferential tariff policies under the North American Free Trade Agreement (NAFTA).

Top five export items to the United States in 2000[a]

Country	Item	Value (millions of dollars)
Brazil	Aircraft	1 435
	Footwear	1 069
	Non-crude petroleum	689
	Steel	485
	Chemical wood pulp	465
Chile	Copper	457
	Grapes	396
	Fish	377
	Lumber	144
	Wood	142
Mexico	Motor vehicles	15 771
	Crude oil	11 977
	Computers and peripherals	6 411
	Ignition wiring sets	5 576
	Trucks	4 853

[a] Using the 4-digit Harmonized System.

TABLE 1

China: Major consumer electronics firms, by ownership type

Market segment	Foreign-owned	Joint venture	Non-FDI[a]
Mobile phones	– Motorola	– Motorola/Eastcom – Nokia/Capitel, Southern – Siemens/Mil subsidiaries – Samsung/Kejian – SAGEM/Bird	– TLC
Personal computers	– HP – Dell	– IBM/Great Wall – Toshiba/Toshiba Computer (Shanghai) – Epson/Start – Taiwan GVC/TCL	– Lenovo (previously Legend) – Founder – Tongfang
"Brown" goods		– Sony/SVA – Philips/Suzhou CTV – Toshiba/Dalian Daxian – Great Wall Electronics/TCL	– Changhong – Konka – Hisense – Skyworth – Haier – Panda – Xoceco

"White" goods	– Siemens	– Samsung/Suzhou
		  Xiangxuehai
		– Electrolux/Changsha
		  Zhongyi
		– LG/Chunlan
		– Mitsubishi/Haier
		– Sanyo/Kelon, Rongshida
		– Sigma/Meiling
		– Hong Leong (SG)/Xinfei
		– Toshiba Carrier/Midea
			– Changling
			– Gree

Source: Prepared by the author.

[a] FDI = Foreign Direct Investment.

V

Policy formulation

The foregoing has important implications for policy formulation, and here again we encounter the difficulty of how little we know in this respect. Any kind of appropriate policy in this area will have to be devised within the country in question by people who know its institutional endowments well, for there is no such thing as a manual of industrial policy, or a set of do's and don'ts to be applied across the board. What we can do is to try to formulate a set of general principles that we think all good policy frameworks should obey, leaving the details of the design to the individual countries and their policy makers. This area is no different from any of the other areas that we have been concerned with, so if the objectives pursued are fiscal sustainability and inflation control, their importance will warrant their being incorporated as general principles of good policy, but the manner in which they are to be achieved will obviously depend to a large extent on what is feasible in each case; the actual instruments and the operational agenda required by those objectives will have to be designed in detail at home.

The same can be said with regard to the provision of an appropriate institutional environment for the protection of property rights. Recognition of the importance of property rights may be a desideratum of economic policy, but when it comes to determining how to protect those desired rights in practice, this cannot be done in general, all-embracing terms. Some countries, such as China or Vietnam, may find it easier and more effective to provide effective property rights for investors through highly heterodox arrangements, while others may find that it is easier just to import Western codes and legislation and blueprints off the shelf. This is really a general issue, and industrial policy and productive policies in general are no exception as regards the impossibility of establishing a very specific concrete agenda. So what can we say as regards general guidelines?

I should like to emphasize a couple of points in this respect. One is that these arrangements need to have both discipline and rewards built into them: you need to have both a carrot and a stick. You need a carrot because, as I have already argued, when entrepreneurs find that there are no extra profits or rents to be obtained from engaging in cost discovery, they will be reluctant to invest in it, and that is not what we want. There will therefore need to be carrots: rewards for entrepreneurs who make this kind of new investment, even though we know the risks of bottling up resources in activities that may potentially end up being unproductive and may also create potential for rent-seeking. So in general terms these arrangements need to combine the carrot and the stick, that is to say, they should encourage investments in non-traditional areas, while weeding out the investments that fail. Taking this standpoint, we may evaluate the industrial policy frameworks of different kinds of countries. East Asia, for example, is famous for having combined both the carrot and the stick: investors in South Korea, Taiwan and Singapore were showered with different kinds of incentives –export subsidies, tax incentives, credit subsidies and so forth– but there were also very clear performance standards, often but not always based on export performance, and when these standards were not fulfilled, these governments were quick to punish the firms or withdraw their incentives, so it is now generally recognized that a large part of the success of East Asian industrial policies was due to the fact that they combined the carrot and the stick: they did not only offer incentives.

The import substituting industrialization (ISI) phase in Latin America, in contrast, was a case of mostly carrot and no –or very few– sticks, because under ISI firms were basically protected with higher levels of import barriers and were subsidized through negative interest rates and so forth, but there was very little in the system to ensure that the firms that ended up not performing as expected and became failures would have their subsidies withdrawn, so that those resources could be released for more productive activities. What happened, I think, under ISI was that, while that system produced a number of world-class industries in Latin America, it also produced a very wide range of inefficient sectors and activities that were allowed to keep on operating for far too long because it provided incentives but no punishment for unsatisfactory performance.

In the 1990s in Latin America, there was a 180 degree turnaround in the incentives structure: firms and entrepreneurs now faced all the discipline in the world, because they had to operate in markets with no protection, open to international competition, and there were no incentives because it was impossible to seek help from governments, since they were no longer able to provide it. In that decade, Latin American firms were in an environment with as much stick and as much discipline as one could imagine, but too little carrot: hardly any incentives.

What I think has happened in these circumstances is that the firms which have done well have done very, very well indeed, as reflected in the high productivity rates of those industries that have survived, but clearly there has not been enough investment in new activities, so that those extraordinarily high productivity levels had not spread to the rest of the economy: a huge gap has developed between the aggregate productivity level of the economy and the level of the firms which have been successful. In Latin America, there was no process like that observed in Asia, as registered in the "gang of four" countries in the 1960s, 1970s and 1980s and, more recently, in China, where basically the whole economy has moved forward, and not just some parts of the firms or sectors.

The second general principle I should like to mention is the need to combine a bureaucratic structure with a certain amount of embeddedness. Traditionally, economists think of regulation as a top down process, in which there is a bureaucratic regulatory agency which, whenever there is uncertainty in the system, issues a set of rules, expects the private sector to live according to those rules, but then keeps that sector at arms length. Thus, there is only an arms length relationship between the regulatory body or the bureaucrats and the private sector they regulate. I think this is a mistaken view of

how productivity policies should be formulated: mistaken because, whatever the agency that is entrusted with formulating such policies, it needs information, and this information exists first and foremost in the private sector. It is the private sector, the firms and investors who know where the obstacles are: whether they lie in the market, in market externalities or, as often happens, in problems caused by government regulations and red tape. It is not the bureaucracy but the private sector that knows where the problems are and how they should be solved, and there therefore needs to be a mechanism whereby the public sector, the agencies and the bureaucracy in general can obtain this information from the private

sector. If this is not done – if there is a simple top down, arms length regulatory model, the policies imposed may be ineffective or even harmful. The right model, I think, lies in between these two extremes, and its objective should be to create a form of strategic collaboration and coordination between the public and the private sectors, with the aim of identifying the most serious obstacles to productive restructuring. So, just as economic development and productive change are processes of self-discovery, the kind of arrangement I have in mind is a process of discovery as well, both of the opportunities that exist for creative, collaborative action and of the most suitable types of instruments for achieving this objective.

VI

Some final reflections

With regard to the general design principles for industrial policies that I have briefly discussed above, there are some general conclusions that I would like to highlight.

One of these is that, when thinking about industrial policies, what is important is to concentrate on the process of their generation, rather than on their outcome. There is a tendency to become obsessed with the instruments that are to be used: are they going to be tax credits?, credit subsidies?, export subsidies?, export processing zones?, and so on. This is equivalent to overlooking the question of what the policy formulation process is or ought to be: a process of discovering precisely what problems are to be solved, in the first place, before focusing on exactly what type of instruments are to be used to solve them. Getting the institutional setting and the process right are the key considerations in this respect, and I think in general that applying a first-best policy in the wrong institutional setting is likely to do more harm than using a second-best policy in the right setting, for in the latter case, at least you are going after the right target, even if your instrument is a second-best one.

Another conclusion is that one should not be overly concerned about identifying the sectors in which to act. Once again, the process is what matters: these sectors should not be selected on the basis of some preconceived idea of what they are, but should ideally emerge naturally from this kind of collaborative

process, and I think eliciting information on the private sector's willingness to invest in the different areas, subject to removal of the obstacles in question, is an essential part of the process of considering sectoral priorities. Finally, an important implication emerging from all this is that the key to applying successful industrial policies is not the ability to "pick winners" but the ability to discard losers. The usual argument against industrial policy is that governments are incapable of picking winners, and that is absolutely right, but I think that it is the wrong way of looking at what it is that we are trying to do. If the process of productive change outlined above is correct, then it is a process of experimentation, where there is a lot of uncertainty about which investments will work and which will fail. This uncertainty prevails not only in the public sector, but also in the private sector, so it is inevitable that, even with optimal policy configurations, some of the investments promoted will end up being failures. Indeed, if none of them end up in this way, this would be a sure sign that not enough is being done, because the logic is that if you have a portfolio of projects, some of them are going to be successes, but some will be failures. If it turns out that all the projects which received investments are successful, this means that not enough has been invested, since the return has been much higher than could reasonably be expected.

So it is not a case of not making any mistakes at all. The distinction between policy regimes that are

going to work and those that will not, is that some policy regimes are self-correcting and incorporate a mechanism for recognizing mistakes and gradually withdrawing support from them. That is, by and large, what happened in the most successful cases of industrial policies in Asia and, in a lot of cases, it is also what has been happening in China. So the key institutional capacity, the key institutional design feature that needs to be incorporated in any such policies is a true automatic sunset clause which operates by making the incentives or promotion regimes temporary, by building in periodic reviews, by ensuring that there is accountability, by ensuring that the reviews are transparent and open for all to see, and, in short, by providing mechanisms whereby, when ventures are failing, there are automatic processes that cause support to be withdrawn. Using this kind of approach is obviously much less demanding than assuming omniscience, as happens when it is assumed that industrial policies should not be formulated unless one can pick winners, for only if one were omniscient could it be assumed that one would never make a mistake and would always pick winners. The incorporation of an automatic sunset clause in industrial policy considerably reduces such unrealistic demands: it just requires the capacity to recognize a mistake.

For reasons already explained earlier, it is impossible (and undesirable) to specify *ex ante* the policy results that the type of architecture discussed above will yield. Everything depends on the opportunities and constraints that will be identified through the collaborative process. Nonetheless, it is possible to list (see box 2) some general "design principles" that can help in the formulation of industrial policies.

A consensus currently seems to be emerging regarding the broad lines of what an appropriate growth strategy for developing countries should be like. In this emergent consensus, a key role is assigned to macroeconomic stability, and while I have not said much about this, except in relation to exchange rate policy, I would certainly agree that macroeconomic stability is a necessary although often not sufficient condition for growth.

Another key element in this emergent consensus, besides macroeconomic stability, is the importance of high-quality institutions, especially in the case of the regulatory framework. While this is perfectly true, I think there is currently too much emphasis on institutions as an economic development strategy: in a sense, the market fundamentalism of a few years back is now being replaced by institution-based fundamentalism. While I am absolutely convinced that high-quality institutions are a *sine qua non* for long-term economic development, their effects are not so evident when most of the action is in the short term: it takes a long time to build institutions, and there is evidence that you can get a lot of growth with the institutions that you have, if you are creative and imaginative. Although the evidence we have is that you do not need a very ambitious programme of institutional reform in order to get growth going, however, you will nevertheless eventually need high-quality institutions in order to catch up with more advanced countries. If China continues to grow at its present rate, it will have to make an inordinate number of institutional reforms, even though it must be admitted that so far it has achieved outstanding growth with very little institutional reform. I would suggest that, instead of a very ambitious agenda of institutional reform at the

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Box 2

TEN DESIGN PRINCIPLES FOR ECONOMIC DIVERSIFICATION POLICIES

1. Provide incentives and subsidies only for "new" activities.
2. Establish clear benchmarks and criteria for success and failure of subsidized projects.
3. Build in automatic sunset clause for subsidies.
4. Target economic activities (technology transfer or adoption, training, and so on), not industrial sectors.
5. Subsidize only activities that have clear potential to provide spillovers and demonstration effects.
6. Vest the authority for carrying out industrial policies in agencies with demonstrated competence.
7. Make sure agencies are monitored closely by a "principal" who has a clear stake in the outcomes and has political authority at the highest level.
8. Make sure implementing agencies maintain channels of communication with the private sector.
9. Understand that even under "optimal" industrial policies "picking losers" will sometimes occur.
10. Endow promotion activities with the capacity to renew themselves, so that the cycle of discovery can become an ongoing one.

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outset, which eats up political capital, it would be better to spend that capital on an explicit growth strategy in the short term, focused on promoting restructuring and investment in new industrial activities. This is useful and perhaps even necessary during the early stages, when it is important to get the economy going, to endow the private sector with dynamism, and this calls for an explicitly production-oriented strategy.

In conclusion, I would say that, rather than necessarily having a specific policy of the kind that I have been talking about, what is really important is to have a production-oriented mentality. There is an enormous difference between a government that has such a mentality and one that basically believes that macroeconomic stability and the market fundamentals are enough to get an economy going: between a government that actually listens to businessmen, when they come and complain about something, and one that assumes that any businessman who comes and asks for something is a crook. There is a difference between a government that views the exchange rate as something that can really make a difference for productive development, as opposed to one that sees the exchange rate as a mere equilibrium variable best determined in the financial market, and finally there is a world of difference between a government that is actively thinking about how it can foster productive collaboration with the private sector in order to identify or at least help to identify new investments and areas of investment and ways in which it can organize itself to provide the best kind of support, and a government that basically considers that productive restructuring is a process that will take care of itself and that it is not the government's job to get involved in it.

Towards an efficient innovation policy
in Latin America

William F. Maloney and Guillermo Perry

Innovation has emerged as a central theme on the growth agenda of Latin America. This paper examines four issues. First, how can we know if Latin America really has an "innovation problem" that is behind its weak total factor productivity performance? Second, what do we mean by innovation and what are dimensions of it in which the region exhibits weaknesses? Third, what does recent experience and literature suggest for principles and broad policy measures to foment innovation? Fourth, are there any linkages between these weaknesses and equity? Since even in the Organisation for Economic Cooperation and Development (OECD) there is little consensus on the specific policies that governments should implement, and even less on their suitability to developing countries, this paper attempts to organize thinking around some basic principles and offer suggestive experience rather than specific policy advice.

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I

Introduction

Several issues have led policy makers in Latin America and the Caribbean (LAC) to place "innovation" on the policy agenda. First, the region's growth performance has been modest despite two decades of extensive structural reforms. Since roughly half of cross-country differences in income and growth is attributed to total factor productivity (TFP), the poor TFP growth of Latin America and the Caribbean in the last three decades is a major cause for concern. While in many respects a measure of our ignorance, TFP is often equated to what can be loosely called "technological progress" and, more broadly, to "innovation" (including both technical, institutional, organizational and managerial change and the development of new activities, products and services, both at the firm and the aggregate economy level). Second, much of the discussion on competitiveness is really about productivity, and hence has much to do with the issue of innovation.

Finally, the region's persistent pattern of resource-based exports raises the questions of where other product lines may come from –consider, for example, forestry giant Nokia's evolution into cell phones in the case of Finland– and whether we can achieve better results with what we have. On the latter point, one of the World Bank's flagship publications, *From Natural Resources to the Knowledge Economy*,[1] argued that recent research and the experience of numerous now developed, but resource-based economies suggest that Prebisch was perhaps too pessimistic: resources are neither a curse, nor a destiny that we are bound to follow. In the document in question, our main conclusion was that the region was not getting as much

growth out of its resources as it could, due in part to the now familiar inefficiencies of import substitution industrialization, which penalized those sectors, but perhaps more fundamentally to a lack of national learning and innovative capacity. Latin America's willingness to depend passively on technological transfer from abroad, and its insufficient investments in skills and R&D may, in the end, have been a dimension of dependency far more damaging than others which have received more attention in the literature.

Hence, as in the OECD, increasingly Latin American and Caribbean policy makers have come to identify trade barriers and lack of incentives for innovation as the main obstacles to further growth and development. In pursuit of the aim of "turning the EU into the most competitive knowledge-based economy in the world" the March 2002 meeting of the European Council in Barcelona announced a goal of increasing average R&D expenditure from 1.9% of GDP to 3% by 2010 so as to close the gap with the United States (2.7%) and Japan (3.0%) (OECD, 2004). Latin America's 0.4% is in a different league altogether (De Ferranti, Perry, Guasch and others, 2003).

This paper takes a step back to examine four issues. First, is the region's weak total factor productivity performance really due to an "innovation problem"? Second, what do we mean by innovation and what are dimensions of it in which the region exhibits weaknesses? Third are there any linkages between these weaknesses and equity: an issue which was also examined at the seminar at which a preliminary version of the present paper was presented? Fourth, what does recent experience and literature suggest for principles and broad policy measures to foment innovation? In view of the lack of consensus on the specific policies that governments should implement and their suitability to developing countries, we have attempted to organize thinking around some basic principles and to offer suggestive experience rather than specific policy advice.

[1] De Ferranti, Perry, Lederman and Maloney (2002).

II

Does Latin America have an innovation problem?

The issue of innovation is especially sensitive because the theory surrounding it is abundant in examples of market failures which, inevitably, lead to a role that the government must play. In a region whose history has led it to worry so much about government failures, the idea that the market is generating insufficient investment in innovation may imply reversing, to some degree, the tendency over the last 20 years towards reducing the role of public policy in the economy. Understanding the magnitude of the innovation problem is thus important for judging whether the costs of existing market failures indeed exceed the costs of potential government failures in implementing specific innovation policies.

The study by De Ferranti, Perry, Guasch and others (2003), among other analyses, suggests that by common measures of innovation effort and output, the countries of Latin America and the Caribbean lag substantially behind comparable countries. By OECD standards, the region exhibits low levels of R&D expenditure and private sector participation in R&D, low patent production, and high relative importance of basic versus applied research. It also performs relatively poorly against international benchmarks of educational quality and human resources devoted to research and development. Such lags remain even after controlling for per capita income.

These data, though suggestive, in themselves cannot convincingly tell us if we have an innovation problem or not, for several reasons. First, innovation diagnostics often proceed as if the accumulation of knowledge capital were a free-floating activity independent of other factors affecting the level of a country's development. This is not the case, however: globally, there is a very strong positive relationship of TFP with the capital/labour ratio, suggesting that the accumulation of knowledge related capital is complementary to and is driven by many of the same forces determining the accumulation of physical capital (Maloney and Rodriguez-Clare, 2005). In turn, this raises the question of whether a country's perceived innovation shortfall results from problems common to accumulation overall, or whether the activity of innovation itself is somehow especially impeded by specific market, institutional or policy failures.

These likely complementarities also suggest that any discussion on promoting innovation should occur within the context of the climate for promoting accumulation overall. There is a precedent for this broad view in the dual approach the New Zealanders are taking –upgrading their education and science and technology infrastructure, but also focusing heavily on business mentorship, competition policy, and incentives to "get off the island" and export– generally creating a demand for innovation. Many Latin American countries face a similar challenge, and because of their small domestic markets and distance from larger ones they are more like New Zealand than Spain or Italy, which, with their integration into the European Community, gained exposure to energetic forces of competition, other ways of doing business, and broader markets. The danger of not taking this view is that innovation policy may occur as a kind of sexy but isolated activity de-linked from the less glamorous work of finding out why firms may lack dynamism overall.

However, even after accounting for accumulation of human and physical capital, the Latin American countries still appear to have an innovation problem. Maloney and Rodriguez Clare (2005) calibrate a model that allows us to conclude that, given the measured level of accumulation of human and physical capital, many countries in the region show relatively low levels of TFP and implicitly high barriers to innovative activity. The country that they analysed most carefully in terms of data, Chile, appears to have an innovation problem apart from a general accumulation problem.

It is important to note that the calibrated model cannot distinguish between innovation problems and other inefficiencies that drag down TFP. An emerging literature in Chile and elsewhere has stressed the importance of microeconomic adjustment costs as an explanation for poor TFP performance. Caballero, Cowan and others (2004) argue that microeconomic flexibility is the core of creative destruction, productivity increases and economic growth, and that rigidities can be very costly. Focusing on labour legislation, they estimate the effects of job security using a sample of 60 countries for 1980-1998 and find that increasing job security significantly lowers the speed of adjustment to shocks in a third and reduces

productivity growth by almost 1% (for countries with strong rule of law, Chile among them). Caballero, Cowan and others (2004) go even further, suggesting that the reduction in productivity growth after 1997 in Chile was due largely to an increase in microeconomic inflexibility, and potentially can reduce structural long run growth by 0.5% yearly.

While this line of argument is compelling, several pieces of evidence suggest that innovation still remains a strong candidate for explaining deficient TFP and sluggish growth.

First, if we were to explain the TFP gap solely by adjustment costs, Maloney and Rodriguez Clare's calibration suggests that the inefficiencies compared with the United States would appear to be surprisingly large given the extensive micro reforms to date in Chile.

Second, history suggests that deficient national innovative capacity has been a major barrier to post-war Latin American growth.[2] De Ferranti, Perry, Lederman and Maloney (2002) offer several examples in this respect, perhaps the most illustrative being that of Chile. In the case of the Chilean mining sector, Pinto (1959) argued that local mining companies did not engage in learning by doing in the lower-tech phases of mining and hence "faced with the technological revolution, the local mining companies had behind them neither sufficient accumulated resources, nor the organizational or administrative capacity that were indispensable. In these circumstances, there was no other option but the introduction of foreign capital and expertise." Meller (2001) describes how Chile's technological position continued to deteriorate: "in the 1950s one could have learned more about Chilean copper in foreign libraries than in Chilean ones. Neither was there training of Chilean engineers and technicians specializing in copper." Only in 1965 would Chile develop domestic capacity to analyse the role of the copper industry and educate Chilean professionals and technicians in the management of the large copper firms. Meanwhile, Australia's development of an extensive mining cluster and the University of New South Wales' position as the largest generator of mining engineers in the world perhaps explains why they, and not Chileans, discovered the La Escondida mine, despite the fact that Chile was an exporter of copper well before Australia. Wright (2001) sees innovation issues behind the resource underperformance of Peru and other mining countries as well. Other examples from Mexico and Brazil discussed in De Ferranti, Perry, Lederman and Maloney (2002) show the importance of innovative capacity both for taking advantage of existing areas of comparative advantage and also, presumably, discovering new ones.

Finally, although the argument that "everybody else is doing it" is seldom compelling in itself, it is interesting to note that comparable countries such as Spain and New Zealand –the latter a country whose reform trajectory closely parallels that of the Latin American countries– are focusing heavily on innovation as critical to their future growth.

To be sure, these perspectives on the reasons for deficient TFP are completely compatible. Resolving problems of microeconomic adjustment must be a central part of the innovation agenda, broadly construed as raising the capacity of firms to introduce productivity-improving measures at the firm level.

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[2] See Maloney (2002) for a further elaboration of these arguments.

III

What type of innovation do the Latin American countries lack?

Although the literature often uses R&D as a conveniently available proxy for innovation effort, both at the aggregate and at the firm level, it is not clear what measures of innovation we should be looking at. Despite the amount that has been written on the importance of R&D to the learning process and technological transfer, the distinction between adoption and invention gives grounds for suspecting that R&D may be less important for less developed countries than for more advanced countries. Even within the OECD, some observers argue that the role of R&D is small compared with the introduction of new organizational and managerial practices.[3] The question arises, then: what are the ingredients of a good innovation-related strategy for TFP growth? Further, do the differing recipes for achieving growth of the present levels of income all

offer equally sound foundations for future income growth? The answers to these questions clearly affect how we measure innovation deficiencies and how we focus policy in this respect.

A first glance at the use of four commonly cited ingredients involved in technological transfer, adjusted for level of development, suggests some provocative conclusions (Maloney, 2005b). Figure 1 shows that the R&D trend rises sharply with the development process, but there is substantial variance around this trend, with the Latin American countries generally falling below it. Licensing and tertiary education follow similar trends, although less dramatically, and in these dimensions the region's performance is more mixed. However, just as in the case of the unconditional indicators generally used, we must be cautious using these measures as innovation diagnostics as well. Standard growth theory suggests that investments in innovation, as in the case of physical investments, drive the steady state level of output. Hence, these investment

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[3] Comin (2004) argues that in the United States, for example, less that 3 to 5 tenths of a percentage point of the 2.2% annual growth rate in productivity is attributable to R&D.

FIGURE 1

Selected countries: R&D across the development process
(Percentages)
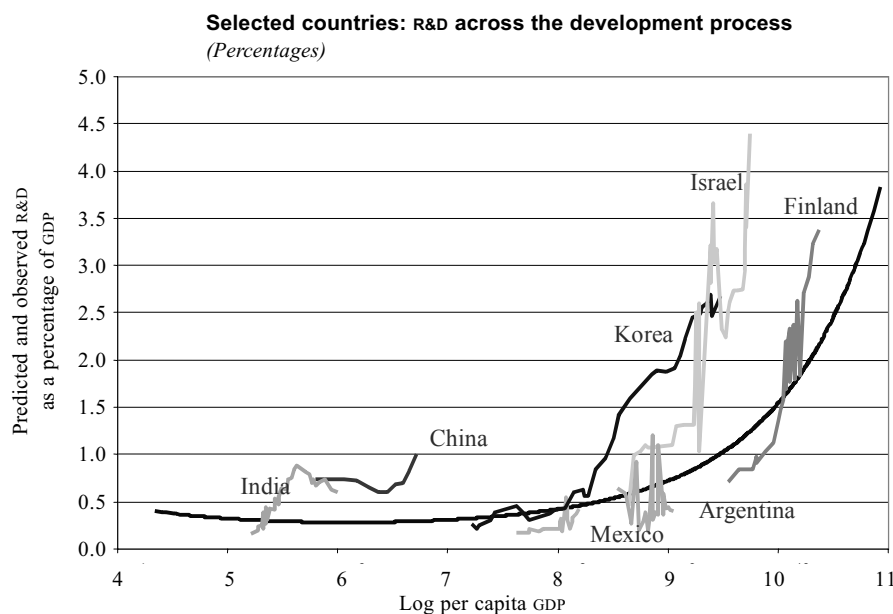
Source: Lederman and Maloney (2003).

levels cannot be seen as measures of performance, but rather as recipes for attaining the observed level of income. From a pure efficiency perspective, China's high level of R&D spending shown in figure 1 may reflect a penchant for technological white elephants, while, less plausibly, Latin America's low levels of tertiary education might reflect hyper-efficient use of those scarce resources. Clearly, economic structure –the fact that Latin America and the Caribbean specialize in goods that, on average, have low "innovation intensities", measured for example as R&D/value added– also influences the patterns we see.[4] Still, two observations are worth making in this respect.

First, the Latin American countries and the high-tech miracles have followed very different recipes with regard to R&D, foreign direct investment (FDI), licensing, and education. Finland and South Korea relied very little on FDI and very heavily on R&D and licensing of foreign technologies: a pattern that China is also following. This partly reflects their specialization in electronic products, which are especially R&D intensive. In contrast, Latin America has followed a recipe that has relied little on R&D or licensing and heavily on FDI. This is a perhaps a worrisome finding, in view of the low rates of technological transfer with FDI documented by numerous authors and even more so in the light of the generally passive approach to the idea of taking advantage of the technological benefits of FDI. In Mexico, for example, although IBM and Hewlett Packard have been present for 30 years in Guadalajara, there is little evidence of a knowledge cluster in computer technologies, at least according to the data available on patent applications (figure 2).

Though often cited as a possible model for the region, Ireland's recipe of relying on extremely high levels of licensing is *sui generis* and derives from its unique position as an English-speaking bridge from the United States to the European Union: conditions which are not likely to be replicated in our region. The most striking finding is that Spain (and also Italy, though not shown in the figure) appears to follow the Latin American recipe, having made little effort in either R&D or licensing in order to attain their relatively high levels of income. Spain has converged rapidly to frontier income levels over the last 30 years, and provides an important alternative to the Asian newly industrialized countries as a benchmark for Latin America. This suggests that there is considerable potential in non-R&D sources of TFP growth, such as the adoption of organizational and management innovation (Caselli and Tenreyro, 2004).

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[4] Since the analysis was conducted in the light of income and not TFP, this may suggest that high non-innovation accumulation drove income growth, as suggested above.

FIGURE 2

**Selected countries: Deviation from trend for four indicators
of technological adoption and capacity, 1972-1998**
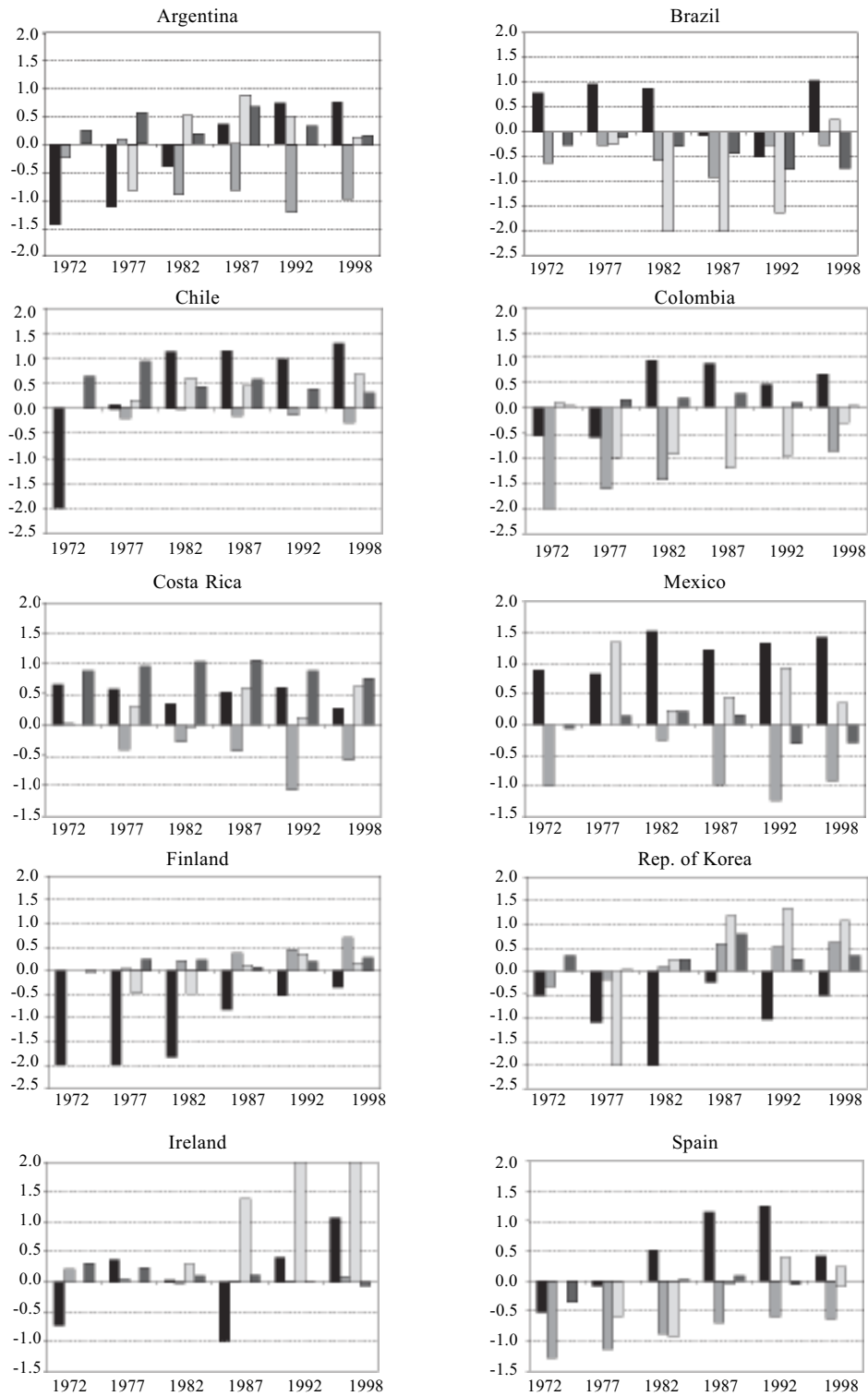
Source: Prepared by the authors.

IV

Medium- and long- term innovation policy

Thus, more attention needs to be paid to fomenting these perhaps less celebrated aspects of innovation over the medium term. Benavente (2004) shows that in, fact, innovations in processes, design, organization etc. are as common in Chile as those in products, which are often associated with R&D expenditure (figure 3), and this pattern is relatively similar to those we find in the OECD. Figure 4, however, suggests that the actual amounts firms in Argentina and Chile are spending on innovation-related activities as a share of turnover is very low. In the case of Chile, the high heterogeneity among firms within the same sector suggests that increasing the productivity of firms that are well behind the frontier could have substantial effects on TFP growth.[5]

Unfortunately, we do not know much about what makes some firms pursue such innovations and others not, or what policies would encourage them to do so. The system of Technological Centres in Spain has been central to enhancing the capacity of small and medium-sized enterprises, clustering, networking and cooperative activities. The fact that both Spain and Italy have seen large productivity gains by relatively small firms suggests that more research is needed to gain a better understanding of the constraints these firms face and what policies are effective in raising their technological "absorptive capacity"- the ability to use and benefit from existing information. Further, given the complementarities with capital accumulation, the standard litany of needed reform measures in credit, infrastructure, labour markets, etc. also needs to be reviewed with an eye towards their particular implications for innovation.

In addition, a more creative approach to innovation may turn up new areas of comparative advantage for the region. In Italy, for example, sales of the fashion industry now exceed those of the automobile industry. For countries such as Mexico or Colombia with a strong

FIGURE 3

Chile: Percentage of manufacturing establishments declaring that they have made innovations in various aspects of the production process, 1998 and 2001
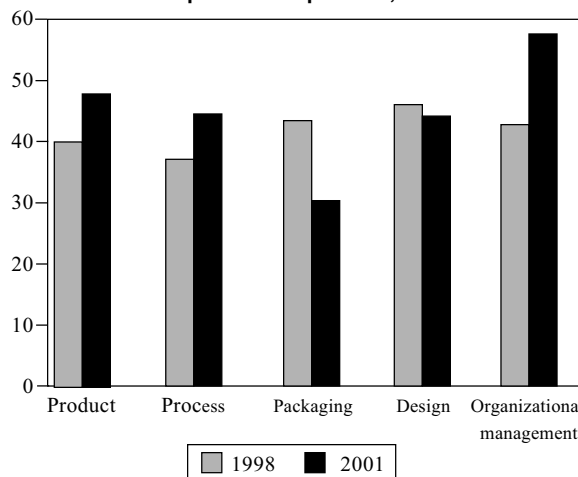
Source: Benavente (2004).

design tradition, investments in these areas may make as much sense as those in science and technology. In more general terms, it is unclear what kind of ingredients are required for the discovery of new areas of comparative advantage of whatever kind, as stressed by Hausmann and Rodrik (2003).

What cannot be overstressed is that, given the relatively little insight we have into the dynamics and choices of firms, we must be very careful that the demand by enterprises for innovation of whatever kind is kept at centre stage in the policy dialogue, lest investments in supply-side measures be rendered useless from the productivity point of view or, still worse, be turned into a sideshow distracting attention from the truly critical issues.

Having said this, investment in science and technology and R&D is important now and appears even more essential over the longer term for generating sustained growth. First, as initially argued by Cohen and Levinthal (1989), R&D is essential not only for generating new knowledge, but also for enhancing firms' absorptive capacity. This means that policies to

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[5] See Bergoeing, Hernando and Repetto (2002) for evidence on Chile. This argument has been stressed by Chen and Dahlman (2004).

FIGURE 4

**Europe (average) and selected European and Latin American countries:
Innovation-related activities, various years**
(Percentage of turnover)
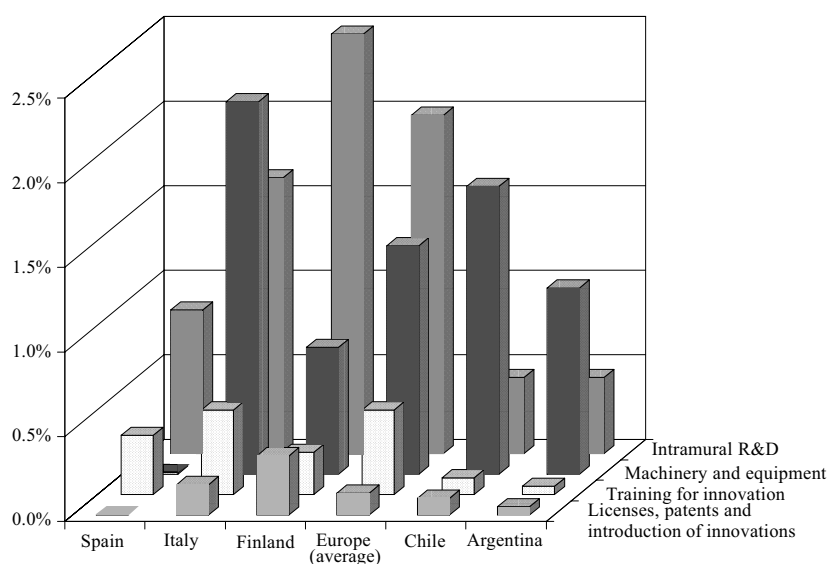
Source: Prepared by the authors on the basis of enterprise innovation surveys in Europe and Chile.

strengthen technology transfer have little value if industry does not have a critical mass of human capital with a highly technical bent able to turn new knowledge into business opportunities. In addition, most technological transfers need significant adaptation to local resources, market conditions, etc, and substantial R&D is required for this. Much of the R&D in advanced countries like France is not oriented towards "new" products or techniques, but towards efficient transfer and adaptation of new technologies developed elsewhere.

Second, the slackening recent performance of Italy and Spain suggests that even though Latin America should focus on these broader types of innovations in the medium term, there is no substitute for investments in science and technology, more appropriately captured by R&D, over the longer term. Italy, with negative TFP growth rates over the last decade, has recently been awarded the honorary "Sick Man of Europe" award by *The Economist*, partly because of its weak science and technology capacity. Spain has been worried about this and has been aggressively upgrading both its own R&D efforts and its collaboration with research centers in the rest of Europe. In the context of the convergence club model developed by Howitt and Mayer-Foulkes (2005), limiting itself to the adoption of technologies would doom Spain forever to a lower level of income

than those who really invent.[6] This scenario also appears to haunt other countries with conditionally average levels of R&D. Denmark, New Zealand, Australia and Canada are increasingly concerned that this has left them as good adopters rather than as countries capable of staying in front in the innovation game, where the big gains appear to lie. Blomström, Kokko and Sjoholm (2002) argue that the application of a similar logic pushed Singapore into a position of being more of a knowledge generator than a mere adopter, in contrast with its previous more typically Latin American stance of relying on FDI and licensing.

Such an effort requires not only increased resources, but also increased efficiency in how those resources are used. De Ferranti, Perry, Guasch and others (2003) suggest that Latin America lags behind in this respect as well. Figure 5 looks at the efficiency in the creation of knowledge, using patents as a proxy, and finds that Latin America has substantially lower elasticities of patents with respect to R&D than comparator countries. Since the microeconomic studies generally find elasticities around 0.5 in the region,

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[6] See Maloney (2002) for an application of this view to the underperformance in terms of natural resources displayed by Latin America.

FIGURE 5

Selected countries: Elasticity of knowledge creation, 1960-2000
(Percentages)
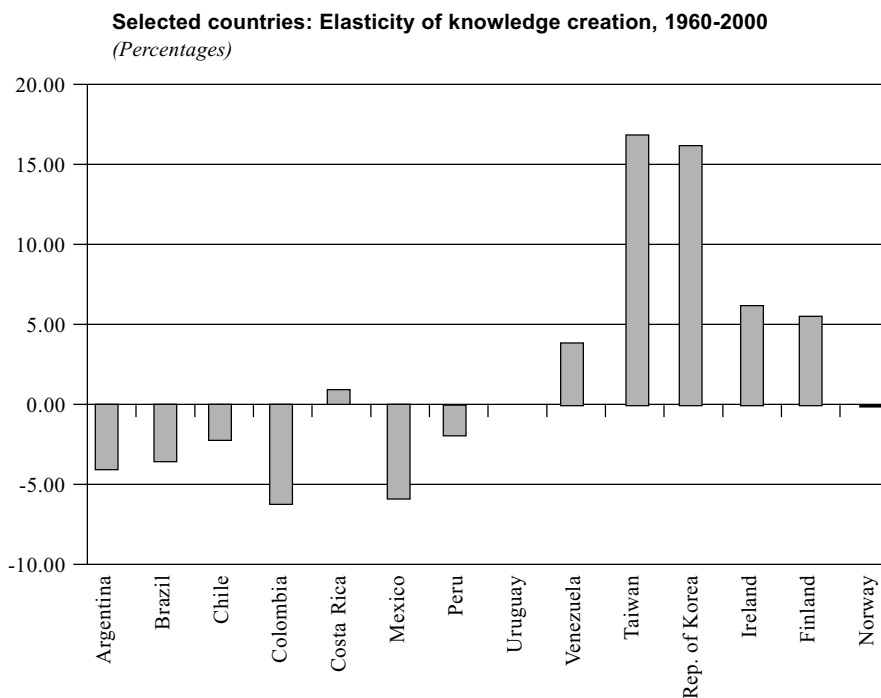
Source: Bosch, Lederman and Maloney (2004).

FIGURE 6

**Selected countries: Subjective evaluation of research
quality and degree of collaboration, 2002**
(Seven point response scale)

Quality of scientific institutions   Cooperation between universities and private sector
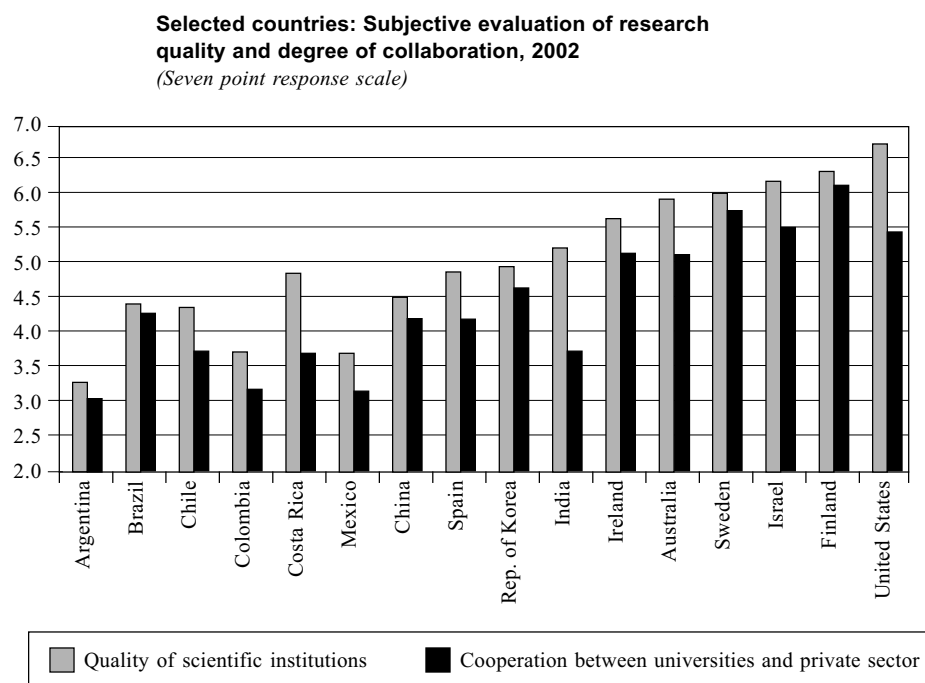
Source: World Economic Forum (2002).

whereas the OECD is closer to 1, the lower performance of the Latin American countries suggests that they are less able to exploit knowledge spillovers than they ought to be. Figure 6, which reports the subjective responses of entrepreneurs to a World Economic Forum questionnaire, suggests that Latin America does quite poorly on a 7 point scale as regards the degree of interaction between the private sector and research centers. In turn, this may reflect the generally low opinion that the private sector has of the local research centres.[7]

It also appears that in the region overall, roughly 60% of R&D resources are devoted to basic research, whereas the comparable figure for the United States is 15%, and a very low percentage is carried on or financed by the private sector, contrary to what happens in countries that are more effective in this respect. This suggests some misalignment between the incentives given to the institutions doing research and the actual needs of the local economies, as well as a lack of incentives for private firms to engage in R&D activities themselves.

V

Specific policies and institutions

for fostering innovation

Since, there is as yet no set of best practices in the OECD that can be easily extrapolated to the Latin American context, in this section we seek only to set forth some considerations emerging from the literature that could be useful for policy making.[8]

1. Dealing with appropriability and spillovers of innovation: intellectual property rights versus subsidies and tax credits

The potential high spillovers of innovation imply that social returns are much higher than private returns and thus the innovative effort of individual firms, left to themselves, would be suboptimal from a social point of view, even if barriers and artificial disincentives were removed. Two types of instruments have been used to deal with this problem: intellectual property rights, and public subsidies (through different means such as public supply, matching grants, or tax credits).

Traditionally, the transition process from scientific activity to technological breakthroughs and their development, application and diffusion has been seen as a linear process in which spillovers are higher at the scientific end and lower at the applied end. This view leads to the concentration of public subsidies at the

scientific and basic technological research level (which in many countries is fully financed by public resources assigned to universities and public research institutes) and the use of "strong" intellectual property rights at the more applied side of the process, since such rights help to solve the appropriability problem at the expense of actually reducing spillovers and diffusion (since imitators or users must now pay a royalty cost).

Romer (2005) and Rosenberg (2005)[9] have argued that this view is incorrect, as in practice there is a strong backwards feedback loop from application to technological and scientific discovery: many, if not most scientific breakthroughs have emerged from attempts to solve concrete problems at the production end and the basic questions and problems that such attempts have posed to more basic technological and scientific research. Hence, it makes sense to distribute public subsidies more evenly across the process, using matching grants or tax credits at the applied side, and relying less on "strong" intellectual property rights for stimulating applied technological R&D. This parallels the discussion about the relative efficiency of supply and demand side subsidies in other areas: subsidies should be oriented not only to the supply side (basic scientific and technological capacity and activities), but

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[7] Both the variables considered in figure 6 appear to be correlated with the elasticity of knowledge creation, as also are education levels and intellectual property rights (Bosch, Lederman and Maloney, 2005).

[8] This section draws heavily on Maloney (2005a).

[9] Both these papers were presented at the Conference on "R&D and Innovation in the Development Process: A New Look at Theory, Evidence and Policies", (World Bank/Universitat Pompeu Fabra, Barcelona, 9-11 June 2005).

should also aim to stimulate demand for innovation from firms.[10]

Authors like these thus question whether the orientation given to trade-related intellectual property rights in the World Trade Organization (WTO) may not be inefficient from a systemic point of view. Deciding the precise kind of intellectual property rights which are most appropriate for countries at a level of development similar to that of Latin America is beyond the scope of this paper, and the reader is referred to the broad literature on this subject.[11]

What we should consider here is the relative efficiency of tax credits versus direct subsidies (e.g., under matching fund schemes) to stimulate firms' demand for innovation. Arguments in favour of tax credits for R&D expenditure rather than direct subsidies point to potential rent seeking and other government failures in "selecting winners" through subsidy schemes. However, the inefficiencies of tax credits are also well known: i) they are not proportional to the difference between social and private rates of return, as they should be, but instead to R&D costs; ii) in most cases, they are proportional to total annual R&D costs, and although this may lead to some marginal R&D projects being executed, most of the resources will benefit intra-marginal R&D that would be carried out anyway. In such cases, benefits will be low compared to the high fiscal costs. Some countries, like the United States, have attempted to design an incremental "R&D" tax credit, but problems related to the definition and measurement of the corresponding "base" are huge; iii) they create an incentive to artificially classify non-R&D expenses as R&D, which may not be easy for tax authorities to detect, especially in developing countries where technical and administrative capacities are low.

Some studies –although they do not include a cost/benefit analysis– have found that tax credits do indeed increase private R&D in OECD countries. In most of the Latin American countries, however, where tax regimes are already full of exemptions, tax credits and loopholes, and where administrative capacity is weak, it is highly doubtful that the fiscal costs would not be large in comparison to the potential benefits. Probably only countries like Chile and Brazil, which have shown that they can enforce tax laws with some effectiveness,

should think of trying out this instrument. We would not recommend it for most of the Latin American and Caribbean countries at this stage, however.

Instead, efforts might initially be devoted to improving the design of the subsidy schemes that already exist in many countries in the region, thereby possibly overcoming these problems (as well as serving as a good instrument to promote cooperation between firms and universities/research Institutes and to foment R&D by the latter on public goods – health, the environment, etc.). Some of these schemes have proven quite effective, but in other cases there seems to be too much duplication and lack of efficiency criteria.[12] Examining successful experiences around the world, some general guidelines can be extracted on how to maximize their potential benefits, while mitigating the risks of rent seeking and government failure:

i) First, there is the issue of governance: who regulates and administers the system? To reduce the probability of government failures and rent seeking and ensure commercial relevance, it is advisable to ensure participation by the private sector –through broad business associations– and the academic world. In view of the limited size of the science and technology community in most Latin American and Caribbean countries and the fact that local knowledge will not be at the frontier in many areas, approval of schemes in specific areas should be given by expert committees which should include foreign experts. Although Finland is now at the frontier of technological creation in many areas, its highly successful national technology agency (TEKES) nevertheless makes routine pilgrimages to the Massachusetts Institute of Technology (MIT), the National Science Foundation (NSF) and other global centers of advanced knowledge in order to identify emerging new directions of technological research.

ii) Second, there is the issue of the size of the subsidy. Theoretically, it would be desirable to make it proportional to the difference between social and private rates of return, but this is quite difficult in practice. Perhaps it would be useful to specify *ex ante* a range for the matching contribution to costs (estimates suggest that this should be around the level of 50% or more to be effective, in line with the OECD's usual benchmark), while leaving some discretion to the experts and the competent authorities for classifying proposals in a few categories (with different rates of subsidy), depending

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[10] In order to satisfy their demand for technology transfer, creation or adaptation, firms may build their own R&D supply capacity at home, contract the work out to universities, research centres, etc., or, more usually, use a combination of both methods.

[11] See, for instance, Maskus (2000) and Fink and Maskus (2005).

[12] See Sanguinetti (2004) for Argentina, and Benavente (2004) for Chile.

on their assessment of how large the spillovers may be with respect to costs. Some categories of research (on public goods, or basic technological research with a wide array of potential applications) could systematically receive higher proportions of subsidy than others. Alternatively, it has been suggested that the ratio of subsidy should not be fixed administratively (Link and Scott, 2004), but should be subject to competitive bidding so as to guarantee that hurdle rates are met, but not widely exceeded. However, this can at best be only one of several selection criteria, as otherwise there would be a bias towards selection of projects with low differences between the social and private rates of return.

iii) Third, there is the issue of the allocation of funds among various areas or the promotion of "strategic" areas. Some highly successful countries like Finland have found it appropriate to concentrate support in a few broad areas in which there is already some capacity and activity and in which the country is deemed to be competitive (so as to avoid a narrow approach involving "picking winners", but at the same time seeking to avoid spreading scarce resources and evaluation capacities too thinly). Thus, it might make sense to either give priority (other things being equal) or to pre-allocate part of the funds to a few well-selected broad areas in which there is already revealed comparative advantage (as measured, for example, by export ratios and export dynamism) or strong reasons to believe that comparative advantage can be easily developed. Even so, some funds should be reserved for "open" competition, as development of new, unexpected activities or exports might be quite critical for growth (Hausmann and Rodrik, 2003). Furthermore, some critical areas of non-tradables which have important public good characteristics, such as tropical health, or which involve environmental and infrastructural issues, might also be pre-specified as priority "strategic" areas. In any case, care must be taken to prevent such "sectoral" allocations from becoming areas of rent-seeking by business or academic groups.

iv) Fourth, given the importance of developing stronger ties between universities and research centres or institutes and firms in Latin America, priority could be given to proposals that involve cooperation. Also, given the low contribution currently made by firms in much of the region, some priority could be given to proposals presented and partially financed by productive firms. Participation by small and medium-sized enterprises could also receive some priority. Such characteristics might "add" points for the final selection,

but the overriding criteria should be "technical soundness and capacity" and "relevance and potential spillovers." In Chile, the Production Development Corporation (CORFO), the National Commission for Scientific and Technological Research (CONYCIT) and the National Foundation for Agricultural Innovation (FIA) recently launched a special programme to stimulate such forms of cooperation.

v) Finally, in view of the importance of experimentation and learning in this area, careful monitoring and evaluation systems should be established from the start.

2. The role of universities and public research institutes

Given that the capacity to undertake major R&D activities requires a critical mass and that spillovers might be higher at the scientific and basic technological research level (as well as in the area of public goods), there is clearly a role for specialized science and technology institutions. It is no surprise, then, that such non-market R&D institutions have developed everywhere. Research centres are often part of or related to universities, given the big synergies and interrelations between innovation and specialized skills in the modern world. Indeed, most R&D in Latin America (perhaps too much, as discussed above) has so far been carried out by such entities, especially universities, but unfortunately often in splendid isolation from the productive sector and with too much concentration on the "basic" research side. Most agricultural and natural resource-related research, in particular, has been carried out by public research institutes, with mixed results (De Ferranti, Perry, Lederman and Valdés, 2004). The key issue to be tackled is thus how to enhance cooperation between such institutions and the productive sector and how to stimulate more relevant and applied technological research. Some guidelines derived from successful experiences are the following:

i) Funding for research in such agencies should increasingly be obtained through competition rather than entitlement. This has already begun to happen in some countries in the region.

ii) However, given the need to maintain critical mass and some degree of continuity in the science and technology field, there is a need to balance "basic financing" (whose amount should be reviewed every few years against performance) and competitive finance for programmes and projects through the matching grant funds discussed above. It is possible to go too far

in the direction of competitive programme/project financing, as the New Zealand experience shows and as seems to have happened with agricultural research reform in some Latin American countries in recent years. Finland's VTT technological research centre combines about 25% base financing for research institutes, with nearly 25% private finance and around 50% matching grants from the TEKES national technological agency.

iii) The structure of incentives to researchers is critical: both promotion and rewards should depend on performance. The way intellectual property rights are allocated is also critical: though universities or institutes might keep a part of the royalties from possible patents (as a reward for the risks they run in supporting and partially funding research), most of them should go the researchers themselves. The allocation of intellectual property rights among firms, universities and researchers in the case of R&D contracted by firms or carried out under cooperative arrangements is also crucial. Little progress has been made so far in Latin America in these areas, in contrast to what happened long ago in the United States with the Bayh-Dole Act of 1980,[13] whose evaluations are generally positive (though not fully conclusive).

iv) Infrastructure is also important: laboratories, technology transfer offices, etc. The purpose of the latter offices is to develop networks of industrial partners, set up guidelines for the commercialization of research results and manage the intellectual property rights of universities, science parks and incubators. Many Latin American universities have began to create such offices to carry out some of these functions, though few of them are really effective yet.

v) All kinds of links between firms and universities and research institutes should be encouraged (not just links in respect of R&D): student practices, specialized training, and advisory and consultancy services. Some Latin American universities have also begun to move strongly in such directions, especially in countries where there is more competition among public and private universities.

vi) Finally, governance and culture are key elements. The presence of private sector representatives on university and research institutes boards and committees could be quite useful in this regard. However, there might be a more basic cultural problem in many Latin American universities which evolved

from the more monastic humanistic conception prevalent in Continental Europe and which show some reluctance to mix in "worldly affairs" and to play a more practical role, especially as the handmaidens of industry. Overcoming this requires a profound national debate on the role and purpose of universities.

3. Other specialized institutions

There are other important functions within the national innovation system that demand the existence of specialized public, private or hybrid institutions that will act as "honest brokers" with no direct market interest in the outcomes (Link and Scott, 2004). The most important are:

i) Promulgation and adoption of standards and certification.

ii) Extension services to transfer technologies and management techniques, especially in sectors such as light industry and agriculture, where the predominantly small size of the enterprises implies lower appropriability of the benefits of the adoption of technologies and credit and information constraints are larger.

iii) Coordination and facilitation of cooperative R&D efforts joining industry, government and universities in research projects subsidized by the government, as well as oversight functions in respect of publicly funded or subsidized private research.

iv) Serving as international "antennae", to identify new directions in technology and R&D and foster cooperation with international institutions in specific areas.

Institutions that carry on functions i) and ii) above are common (though not always effective) in Latin America and the Caribbean. Fundación Chile is a very successful example of an institution that carries on activities in areas ii), iii) and iv) above, but it has proved difficult to replicate it successfully in other countries of the region.

4. Innovation clusters

Since innovation (and skill enhancing) spillovers are often mainly limited to a particular sector or to a group of inter-related firms (including suppliers, distributors and users), it makes sense to tailor and concentrate part of the innovation policy support on "innovation clusters" that may internalize many of the externalities of the innovation process. The key here seems to be to support emerging clusters (where the private sector

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[13] Patent and Trademark Law Amendment Act (1980).

itself has taken the initiative) and not to attempt to promote them from scratch.

The national innovation system may efficiently contain some sectoral innovation systems. However, cluster-type policies can be a complement to but not a substitute for a properly functioning overall national innovation system, as the latter must facilitate the emergence of industries that are not on the government's radar screen. Israel and Finland seem to have been able to reach a good balance between a strong and efficient overall national innovation system, complemented with a few sectoral clusters.

Clusters should essentially be vehicles for efficient public/private cooperation to solve market and coordination failures, not just to promote innovation and skill enhancement. They can be extremely useful for identifying constraints and coordination failures in supplies, infrastructure (particularly in transport), marketing, attraction of foreign direct investment, etc. However, they can also lead either to rent-seeking behaviour (through unwarranted protection and inefficient or inequitable subsidies) or to artificial and costly development of local suppliers. In particular, the encouragement of "vertical" clusters –which were historically considered to be of key importance in many countries– may lead to very inefficient outcomes in today's world of much lower communications and transport times and costs and higher international production integration within production chains (De Ferranti, Perry, Lederman and Maloney, 2002).

5. International connections

Given that most of the development of new technologies (and other innovations) will continue to take place internationally (and, in fact, in only a few countries, multinational firms and centres of excellence), it is highly important that the national innovation system should be highly international in character. International links among firms,[14] among universities and among local firms and foreign universities are essential and should be stimulated by innovation policies.

International circulation of the best brains, in particular, is central to the operation of an efficient national innovation system, as a considerable proportion of knowledge transfers and cooperation in innovation still depends on individuals and the contacts between them. Individuals learning in centres of excellence or working in firms and institutions that are leaders in innovation (or even simply more advanced than domestic agents) can become catalytic agents for innovation and change upon their return to their own countries. Likewise, hiring foreign researchers, technicians, managers and business advisors or temporarily bringing them in through institutional exchanges or other means may help enormously to spur innovation and change. Governments, universities, research institutes and firms should therefore stimulate such interchanges. International temporary immigration agreements (such as that currently being discussed between the United States and Mexico) and advances in the World Trade Organization on the movement of persons could be an important part of the international dimension of innovation policies.

Even the feared (and initially costly) "brain drain" can eventually be turned into an advantage. The Russian-Jewish, Chinese, Irish and Indian diasporas have come to play a crucial role in this regard (as well as in opening trade and FDI opportunities) for Israel, China, Ireland and India, respectively, often triggered when sensible policies in these countries created a strong investment, innovation and growth environment. Some Latin American countries (governments, private sector and research community working jointly or sometimes independently) are beginning to organize effective networks of their skilled nationals who have emigrated to the United States, Europe and other regions and to stimulate their involvement with different public and private initiatives at home. Such policies may give significant pay-offs in the future.

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[14] A significant number of technology transfers and innovations happen through interaction with and support from foreign suppliers and buyers.

VI

A link back to equity?

Moving away from science and technology to a more general innovation agenda allows us to establish a link back to the second focus of this conference, equity, and more generally to the important complementarities of human and other innovation-related capital stressed in De Ferranti, Perry, Guasch and others (2003).

Recent thinking suggests that Latin America's persistent wealth inequality may have played a role in slowing the region's ability to adopt foreign technologies.[15] Engerman, Haber and Sokoloff (2000) argue that the period of sustained economic growth during the eighteenth and early nineteenth centuries that distinguished the United States and Canada from the other New World economies was fundamentally due to the patterns of settlement and crops, which led to a relatively unequal distribution of income in the slower-growing areas. This concentration preserved the political influence of the advantaged elites and led to the marginalization of much of the population, as measured by lower access to enfranchisement, natural resources, financial institutions and property rights, as well as primary schooling.

The lower access to education may have been particularly important. The concerns with social control, extreme inequality of income, weak public finance, and perhaps an intellectual commitment to a small State sector, all led to dramatically smaller efforts in Latin America, as compared with the successful natural resource exporters, towards the achievement of universal education. By 1870, more than 70% of the population aged 10 or above in Australia, the United States, Canada, and Sweden was literate: three times the percentage in Argentina, Chile, Costa Rica and Cuba, and four times the percentage in Brazil and Mexico. Latin America progressed unevenly towards higher levels over the next half century. By 1925, Argentina, Uruguay, Chile and Costa Rica had attained literacy rates of over 66%, while Mexico, Brazil, Venezuela, Peru, Colombia, Bolivia, Guatemala and Honduras continued to hover around 30% until much later (Mariscal and Sokoloff, 2000).

As Engerman and Sokoloff (1997, p. 287) note, this is particularly important because early industrialization reflected the cumulative impact of incremental advances made by individuals throughout the economy, rather than being driven by progress in a single industry or the actions of a narrow elite. They note –as one manifestation critical to the development of innovation– that the greater equality in human capital accounted partially for the high rates of invention in the United States overall. They also argue that "the more general concern with the opportunities for extracting returns from inventions contributed to a patent system which was probably, at the time, the most favorable in the world to common people. This stands in stark contrast to Mexico and Brazil, where patents were restricted by costs and procedures to the wealthy or influential, and where the rights to organize corporations and financial institutions were granted sparingly, largely to protect the value of rights already held by powerful interests."

Blomström and Kokko (2001) argue that in Sweden, the introduction of a mandatory school system in 1842 and emphasis on literacy and numeracy was a key factor in the ability of individuals and firms to learn and adopt new technologies: much elementary learning and technology transfer was based on written instructions such as blueprints and handbooks. This also suggests that the extensive literature comparing Argentina and Australia may be missing a critical point. Despite a strong feeling of "there but for the grace of God go we" on the part of Australian authors, it is very clear that, in the mid-nineteenth century, Australia was far closer to the industrialized countries in levels of literacy; and this, in a country that until the 1840s was a penal colony of the United Kingdom! The story of the global conglomerate Broken Hill Proprietary Company, Ltd. (BHP), started by a boundary rider on a sheep station, shows the importance of a broad base of literate citizens who can grasp new ideas and have the benefit of institutions that provide support in this field.

A recent study by Klinger and Lederman (2005) suggests that such impacts are still relevant and seeks to explain two dimensions of innovation. The first is discovery, measured as new export industries introduced (as argued by Hausmann and Rodrik, 2003), and the second is patenting activity. The first understates innovative activity for advanced countries, since their

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[15] See Maloney (2002) for more discussion.

industrial structures are already quite complete and new exports will need to be "invented", while patenting activity understates overall innovative activity in poor countries, where diffusion of existing technologies may be more the order of the day. Using both measures, Klinger and Lederman find that population is, as might be expected, a significant determinant. In addition, however, poverty, the Gini coefficient for income distribution and the proportion of the labour force with secondary education also enter significantly. This can be interpreted as meaning that the "effective innovative population" is important for the generation of new ideas and growth. In so far as Latin America has reduced its effective innovative population by keeping education, wealth and access to institutions restricted to a relatively narrow elite, growth in total factor productivity is likely to have been hampered.

Furthermore, in societies where the elites heavily emphasized theology and philosophy (economics may be considered as the 20th century equivalent in this respect) and showed a disdain for applied fields such as engineering, the very skewed access to education and low social mobility is likely to have restricted the

supply of aspiring middle-class workers who formed the backbone of the inventive and/or engineering classes in the advanced countries. Once again, as table 1 shows, the difference of Colombia and Chile, on the one hand, and Australia on the other at the turn of the 20th century in terms of the density of engineers in the population is dramatic. The lost opportunities in terms of cumulative learning by doing locked the region into a dependent relationship with the advanced countries not only in the invention of new technological know-how, but also its diffusion.

TABLE 1

Selected countries: Density of engineers at the turn of the twentieth century

Country	Year	Engineers per 100,000 workers
Australia	1920	47
Chile	1930	6
Colombia	1887	8
Sweden	1890	84
United States	1920	128

Source: Maloney (2002).

VII

Conclusions: the need for a comprehensive view

Latin America and the Caribbean have an innovation problem in addition to the gap in accumulation, and this problem manifests itself both in the level of innovative effort in many areas and also in the way this effort spills over to other actors in the economy. Thus, innovation appears to merit an important place on the policy agenda.

Innovation policy goes beyond science and technology policy. Even if we accept deficient total factor productivity as being entirely due to low levels of technological progress and not inefficiencies, this still leaves numerous areas that need to be addressed, such as barriers to the creation of more innovative firms, deficient absorptive capacity of firms, internal obstacles (labour legislation, for instance) or credit market barriers to the adoption of extant technologies, and weak science and technology infrastructure and lack of incentives to innovate. Hence promoting innovation

requires a broader vision of the factors that could impede it and therefore a broader set of diagnostics than those related to science and technology per se. Stimulating innovation in these broader areas requires that attention be focused on the capabilities of firms and incentives for enhancing them: developing entrepreneurial skill and a taste for innovation, and dealing with both innovation- and non-innovation related barriers and market failures that hamper broad-based productivity growth.

The capabilities of firms in terms of technological upgrading are of fundamental importance. Although the discussion often takes place at the aggregate level, productivity growth is primarily a firm-level phenomenon. If there is no demand for innovation on the part of the private sector, efforts to improve science and technology capacity on the supply side will be ineffectual. Fundamentally, spending public money to

provide a public good in this field will be "pushing on a string" and will not lead to productivity growth unless the private sector takes up the challenge.

The private sector of the Latin American and Caribbean countries must prepare itself for this transition. Although the composition of their various innovative activities is similar to that of their European counterparts, the magnitude of the private sector's efforts in the region is extremely low, especially in training and knowledge acquisition, but also in R&D. This is especially regrettable in the case of the larger firms, since they would seem to be less subject to information, credit or other restrictions, and should be closer to the frontier in their respective sectors. The private sector needs to increase its awareness of this and its innovation effort in order to be able to absorb knowledge generated elsewhere in the national innovation system and abroad.

This will require going beyond measures to increase the stock of well-trained human capital and research units: steps must also be taken to improve the diffusion of knowledge across units. Evidence from the OECD suggests that, at the micro level, knowledge generation exhibits decreasing returns to scale, while at the aggregate level, it shows constant returns to scale. This suggests that there are substantial knowledge spillovers among individuals and firms in the economy.

When knowledge creation shows diminishing returns at the national level, this suggests that such spillovers may be less prevalent (Bosch, Lederman and Maloney, 2005). Generally, the degree of spillovers appears to be correlated with such factors as the level of education, perceived quality of research institutes, degree of collaboration between research institutes and the private sector, and intellectual property. These are central aspects of policy design in the context of a national innovation system.

The Latin American and Caribbean countries, then, must begin by making the necessary reforms to secure a better functioning national innovation system and to lay the foundations for full participation in the international science and technology community. Even if, at present, less exotic sources of productivity growth could be exploited, it should be borne in mind that, in practice, reform of the national innovation system and particularly that related to the science and technology system may easily take several decades. It will be necessary to realign incentives, build the required institutions, and reform or dismantle those that are currently inefficient, while identifying successful interventions, and all this probably needs to be begun now.

Pro-equity policies may, in the long run, stimulate growth by enlisting a greater number of individuals in the innovation effort.

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Reassessing social policies in Latin America:

Growth, middle classes and social rights

Andrés Solimano

This paper examines the analytical bases of social policy in Latin America, as illustrated by empirical data. It finds that the dominant approach is based on the following premises: (i) economic growth is the primary mechanism for poverty reduction; (ii) social expenditure should focus mainly on the "really poor"; (iii) private-sector provision of education, health and pension services should be encouraged; and (iv) emergency social protection programmes are needed to deal with macroeconomic crises and natural disasters. The article then identifies areas in which social policy can be renewed, such as income distribution, attention to the middle class as a target of social policies, possibilities for the poor and middle classes to accumulate capital, and the economic and social rights of the population.

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I

Introduction

Economic growth in Latin America and the Caribbean in the past two decades has been modest and volatile. In fact, average per capita income growth was close to a half per cent per year in 1980-2004, and 44% of the population of the region, or around 220 million people, were estimated to live below the poverty line in 2002 (ECLAC 2003). This weak economic performance and insufficient social progress in the region are raising questions about the adequacy of economic and social policies being applied in the region by the national authorities, policies which during the last decade and a half or so have been largely inspired by the blueprint of the "Washington Consensus".

The combination of slow growth and persistent inequality has yielded chronic poverty and social disarray despite the fact that the dominant concern in the past decade has been poverty reduction. Other social objectives such as reducing inequality of income and wealth or promoting empowerment and popular participation have not been, on the whole, policy priorities. The bet on growth-driven poverty reduction has been a disappointment in most Latin American countries, perhaps with the exception of Chile during the 1990s. Only countries with steady and very rapid growth –such as China and India– can show real gains in getting people out of poverty, something that has remained elusive in most of Latin America in the last quarter of a century Even if rapid growth is possible, it is "filtered" by its employment intensity and by inequality levels in its final effects on poverty. In turn, the State's ability to reduce poverty and inequality will depend on various factors such as its own capacity to raise revenues that can finance social spending, on its administrative capacity to conduct social policy and on the political will of the authorities to improve the situation of the poorest and other less affluent groups in society.

New approaches are being developed that attempt to pose the problem of economic development and social policy in terms of human rights, including social and economic rights. Economists are trained to think in terms of incentives, constraints, scarcity and the ability of economic systems to create (or destroy) wealth. In contrast, philosophers focus more on rights, values and the ethical underpinnings of alternative social arrangements. Political scientists and sociologists, in turn, highlight the importance of social contracts and social cooperation for attaining certain social goals. Marrying these different perspectives is not easy, although it is needed for broadening our perspectives on social and economic policies. A new view in this direction is the *rights-based development* (RBD) approach that draws from different strands of social thinking. This view assumes that individuals –as citizens, consumers and producers – have a set of economic, social and political rights that cannot be separated. Economic policy should foster an environment that generates wealth as the required material base for those rights to be satisfied. Development is not only an economic problem, however; it also has a political component. The satisfaction of individual wants and rights depends on resource availability and existing power structures, which affect the actual income distribution and the enforcement of economic and civic rights.

This paper reviews the main guiding principles of social policy in vogue since the 1990s and their links with economic policies in Latin America, and it examines the extent to which the new literature on rights and development can shed light on the design of renewed social policies to overcome the deficiencies and shortcomings of current policies.

The paper is divided into in five sections, including this introduction. Section II gives an overview of the evolution of social and economic policies in Latin America in past decades. Focusing on current policies, the paper discusses the three centerpieces of the prevailing approach, namely, (i) growth-led poverty reduction, (ii) targeting and (iii) private sector participation in the management and delivery of social services. Section III looks briefly at the theoretical literature on rights and development, including (conservative) libertarians (Nozick), liberals (Rawls) and more eclectic authors such as Amartya Sen and

others. The relationships between rights, resources and economic growth, on the one hand, and rights, institutions and political regimes on the other are also examined. Section IV identifies some alternatives to current social policies in Latin America and the Caribbean. Targeting of social benefits on the "really poor" as a policy principle is evaluated in terms of two criteria: (i) its demanding informational requirements for successful implementation and (ii) the political problems posed by separating the groups that are benefited by targeted policies from those who pay for those benefits (through taxes). This section discusses the possibilities of moving to broader policies in which the benefits of social policies are more "universal"– at

least reaching the middle class, as a stabilizing segment in any society. It also considers several effects of partially privatized health, education and social security systems in terms of replicating current inequality and social segmentation in the access to social benefits and services. The paper then examines the potential of asset accumulation by the poor and the middle class in housing, education, capital and land as a mechanism to equalize opportunities, to promote social mobility in stratified societies and to realize the hidden saving and productive potential of economically excluded groups that can lead to higher growth. The paper closes in section V with some remarks about social contracts in Latin America.

II

Social policy in Latin America:

a brief overview

Under the development strategy of import substitution, in place from the 1930s to the 1980s, the main objectives were social modernization and the training of human resources needed by the industrialization process and the growing State. The instruments used for this purpose were: the expansion of education at various levels, including higher education (universities); housing policies to cope with a growing urban population; national public health systems; and pay-as-you-go social security. Labour market policies included legislation on minimum wages, severance payments and restrictions on firing and hiring by firms to ensure job stability of (incumbent) workers. Land reform was also implemented in some countries in an attempt to correct the highly concentrated pattern of land tenure that characterized most Latin American countries. The social constituency behind these policies consisted of trade unions, various civil society organizations in the public and private sectors and rural workers.

Until the late 1970s this development strategy cum social policy delivered economic growth and a degree of social modernization. However, the economic model also involved micro-inefficiencies associated with import protection and the growth of the public sector. The debt crisis of the early 1980s an its legacy of inflation, fiscal deficits, exchange rate instability

and debt servicing problems led to a change in the development model in Latin America. Criticism of the economic model of import substitution was also extended to its associated social model. Main critical elements of the latter were: (i) social spending was not necessarily reaching the most needy in urban and rural areas; (ii) the subsidies on certain basic goods, such as foodstuffs, were fiscally expensive; (iii) public universities, often tuition free, implicitly subsidized the children of rich households and the upper middle class; and (iv) the social security system based on pay-as-you go delivered low pensions and did not contribute to the development of domestic capital markets.

Market-oriented economic reforms included policies of macroeconomic stabilization, external opening, financial liberalization, privatization and market deregulation. These policies started to be implemented in the mid-1980s in many Latin American countries (Chile did so in the mid-1970s under the Pinochet regime). The corresponding social policies in the 1990s had the following main features:

(i) The main social objective was poverty reduction led by faster economic growth following the adoption of market-based reforms. The reduction of wealth and income inequality was absent as a policy priority, in contrast to several previous experiments with income

and wealth redistribution that took place in the 1960s, 1970s and 1980s in the region (Solimano, 1998)[1] .

(ii) Social policies focused on assisting the most vulnerable segments of the population (the poor, the elderly, children, the disabled), according to the principle of "targeting". Targeting was complemented by social emergency funds oriented to provide support income and public works programmes to low-income groups in the wake of severe macro-economic crises or natural disasters.

(iii) Market mechanisms and relative prices were supposed to guide resource allocation, savings and investment. Social policies would have to avoid distorting relative prices through the use of price subsidies for basic consumer goods.

(iv) The private sector had an important role to play in the delivery of education, health and pensions as a natural corollary of market-based development in other areas of the economy.

(v) Labour market policies also changed in the direction of seeking more "flexibility". Firing rules were relaxed, severance payments reduced and minimum wages de-emphasized as an income support policy.

A full evaluation of the results of these economic and social policies is beyond the scope of this paper.[2] However, the results of social and development policies for the region as a whole are not encouraging in terms of rapid and sustained growth, poverty reduction and lower inequality. Tables A.1 to A.7 in annex A show various indicators of poverty, inequality, social spending and GDP growth for Latin America. This evidence shows broadly a strong deterioration of social indicators (poverty and others) in the 1980s and a certain subsequent recovery, although the social situation remains fragile and critical as measured by current levels of poverty (tables A.1 and A.2) and other indicators. Inequality persists in the region (table A.3). Modest increases in real incomes and sluggish but volatile growth occurred in the 1980s and 1990s (tables A.4 and A.7). Several growth crises took place during the last two decades that destroyed jobs and increased poverty (Solimano, 2005a).

The existing evidence seems to suggest an unequal access to education and health services by low-income groups and the middle class compared to the upper middle class and the wealthy (ECLAC, 2004). The reality in some countries of Latin America today is that of a private system that offers better quality education and health services (although often below the quality standards of advanced countries) to the upper middle class and the affluent co-existing with a poorly funded public education and health systems. The quality of education is segmented geographically and by income levels (better education is often found in urban than rural areas and in more affluent neighbourhoods than in poor ones). Moreover, international tests of educational performance in Latin American countries often show significant differences between private and public schools.

In the health sector, public hospitals are often under-funded, and queuing time for patients is routine. In Chile, in recent years, thousands of families have left the private health insurance system of ISAPRES (private health providers) and switched to the State-run National Health Fund (FONASA) system because of the escalation of costs in the private system and the limited coverage of the services offered.[3] Colombia, Brazil and other Latin American countries have also introduced a growing role for private providers of health services.

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[1] The cases of Cuba in the early 1960s, Chile under Allende in the early 1970s, and Nicaragua in the 1980s under the Sandinistas were the most radicalized experiments of asset redistribution. More gradual policies with a redistributive bend were implemented in Chile under Frei Montalva, in Costa Rica and in Uruguay among others.

[2] See ECLAC (2003) and Birdsall and Szekely (2003) for an analysis of the social situation and social policies in Latin America.

[3] See Solimano and Pollack (2005).

III

The literature on rights and development:

basic elements

The previous discussion on the social situation in Latin America could be framed also in terms of economic and social rights. Nearly 45% of the region's population is living below the poverty line (about 220 million people). This shows a clearly unsatisfactory effort to promote the economic and social rights of a significant part of the population that is unable to earn the minimum level of income needed to meet certain basic needs (food, clothing, transportation, housing, etc). Moreover, it is undeniable that the poor and some segments of the middle class do not have access to good health services, high-quality education or decent pensions.[4]

The literature on rights classifies the latter as (i) political and civic rights (i.e., the right to free speech, freedom of the press, right to be elected to office, right to due process, right of free movement) and (ii) economic and social rights (i.e., the right to work and to receive education, health services, a decent pension and economic security). In judging social orders, liberal authors such as John Rawls in his *Theory of Justice* have sought a criterion in which the principles of justice could be made independent of original positions in terms of wealth and political power. Thus, the resulting social contract should be not affected by these original positions, in order to ensure fairness. Rawls calls for a "veil of ignorance" in which each individual negotiating the social contract is ignorant of his or her own material interests and of the endowments of the other negotiators (wealth, talent, social connections or other attributes) that may bias the design of that contract's standards, rules and institutions. Rawls then assumes a set of social arrangements (institutions) that give greater benefits to the least well-off compared to any other alternative arrangement to ensure justice and fairness. Rawls also points out the primacy of certain political rights, such as liberty, over the attainment of economic and social rights, should both

sets of rights enter in conflict (Solimano, 1998; Solimano, Aninat and Birdsall, 2000).

Robert Nozick, in *Anarchy, State and Utopia*, adopts a more radical view on the primacy of liberty (Nozick, 1974). In his view, personal liberty, as a case of "self-ownership" or personal sovereignty, and property rights take absolute priority over "economic rights", irrespective of the consequences of exercising these rights. The "minimal State" proposed by Nozick and the libertarian approach must protect property rights and personal security, but it must abstain from any income redistribution through taxation or other compulsory means, as that would constitute a threat to property rights and the freedom of individuals to dispose of the fruits of their efforts and the return on their assets in any way they wish, without State interference (the self-ownership thesis).[5]

Rawls's position on the preeminence of political rights (personal freedom) over economic or social rights has been questioned in cases of severe economic needs such as hunger and deprivation, which can be a matter of life or death (Hart, 1973). More recently, Amartya Sen, in *Development as Freedom*, mentions that "the priority of liberty" has to be qualified in the sense that the demand for personal liberty should not have the effect of allowing economic needs to be overlooked (Sen, 1999). In turn, regarding the issue of "just institutions", the neo-Marxist approach (or analytical Marxism)[6] questions the feasibility of devising just institutions under the conditions of concentrated ownership of private property that characterize capitalism. These authors question the (Rawlsian) device of the veil of ignorance and the original position in which enlightened legislators and politicians devise such institutions, and they point out that institutions generally serve the economic and political interests of those that design and run them.

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[4] It is apparent that the progress in assuring political rights in Latin America following the transition from military governments in the 1970s and 1980s to civilian elected governments has not been matched by an equal fulfillment of social and economic rights.

[5] For an alternative analysis of the self-ownership thesis from a neo-Marxist perspective, see Cohen (1995).

[6] Exponents of "analytical Marxism" are G.A. Cohen (1985), Roemer (1989,), Olin Wright (1998) and others; see Gargarello (1999).

A new perspective on social policy is that of rights-based development,[7] which sees individuals more as citizens with rights and duties than as consumers facing purely economic choices, although the two concepts need not be antagonistic. In this approach, the citizenry is composed of empowered people who actively participate in the design and oversight of the development projects and social programmes affecting them. Government and development agencies are seen as responsive to the claims of citizens for the delivery of social services. Accountability is critical in this approach. In addition, this approach views human rights as indivisible: economic, social, civic, political and cultural rights are seen as all inherent to the dignity of every person, and therefore they cannot be separated (Ackerman, 2004). This approach also put emphasis on the importance of power structures in society in explaining patterns of poverty and exclusion. Certain power structures –those which are more democratic, participatory and accountable– foster the protection of rights while other structures tend to dampen or deny their realization.

It should be noted that the fulfilment of rights assumes the existence of resources and institutional facilities or, in general, an effective democratic regime and social policy institutions that deliver the good or service implied by certain rights. Consequently, rights have an economic dimension as well as institutional and political scope.

1. Rights, resources and growth

When dealing with rights issues, economists instinctively focus on the resources needed to deliver the service or good deriving from a certain right. Trained to see the economic problem as "the allocation of scarce resources to multiple needs" (as defined by Lionel Robbins), the economist will point out the trade-offs involved in ensuring the enjoyment of various economic and social rights. Alternative ends compete for resources. For example, more resources devoted to health care will compete with the resources allocated to education or pensions. In turn, the financing of social services often involves taxation, lowering the return on productive assets and potentially hampering the process of economic growth and wealth creation.

Libertarian theory, with its emphasis on property rights, gives absolute priority to wealth creation,

although it is unclear that it takes only the protection of property rights for wealth creation to automatically flourish. A certain level of social equity and cohesion are also needed to give stability and credibility to the rules of the game. In contrast, liberal political theory seeks to balance economic and social rights with private property and political freedom. In practice this view provides the theoretical underpinnings for social-democratic capitalism. The economic correlate of Rawls in public policy is the welfare State, or a "developmental State" that taxes property and incomes to finance social expenditure and guarantee social benefits and social protection. The welfare state in Europe and the developmental State in Latin America and East Asia have historically used the instruments of taxes, transfers, regulation and public provision of education, health and pensions to provide the physical and human infrastructure needed by any economic system to operate. In addition, these policies, with all their limitations, serve as an instrument of social protection and training of human resources. From the standpoint of required conditions for wealth creation, the recent literature indicates that inequality can harm capital accumulation and productivity growth by various means, such as social polarization, higher taxation and the deterioration of capital-labour relations (Solimano, 1998).[8]

2. Rights, institutions and political regimes

Rights are closely linked to political regimes, institutions and social movements.[9] Historically, the

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[7] See Hausermann (1998), Ferguson (1999), Ackerman (2004), Nankani (2004) and Alsop and Norton, (2004).

[8] Centrally planned socialism is now discredited, as its historical record shows that the attainment of economic and social rights around the project of an egalitarian society required the virtual elimination of private property rights and a severe restriction of the political rights and freedoms that characterize a democracy. The economic result of the experiment, after an initial period of resource extensive growth, was stagnation and eventual economic collapse followed by political disintegration in the former Soviet Union and Eastern Europe. Social policy, under socialism, provided a high level of social protection around a modest standard of living.
[9] The concept of human rights and their implementation is the result of an evolutionary process. Voting rights have changed over time. In the nineteenth century, only people with a certain level of wealth could vote. Women's right to vote came after men's. Economic and social rights also evolved over time. Social security in the United Sates and the United Kingdom were instituted in response to the economic hardship people had to endure during the Great Depression and the Second World War. Implicit in the creation of these institutions was the belief that people had the right to at least a basic income level regardless of whether they were employed or not, and that the elderly could not be left to their own fate after a life of work. The point we want to emphasize here is that rights are a "social construction" that combines values, beliefs and social institutions.

movement towards political rights, supported by labour unions, social organizations of various kinds and left-wing political parties, can be seen as associated with the expansion of democracy. Political rights such freedom of speech, of forming political parties and of participating in elections, and civil rights such as freedom of association, assembly and demonstration, together with independent media and courts and religious freedom, are all part of the definition of a democracy (Yi Feng, 2003). So when we talk about political rights we implicitly refer to a specific type of political regime: democracy. In the case of economic and social rights, the relationship with the political regime is less direct, in principle. A right-wing authoritarian regime may defend property rights –an economic right– but at the same time deny civil rights and political freedoms. In turn, a classic socialist regime may enshrine social rights to education, employment, health and others but at the same time restrict property rights and political freedoms. Thus, although the concept of "indivisibility of rights" sounds appealing as a general principle, in practice the fulfillment of certain rights has been historically conditioned by the prevailing political regime.

There are various connections between democracy and the fulfillment of economic and social rights. Sen calls attention to the fact that famines tend to be avoided in democracies but tend to occur in non-democratic systems (Sen, 1999). In the African context, this author mentions that in the late 1970s and early 1980s famines occurred in Ethiopia and Sudan but were avoided in Botswana and Zimbabwe. At the time, the common factor in all four countries was a decline in food production; the difference was, according to the author, that in Botswana and Zimbabwe mechanisms of political accountability and an independent press forced authorities to prevent famines that, if they had occurred, could have been very damaging to the authorities at the time of elections. Those conditions apparently were not present in the former two countries.

The enforcement of rights involves an "agency problem". There is a beneficiary (principal), and there must be an institution (agent) to provide that beneficiary with the good or service. The right to health care, for example, necessitates an institution that provides health services; otherwise that right will represent a moral category devoid of operational content. The new literature on rights stresses the need to empower the beneficiaries of social services to demand better services and participate in the design, provision and evaluation of these services. The main purpose of the new social policies is to abandon paternalistic practices in the provision of social services and empower beneficiaries to demand social accountability from the authorities.[10]

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[10] Ackerman (2004) reviews four case studies of social accountability initiatives in social projects in Bangalore, India, Malawi, Indonesia and Peru. Some of these projects are funded and managed by non-governmental organizations or receive support from the World Bank. These social accountability initiatives are structured around "citizen scorecards", "community scorecards" and "social accountability systems". This methodology seeks to evaluate the degree of the recipients' satisfaction with the quality of social services such as public transport, telephone systems, electricity, water, waste disposal and others provided by the State at national, regional and local levels. The Ackerman study evaluates the scorecard methodologies from a "human rights perspective". This perspective is certainly more demanding than "simple" consumer satisfaction. In fact, the consumer bias of standard focus group exercises must be replaced by the concept of the *citizen*, endowed with rights and duties. Likewise, "consumer feedback" is to be extended to the accountability of public agencies, making them responsible for delivering social services in an effective and transparent way. In addition, social participation is to be fostered and power structures identified. The approach also calls attention to the need for citizens to organize to increase the impact of their voice in a forceful way and to influence the delivery of social services in a way consistent with citizens' rights.

IV

Options for Latin America:

new criteria for social policy

New and more balanced social polices for Latin America should recognize broader goals and a greater variety of instruments. Bringing the concept of social rights and rights-based development into the picture can help to reform current policies, provided that due attention is given to issues of resource-generation (essentially through economic growth), the devising of adequate social institutions that will carry out reformed social policies and the nurturing of public accountability, connecting beneficiaries with policy makers and agencies in charge of social policy. We can identify at least four areas in which social policies can be broadened:

(i) Define the right to a universal "minimum welfare level". In practice, this would ensure a level of income (or its equivalent in kind, such as food and other essential goods and social services) that meets the basic needs of all the population. The minimum income must be defined in per capita terms, and institutional measures will need to be put in place to reach the whole population, in particular children and other vulnerable individuals, through a combination of transfers, emergency employment programmes and the minimum wage. The evidence indicates that mothers and schools are often reliable intermediaries for providing aid to children. Other options can also be explored.

(ii) Bring in the middle class as a target of broader social policy. Devise education, health, housing and social security policies that consider the demands and specificities of the middle class, such as its quest for upward mobility and its role as a stabilizing segment in society.

(iii) Focus on the potential (and constraints) for the poor and the middle class to accumulate and own assets (housing, access to good quality education, capital and land). Broader access to asset accumulation by excluded sectors can help to mobilize hidden productive potential with positive effects on economic efficiency and growth.[11]

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[11] See the various essays in Olin Wright (1998) on "asset-based redistribution" and its economic and social effects.

(iv) Create and nurture social policy mechanisms of participation and democratic accountability.

1. Universal versus targeted systems

New principles of social policy aimed at universalizing benefits may increase the fiscal cost, but may also bring various economic and political benefits also worth considering. One rationale for targeting was that the cost of universal programmes was difficult for fiscally constrained governments to afford. Another rationale was the desire to use the scarce resources available to help the "really poor", implicitly assuming that the rest of the population would take care of their social situation by themselves. An increase in the number of beneficiaries would clearly increase the total fiscal costs of various social programmes; however, the administrative costs of managing a targeted system are not negligible either.

In fact, Moene and Wallerstein (1998), in discussing the Scandinavian case of universal coverage for social policies, note that managing a universal system may be less costly (per beneficiary) than managing a targeted system. Moreover, there are economies of scale and standardization of payments in the universal systems that the segmented or targeted systems do not have. Targeting poses considerable informational demands on social policy, since the identification of the "really poor" is not easy. In addition, reaching the really poor is a complex task because of lack of administrative capacities to locate the marginalized, who often reside in remote rural areas or urban slums). In general, the poor are often weakly organized. They have an insufficient capacity to formulate and implement the policies that affect them and to demand accountability for these policies. "Borderline cases" are not easy to manage either. For example, denying benefits to individuals whose incomes are only marginally above the cut-off criterion that is used to define the "really poor" may create understandable frustration and even resentment among the excluded populations. Moreover, targeting implicitly identifies the poor as passive beneficiaries,

or "victims of the system", rather than as agents or citizens with choices and rights (Solimano, 1998).

In principle, more universal social policies, or at least policies that reach the middle class more forcefully, could avoid several of these problems associated with targeting. Given the fiscal constraints involved, social benefits can be set in terms of an inverse relationship with the income level of the recipient, although the total elimination of the benefit at certain income level entails certain problems, as we have seen.

An important issue is the level of taxation compatible with universal benefits. In the Scandinavian system, where social policies are largely universalistic, the level of direct and indirect taxation is high but the quality of the social services provided by the State is also good. In Latin America, taxation is certainly lower than in the Scandinavian countries (and tax evasion is greater) but the coverage and quality of public services are also lower. In general, a targeted system and limited social benefits involve a lower tax burden than a social policy whose benefits are more universal. A lower level of taxation, by releasing income that would otherwise be paid out in taxes, will enable the individual or household to be free to choose the providers of education, health and pensions systems that they like and pay accordingly. Although individual choice is certainly a good thing, we cannot ignore the informational problems (let alone the income problem, assuming that the beneficiary has the income to pay for the service) of choosing among private providers of complex social services in societies, like those of Latin America, with a still modest tradition of consumer information and client protection. Also, the concentration of providers and the limited competition among them have raised the cost of delivering services. For example, the fees of private administrators of pension funds in Chile are notoriously high, owing to the limited competition and the small number of administrators in that market (Valdés, 2002).

2. Non-economic implications of universal social policies

A move to incorporate the middle class as a beneficiary of social policies may broaden political support for these policies. Targeted policies highlight a problem of incentives: the group that receives the benefits (the poor) is not the same one that pays for them (the middle and more affluent classes). Policies become more redistributive and therefore more conflictive. In turn, if those who pay the cost (i.e. taxes) also receive the

benefits of social policies, their support of those policies can be expected to increase. Also, the current experience with expensive social services provided by the private sector (typically health and pensions) whose benefits are limited to those with an ability to pay is leading people to seek alternative systems of delivery that could offer a more favourable cost-service combination.

In terms of political economy, stable, higher-income democracies often have a strong middle class and relatively low levels of inequality (Solimano, 2005b). In contrast, lower- or middle-income countries often have a weak middle class and more highly concentrated income distributions. The current pattern of expensive and better quality social services for the upper middle class and the rich provided by the private sector along with under-funded and modest quality public services for the poor and lower middle class is socially divisive. The political correlate of this system is popular dissatisfaction with current policies, potentially breeding volatile and populist politics. More universal social policies can strengthen social cohesion and stabilize politics, thereby favouring social peace and economic growth in a virtuous circle.

As we mentioned before in discussing new criteria for social policies, more emphasis should be placed on asset accumulation and ownership by the poor and the middle class as another component of renewed social policies. Sometimes this is called "asset-based redistribution" although the name is slightly inaccurate. The political consequences of asset-based redistribution may take various forms. If the policy is framed in terms of redistribution of *existing assets,* this policy can be politically conflictive, as the owners of capital, land and other assets will not want to give up the degree of social control and income that this ownership entails. Also, asset redistribution creates uncertainty over respect for property rights in the future that can be damaging to investment and innovation in a market economy.

Broader access to wealth accumulation by the poor and popular classes is a more promising approach in this regard, as it can be redistributive of the flows of assets (and not of stocks, which would reduce the zero-sum element of redistributing existing assets) and boost economic growth by unleashing more savings and investment on the part of excluded segments. This can become a powerful policy, for it empowers the recipients to successfully enter the job market, accumulate capital and effectively participate in policy-making. More democratic asset accumulation could be expected to have an economic pay-off and a political

dividend for democratizing the traditionally elitist Latin American societies. Access to capital by small-scale entrepreneurs and the poor is a redistributive policy in a dynamic sense, as it opens up access to capital accumulation by many individuals with entrepreneurial talent and a favourable attitude to risk-taking who are currently hampered by restricted access to capital markets oriented to large firms and individuals that are socially well connected. A more democratic access to finance can benefit the large segment of small and medium-scale enterprises and the poor who lack assets and collateral. All these policies, should generate greater political support, and if properly implemented, can match social equity with economic growth.

V

Social contracts in Latin America:

final remarks

Slow and volatile growth combined with persistent social inequality has led to high poverty levels and social fragmentation in Latin America. A redress of these social trends requires more growth and less inequality, among other things. At the same time, the current social policy approach, based on targeting "the poorest" and on privatized social services for those who can afford them, seems to be exacerbating social stratification in Latin American societies, with adverse effects on political stability. Problems of information, implementation and political economy are pervasive both in the practice of targeting of social benefits and in citizen choice between privately provided social services, although these are worthwhile concepts. Moreover, excessive segmentation in the quality and access of social services adversely affects the middle class, which pays taxes but receives reduced and lower quality social benefits.

A new social contract with a greater awareness of the social and economic rights of the poor and the middle class as a valid subject of the benefits of social policy may be a more promising avenue to explore. In order to be economically feasible, the new social contract must devise ways to accelerate growth on a sustained basis, mobilizing savings, investment and innovation potential from new sources traditionally excluded from the economic process. It is important to make the middle class a legitimate subject of social policies and broaden access by the poor and middle classes to asset and capital accumulation, since these groups have a reservoir of productive talent, entrepreneurship and innovation. Better and more inclusive economic and social policies will also help support the endemically weak Latin American democracies by strengthening the middle class, a traditionally stabilizing force.

ANNEX

TABLE A.1

Latin America (18 countries): incidence of poverty and critical poverty [a] 1980-2002

Year	Percentage of population in:					
	Poverty[b]			Critical poverty[c]		
	Total[d]	Urban	Rural	Total[d]	Urban	Rural
1980	40.5	29.8	59.9	18.6	10.6	32.7
1990	48.3	41.4	65.4	22.5	15.3	40.4
1997	43.5	36.5	63.0	19.0	12.3	37.6
1999	43.8	37.1	63.7	18.5	11.9	38.3
2000	42.5	35.9	62.5	18.1	11.7	37.8
2001	43.2	37.0	62.3	18.5	12.2	38.0
2002	44.0	38.4	61.8	19.4	13.5	37.9

Source: ECLAC (2003 p. 50).

[a] Estimates corresponding to 18 countries of the region including Haiti.
[b] Percentage of population with income below the poverty line.
[c] Percentage of population with income below the critical poverty line.
[d] Total averages are weighted by the shares of urban and rural populations in total population.

TABLE A.2

Latin America (18 countries): population living in poverty and critical poverty [a] 1980-2002

Year	Millions of persons					
	Poverty[b]			Critical poverty[c]		
	Total	Urban	Rural	Total	Urban	Rural
1980	135.9	62.9	73.0	62.4	22.5	39.9
1990	200.2	121.7	78.5	93.4	45.0	48.4
1997	203.8	125.7	78.2	88.8	42.2	46.6
1999	211.4	134.2	77.2	89.4	43.0	46.4
2000	207.1	131.8	75.3	88.4	42.8	45.6
2001	213.9	138.7	75.2	91.7	45.8	45.9
2002	221.4	146.7	74.8	97.4	51.6	45.8

Source: ECLAC (2003 p. 50).

[a] Estimates corresponding to 18 countries of the region including Haiti.
[b] Population with income below the poverty line.
[c] Population with income below the critical poverty line.

TABLE A.3

Latin America (12 countries): income distribution by households 1990 - 2002[a]

Country	Year	Share in total income of:		Ratio 10%/40%	Concentration index			
		40% poorest	10% richest		Gini	Logarithmic variance	Theil	Atkinson
Argentina[b]	1990	14.9	34.8	2.3	0.501	0.982	0.555	0.570
	1997	14.9	35.8	2.4	0.530	1.143	0.601	0.607
	1999	15.4	37.0	2.4	0.542	1.183	0.681	0.623
	2002	13.4	42.1	3.1	0.590	1.603	0.742	0.702
Bolivia	1989[c]	12.1	27.9	2.3	0.538	1.528	0.574	0.771
	1997	9.4	27.9	3.0	0.595	2.024	0.728	0.795
	1999	9.2	29.6	3.2	0.586	2.548	0.658	0.867
	2002	9.5	28.3	3.0	0.614	2.510	0.776	0.865
Brazil	1990	9.5	43.9	4.6	0.627	1.938	0.816	0.790
	1996	9.9	46.0	4.6	0.638	1.962	0.871	0.762
	1999	10.1	47.1	4.7	0.640	1.913	0.914	0.754
	2001	10.2	46.8	4.6	0.639	1.925	0.914	0.760
Chile	1990	13.2	40.7	3.1	0.554	1.258	0.644	0.671
	1996	13.1	40.2	3.1	0.553	1.261	0.630	0.667
	2000	13.8	40.3	2.9	0.559	1.278	0.666	0.658
Colombia	1994	10.0	41.8	4.2	0.601	2.042	0.794	0.817
	1997	12.5	40.1	3.2	0.569	1.399	0.857	0.822
	1999	12.3	40.1	3.3	0.572	1.456	0.734	0.945
	2002[d]	11.9	39.1	3.3	0.575	1.413	0.714	0.701

TABLE A.3 *(continued)*

Country	Year	Share in total income of:		Ratio 10%/40%	Concentration index			
		40% poorest	10% richest		Gini	Logarithmic variance	Theil	Atkinson
Costa Rica	1990	16.7	25.6	1.5	0.438	0.833	0.328	0.539
	1997	16.5	27.3	1.7	0.450	0.860	0.356	0.535
	1999	15.3	29.4	1.9	0.473	0.974	0.395	0.573
	2002	14.5	30.2	2.1	0.488	1.080	0.440	0.646
Ecuador[d]	1990	16.7	25.6	1.5	0.461	0.823	0.403	0.591
	1997	16.5	27.3	1.7	0.469	0.832	0.409	0.510
	1999	15.3	29.4	1.9	0.521	1.075	0.567	0.597
	2002	14.5	30.2	2.1	0.513	1.031	0.563	0.593
Mexico	1989	15.8	36.6	2.3	0.536	1.096	0.680	0.598
	1998	15.1	36.7	2.4	0.539	1.142	0.634	0.599
	2000	14.6	36.4	2.5	0.542	1.221	0.603	0.621
	2002	15.7	33.2	2.1	0.514	1.045	0.521	0.571
Peru	1997	13.4	33.3	2.5	0.532	1.348	0.567	0.663
	1999	13.4	36.5	2.7	0.545	1.358	0.599	0.673
	2001	13.4	33.5	2.5	0.525	1.219	0.556	0.636
Dominican Republic	2000	11.4	38.8	3.4	0.554	1.250	0.583	0.635
	2002	12.0	38.3	3.2	0.544	1.216	0.570	0.637
Uruguay[d]	1990	20.1	31.2	1.6	0.492	0.812	0.699	0.519
	1997	22.0	25.8	1.2	0.430	0.730	0.336	0.475
	1999	21.6	27.0	1.3	0.440	0.764	0.354	0.483
	2002	21.6	27.3	1.3	0.455	0.802	0.385	0.661
Venezuela (Bolivarian Republic of)	1990	16.7	28.7	1.7	0.471	0.930	0.416	0.545
	1997	14.7	32.8	2.2	0.507	1.223	0.508	0.985
	1999	14.6	31.4	2.2	0.498	1.134	0.464	0.664
	2002	14.3	31.3	2.2	0.500	1.122	0.456	0.866

Source: ECLAC (2003 pp. 73-74).

[a] Country households sorted by per capita income.
[b] Greater Buenos Aires.
[c] Eight main cities and El Alto.
[d] Urban total.

TABLE A.4

Latin America (12 countries): evolution of GDP per capita income and urban unemployment

Country	Year	Per capita GDP (in 1995 US dollars)[a]	Per capita income (in 1995 US dollars)	Urban Unemployment (percentage)
Argentina	1990	5 545	5 291	7.4
	1999	7 435	7 183	14.3
	2000	7 283	7 095	15.1
	2001	6 875	6 645	17.4
	2002	6 055	5 824	19.7
Bolivia	1989	804	821	10.2
	1999	941	961	8
	2000	941	959	7.5
	2001	934	950	8.5
	2002	938	930	8.7

TABLE A.4 *(continued)*

Country	Year	Per capita GDP (in 1995 US dollars) [a]	Per capita income (in 1995 US dollars)	Urban Unemployment (percentage)
Brazil	1990	3 859	3 733	4.3
	1999	4 217	4 057	7.6
	2000	4 328	4 180	7.1
	2001	4 335	4 155	6.2
	2002	4 340	4 163	7.1
Chile	1990	3 779	5 311	7.8[b]
	1999	5 631	5 299	9.8[b]
	2000	5 792	5 459	9.2[b]
	2001	5 902	5 475	9.1[b]
	2002	5 952	5 560	9.0[b]
Colombia	1991	2 158	2 142	10.5
	1999	2 272	2 232	19.4
	2000	2 288	2 222	17.2
	2001	2 282	2 205	18.2
	2002	2 277	2 216	17.6
Costa Rica	1990	2 960	2 870	5.4
	1999	3 793	3 379	6.2
	2000	3 775	3 359	5.3
	2001	3 741	3 506	5.8
	2002	3 762	3 558	6.8
Ecuador	1990	1 670	1 588	6.1
	1999	1 699	1 627	14.4
	2000	1 682	1 677	14.1
	2001	1 742	1 689	10.4
	2002	1 776	1 740	8.6
Mexico	1989	3 925	3 853	2.7
	1998	4 484	4 430	3.2
	2000	4 813	4 878	2.2
	2001	4 720	4 810	2.5
	2002	4 690	4 813	2.7
Peru	1990	1 879	1 795	8.3
	1999	2 310	2 236	9.2
	2000	2 330	2 227	8.5
	2001	2 290	2 179	9.3
	2002	2 376	2 258	9.4
Dominican Republic	1990	1 378	1 380	…
	1998	1 831	2 009	14.3[b]
	2000	2 052	2 207	13.9[b]
	2001	2 079	2 274	15.4[b]
	2002	2 133	2 334	16.1[b]
Uruguay	1990	4 707	4 577	8.5
	1999	5 984	5 917	11.3
	2000	5 826	5 668	13.6
	2001	5 580	5 413	15.3
	2002	4 946	4 778	17.0
Venezuela (Bolivarian Republic of)	1990	3 045	3 310	10.4[b]
	1999	3 028	3 003	14.9[b]
	2000	3 082	3 519	13.9[b]
	2001	3 130	3 292	13.3[b]
	2002	2 796	2 929	15.8[b]

Source: ECLAC (2003, pp. 239-240).

[a] Refers to the real gross national income per capita.
[b] National total.

TABLE A.5

**Latin America and the Caribbean (12 countries):
minimum wage and per capita GDP 2002**

Country	Monthly minimum wage (in 2002 US dollars)[a]	Urban poverty line (in US dollars)[b]
Bolivia	60.0	49.8
Brazil	68.5	53.5
Chile	161.4	62.5
Colombia	123.4	70.0
Cuba	-	-
Ecuador	128.0	73.3
El Salvador	109.1	72.4
Guatemala	115.1	85.9
Honduras	127.7	89.6
Mexico	123.4	153.9
Peru	116.6	64.2
Uruguay	52.2	75.0

Source: ECLAC (2003 p. 200).

[a] Calculated with the "rf" series of the International Monetary Fund (IMF) with the exception of Guatemala for which the "wf" series was used.

[b] The values of poverty lines around 1999 were converted to 2002 prices on the basis of annually averaged general price index available in the online database of IMF (http://imfstatistics.org) because the food consumer price index which is more suited to this type of updating is not available.

TABLE A.6

Latin America (12 countries): social public spending
(as percentage of GDP)

Country	1990-1991	1992-1993	1994-1995	1996-1997	1998-1999	2000-2001
Argentina	19.3	20.1	21.1	20.0	20.8	21.6
Bolivia [a]	…	…	12.4	14.6	16.3	17.9
Brazil	18.1	17.7	19.3	17.3	19.3	18.8
Chile	11.7	12.4	12.3	13.0	14.7	16.0
Colombia	6.8	8.1	11.5	15.3	14.0	13.6
Costa Rica	15.6	15.2	15.8	16.8	16.4	18.2
Ecuador [b]	5.5	5.8	7.4	8.2	8.1	8.8
Mexico	6.5	8.1	8.8	8.5	9.2	9.8
Peru	4.0	5.3	6.7	7.1	7.7	8.0
Dominican Republic	4.3	5.9	6.1	6.0	6.6	7.6
Uruguay	16.9	18.9	20.3	21.3	22.8	23.5
Venezuela (Bolivarian Republic of)	8.5	8.9	7.6	8.3	8.4	11.3
Latin America [c]	10.1	10.9	11.7	12.1	12.8	13.8

Source: ECLAC (2003 p. 176).

[a] The numbers in the column 1994-1995 correspond to 1995.

[b] The numbers in the column 1990-1991 correspond to 1991, and in the column 2000-2001 to 2000.

[c] Simple average of countries excluding Bolivia and El Salvador. The average for Latin America and the Caribbean, if these countries were included, would be 11.3%, 11.7%, 12.5% and 13.5% for the columns 1994-1995, 1996-1997, 1998-1999, and 2000-2001, respectively.

TABLE A.7

**Latin America (12 countries): rate of growth of GDP
and per capita GDP 1980-2003**

(exchange rate in percentages)

Country	1980-1989	1990-1999	2000	2001	2002	2003
			GDP[a]			
Argentina	-0.49	4.10	-0.83	-4.44	-10.81	5.45
Bolivia	-0.42	4.00	2.27	1.65	2.74	2.00
Brazil	3.02	1.77	3.97	1.46	1.39	1.50
Chile	3.42	5.88	4.18	3.17	2.07	3.50
Colombia	3.73	2.61	-0.51	1.92	1.75	4.96
Costa Rica	2.08	5.25	1.79	1.21	2.85	4.21
Ecuador	2.15	2.43	0.88	5.46	3.80	1.50
Mexico	2.11	3.41	6.73	-0.29	0.83	1.50
Peru	0.09	3.26	2.72	0.22	4.87	3.45
Dominican Republic	3.62	4.62	7.32	2.99	4.33	-1.00
Uruguay	1.07	3.20	-1.93	-3.54	-10.74	-2.50
Venezuela (Bolivarian Rep. of)	-0.70	2.62	3.77	3.48	-8.99	-13.00
Average	*1.64*	*3.59*	*2.53*	*1.11*	*-0.49*	*0.96*
			GDP per capita[b]			
Argentina	-1.33	2.74	-2.04	-5.60	-11.88	4.19
Bolivia	-3.00	1.60	-0.10	-0.67	0.41	-0.27
Brazil	0.92	0.29	2.63	0.17	0.12	0.25
Chile	2.33	4.26	2.86	1.89	0.85	2.29
Colombia	1.69	0.65	-2.29	0.15	0.01	3.20
Costa Rica	-1.36	2.68	-0.46	-0.89	0.81	2.26
Ecuador	1.04	0.27	-1.00	3.55	1.95	-0.26
Mexico	-0.22	1.61	5.10	-1.77	-0.63	0.07
Peru	-0.97	1.42	1.08	-1.33	3.29	1.93
Dominican Republic	1.17	2.82	5.53	1.30	2.63	-2.59
Uruguay	0.41	2.47	-2.63	-4.23	-11.38	-3.16
Venezuela (Bolivarian Rep. of)	-2.50	0.38	1.78	1.54	-10.67	-14.57
Average	-0.15	1.77	0.87	-0.49	-2.04	-0.55

Source: Prepared by the author.

[a] In millions of 1995 US dollars.

[b] Millions of people at mid-year.

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Health-care financing and equity:

public insurance in Chile

Rafael Urriola Urbina

This article sets out to examine the sources of health-care financing and their use, drawing on the health system accounts available in Chile; the role of public spending at the present time and its effect in reducing inequities in the Chilean system; and the distribution of health-care provision by income level in the population. Solidarity and equity seem to be peculiar to the public sector, although even there equity is found only in certain types of health-care provision. The article then goes on to analyse three public insurance (National Health Fund) programmes designed to reduce inequities in health-care access, which have acted as a test bed for the current Health Reform Plan in Chile; it reviews the central component of that reform, the Plan for Universal Access with Explicit Guarantees (Plan AUGE), which was approved in 2005 and has begun to be gradually applied; and it describes aspects of financial equity.

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I

Introduction

Health system reforms have been in progress around the world for over a decade. Interestingly, these reforms have been taking place simultaneously in countries with differing development levels, with health-care institutions that have developed in a variety of ways, with contrasting approaches to and general conceptions of health system organization, and with methodologies that combine instruments and institutions in very diverse ways.

Everything seems to show that there is no one "right" institutional solution, no single "winning" model that can be applied in all situations to resolve today's health-care challenges, in particular the increased demand for medical provision. This increase, and the longer time period over which demand operates, has led to health expenditure (both individual and institutional) growing faster on average than overall spending by the population.

The fact is that there is a strong positive correlation between countries' general economic development, health expenditure and life expectancy (WHO, 2004). The goal, then, is to strike a virtuous balance between excellence in health care and budgetary effectiveness.

This article sets out to examine the fiscal contribution and some programmes in the Chilean health sector that have had strong effects on equity in

access to health-care goods and services. Following this introduction, section II looks at overall health spending in Chile and its financing sources, highlighting the duality between the country's public and private insurance schemes. It also describes inequalities in access to health-care goods and services that the country's health systems, as now constituted, are incapable of resolving. Section III describes some special programmes whose distinguishing feature is that they target provision and resources on very needy groups. Although from a general health-care point of view it is desirable for provision to be universalized, this kind of piecemeal coverage does mean that assistance can be provided to those whose low incomes would otherwise debar them from seeking treatment. By way of example, three programmes of this type are examined: Medical Loans (Préstamos Médicos), Catastrophe Insurance (Seguro Catastrófico) and the Older Adult Programme (Programa Adulto Mayor). Section IV reviews the new Plan for Universal Access with Explicit Guarantees (Plan de Acceso Universal con Garantías Explícitas (Plan AUGE)), which universalizes coverage of 56 medical conditions by the public insurance system and private insurers. Section V analyses aspects of financial equity. Lastly, section VI offers some conclusions.

II

Public health financing and equity

Concern about rising health-care costs has led to a wide debate, and there have been those in Chile who have ascribed purely financial motives (in particular, the reduction of public expenditure) to the recent reforms, ignoring or downplaying their public health objectives. Public administration must always involve tight spending controls, but in this case it should not be forgotten that, while public-sector health spending increased by 286% in real terms in the 1990s, GDP also rose considerably over the same period (by about 100%).

According to recent studies correlating GDP with health-care expenditure over long periods, the latter tends to grow faster than GDP in the early stage of development and then to converge with and even grow more slowly than it in subsequent stages (López Casasnovas, 2004). Chile is probably in the early phase described for the European Union in the study cited.

For a comparative examination of health spending in relation to the institutional configuration of each country, this spending needs to be broken down by financing source: first, the direct fiscal contribution,

plus contributions from municipalities which supplement that from the State budget; second, the health insurance contributions that people are obliged by law to pay to the public insurance fund (the National Health Fund (FONASA)) or private health insurance institutions (Isapres), plus compulsory contributions to *mutuales* (mutual support societies) to cover occupational accidents.

Private health expenditure, meanwhile, includes all forms of individual or group insurance designed to cover health problems, plus additional voluntary contributions by subscribers and out-of-pocket expenditure, which strictly speaking is that which beneficiaries carry out themselves without reimbursement because they are wholly or partially uninsured.

Table 1 shows the distribution of spending in Chile in 2003 (Urriola, 2004). What is most significant is that the direct fiscal contribution had to be increased greatly (by 32%) between 2000 and 2003 to make up for health-care shortcomings (Comisión de Reforma, 2003). In 2003, the public contribution accounted for 67.1% of total health expenditure.

TABLE 1

Chile: Health system accounts, 2003
(*Millions of current pesos*)

Providers[a]	Public sector					Private sector				Total
	Direct subsidy		Compulsory contributions			Out-of-pocket spending				
	Fiscal	Municipal	FONASA	Friendly societies (*mutuales*)	Isapres	Voluntary contribs. to Isapres	Services copay-ments	Drugs copay-ments	Other directs	
Public sector	544 778	44 051	350 766	3 638	16 415	5 311	0	0	73 018	1 037 977
SNSS establishments	455 545		339 100						65 697	860 342
Municipal PHC		44 051								44 051
ISP	3 072		199						4 177	7 448
Hospitals run by armed forces and by Orden	82 564									82 564
Hospital J.J. Aguirre	3 597		11 467	3 638	16 415	5 311			3 144	43 572
Private sector	0	0	119 762	116 494	343 742	147 484	265 895	0	32 539	1 025 916
Hospitals, clinics and professionals			119 762		343 742	147 484	265 895		32 539	909 422
Friendly societies				116 494						116 494
Administration	0	0	16 494	15 835	76 575	32 506	0	0	0	141 410
FONASA			16 494							16 494
Isapres					76 575	32 506				109 081
Friendly societies				15 835						15 835
Health authority	115 816									115 816
Pharmacies	101 009	0					0	363 296	0	464 305
Public spending	101 009									101 009
Private spending								363 296		363 296
Unassigned				5 446	3 777	1 603				*10 826*
Total	*761 603*	*44 051*	*487 022*	*141 413*	*440 509*	*186 904*	*265 895*	*363 296*	*105 557*	*2 796 250*
%	27.2%	1.6%	17.4%	5.1%	15.8%	6.7%	9.5%	13.0%	3.8%	100.0%

Source: Urriola (2004).

[a] SNSS: Sistema Nacional de Servicios de Salud (National System of Health Services). PHC: primary health care. ISP: Instituto de Salud Pública de Chile (Public Health Institute). FONASA: Fondo Nacional de Salud (National Health Fund). Isapres: Instituciones de Salud Previsional (private health insurance institutions).

According to official statistics (FONASA, 2004a), the number of people in the public insurance scheme[1] increased by about 6% in the 1990s and comprised 67% of the population, while the direct fiscal contribution increased by 286% in real terms over the same period, as already mentioned. This might seem excessive at first sight, but in fact it represents a deliberate effort to make up for low government health spending in the 1980s. Even as it is, average annual health expenditure per inhabitant in Chile is just US$ 139, according to the World Health Organization (WHO), which is much less than in Argentina or Uruguay and similar to the level in Mexico (table 2).

Because of the rise in fiscal spending, the public health sector in Chile has achieved greater equity in recent years. There is a further justification for the increase, which is that average revenues from individual contributions differ enormously between the public and private systems. In 2003, average contributions per beneficiary were 46,032 pesos[2] in the public insurance system and 161,427 pesos in the private system. The direct fiscal contribution increased the average per capita revenue available in the public system to 114,377 pesos, i.e., its net impact was to reduce inequalities between the public and private sectors.[3]

The revenue gap between the public insurance system and private insurers is also due to the fact that the State takes responsibility for the 20% or so of the population who declare they have no income (at least no stable income), and that it is necessarily the repository for those excluded from the Isapres because of the "skimming"[4] these carry out among potential subscribers.

There are various indicators for rating people by risk. Table 3 shows that higher-risk groups (children and older adults) are predominantly enrolled in FONASA.

TABLE 2

Various countries: Government health spending in dollars between 1997 and 2001
(Dollar average per inhabitant, at the average exchange rate)

| Country	Government health spending in dollars per inhabitant (average between 1997 and 2001)
Argentina	380
Chile	139
Spain	786
United States	1 939
Mexico	133
Portugal	639
Singapore	326
Uruguay	295

Source: WHO (2004).

For example, the public sector covers a very high proportion of older adults (92%), this being the most vulnerable group in Chile and indeed in most Latin American countries. This is an instance of what has been called sociodemographic vulnerability, i.e., "a syndrome combining potentially adverse sociodemographic events (risks), incapacity to respond to the materialization of those risks, and inability to adapt actively to the new situation generated by that materialization" (ECLAC, 2002).

Where health is concerned, the vulnerability of older adults derives from the increasing need for health services with age, a lack of active social security to provide them with adequate incomes, and the weaknesses of public and private infrastructure when it comes to coping with differentiated demand. These are urgent challenges for the region in the immediate future.

The financial proof of this vulnerability (incapacity to respond) can be found in the incomes of the country's pensioners (retirees) in 2003. The pensions curve in figure 1 shows that 60% of them receive incomes of less than 81,457 pesos a month.

FIGURE 1

Chile: Monthly pensioner incomes, by income band, 2003
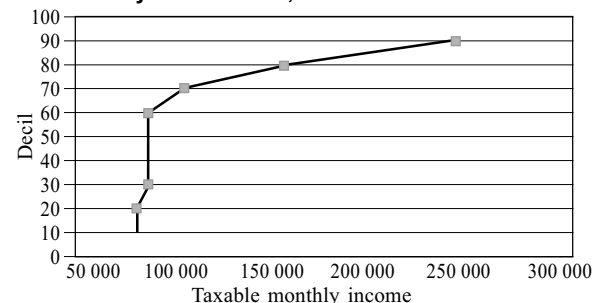
Source: Angulo and Urriola, 2004.

TABLE 3

**Chile: Age and sex distribution of the population,
by insurance type, 2001**

Age group	National Health Fund (FONASA)			Subscribers to private health subscribers insurance institutions (Isapres)		
	Men	Women	FONASA total	Men	Women	Isapre total
0 - 4	450 725	436 096	886 821	135 343	126 862	262 205
5 - 19	1 515 551	1 434 176	2 949 727	411 002	392 716	803 718
20 - 44	1 623 376	1 984 338	3 607 714	636 280	625 645	1 261 925
45 - 64	813 634	988 553	1 802 187	244 436	258 016	502 452
65 and over	370 204	539 711	909 915	37 206	43 282	80 488
Total	*4 773 490*	*5 382 874*	*10 156 364*	*1 464 267*	*1 446 521*	*2 910 788*

Source: FONASA Subdepartamento de Estudios.

To sum up, the State is mainly required to cover those at highest risk: older adults, women of childbearing age, and those with chronic illnesses.

From the general perspective of a mixed (public/private) health system like Chile's, it might be concluded that the existence of private-sector provision has led to: i) greater competition, both because of the tendency for health-care charges to even out between the public and private insurers[5] and because the public sector has been forced to modernize, something that is reflected in rising approval ratings for public-sector provision in surveys; ii) a 30% increase in the voluntary contributions made by subscribers to private insurance policies on top of their compulsory contributions (table 1), enabling the quality of plans to be improved for those with "normal" risk levels; and iii) an improvement in the country's general health infrastructure.

The criticisms made of this mixed system are also telling, however: it is charged with i) increasing the level of inequity, because the public sector takes in the poorest, most vulnerable and most "expensive" individuals, which means it is neither limiting the "skimming" carried out by private insurers nor using pooled inter-institutional solidarity funds to provide compensatory financing; ii) displaying, as is recognized, a degree of arbitrariness in the costs of individual plans, since information asymmetries make it very difficult to choose properly between health plans when there are thousands of options available; iii) creating superfluous and costly marketing competition

that drives up private-sector costs;[6] and iv) making it hard or impossible to optimize overall health planning, since there is the element of uncertainty represented by those who may move from one subsystem to the other.

Lastly, the public and private sectors differ in the way they cover spending on drugs (other than those included in Plan AUGE). Whereas the private-sector insurers' plans never include medicines, the public insurer does cover them in the case of primary care for category A and B FONASA users, i.e., the indigent and those earning up to one minimum wage.[7] Of total spending on medicines, in fact, about 22% comes from the public sector and the rest is private spending. According to regional estimates (table 4), drug spending in Chile is below the regional average, although it represents about 16% of total health spending.

More generally, accepting that out-of-pocket spending is detrimental to equity, it should be noted that about 10% of the population in Chile does not appear in the health insurance coverage figures, while in Latin America the percentage of people without cover is put at 25% (Titelman and Uthoff, 2000).

Reducing out-of-pocket spending is also a goal of the current reforms. To do this, it will be necessary to increase coverage and exert better control over the way medicines are administered, particularly where the use of generic and alternative drugs is concerned. In Chile, generic drugs account for 41% of

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[5] The public insurance agency acts as a regulator in this respect, particularly where the cost of consultations is concerned, since the different types of provision have fixed levels of coverage set annually in advance.

[6] In 2003, per capita administration costs were 1,559 pesos in FONASA and 39,970 pesos in the Isapres, i.e., 26 times as high.

[7] Often, however, surgeries do not have enough drugs available and users have to buy them for themselves in private-sector pharmacies.

TABLE 4

Ten countries and one region of Latin America: Drug spending and consumption (2003)

Country	Total spending (millions of dollars)	2001 population (thousands)	Per capita consumption (units)
Argentina	3 656	37 487	9
Brazil	4 939	172 891	7
Chile	513[a]	15 402	11
Colombia	915	43 070	7
Ecuador	426	12 880	9
Mexico	6 605	100 373	10
Peru	335	26 090	2
Dominican Republic	252	8 624	4
Uruguay	262	3 361	15
Venezuela (Bolivarian Republic of)	1 775	24 632	14
Central America	654	55 658	2
Total	*20 332*	*500 468*	*7*

Source: IMS Health (undated).

[a] This figure does not match that of table 1. We believe that the difference is essentially due to the fact that this table does not include public drugs spending.

consumption in unit terms, and for just 8% of total drugs spending (IMS, 2004).

Reforms, however, have tended to increase copayments (included in out-of-pocket expenditure) with a view to reducing "moral hazard". No-one has yet shown convincingly, however, how high copayments can go before they lead to exclusion.

It has been argued that where there is no guarantee of universal access to health services, rules are needed to mitigate the disadvantages of those who have no certainty of receiving prompt treatment because they have no resources to spare. What this amounts to is a suggestion that copayments be reduced, at least for the worse-off. Here, the dichotomy of "Isapres for the rich and FONASA for the poor" (Sapelli and Torche, 1997), besides its somewhat pejorative connotations, does convey the fact that solidarity and equity are peculiar to the public sector, although the equity (as will be seen) is incomplete, i.e., it is segmented by type of service. The findings of a recent study (Van Doorslaer and Masseria, 2004) carried out at the Organisation for Economic Co-operation and Development (OECD) bear out the claim just quoted.

1. Income levels and the demand for services

Analyses of demand always differentiate demand for services by household income levels (Mahieu, 2000; Titelman, 1999). To this end, the population is grouped by income quintiles[8] to ascertain whether there are significant differences by stratum in health service demand.

Table 5 suggests a number of conclusions. First, in Chile the block of services constituted by primary care (check-ups and general consultations) and emergency care has achieved a level of coverage such that there is no discrimination in access by income quintile. This is not the case, though, with the second block of services: specialist consultations, dental care, laboratory tests and imaging services (X-rays and ultrasound).

When the quintile averages are compared, it transpires that lower-income households actually receive more services in the first block, so that the percentage deviation from the mean in the demand for these services is higher in the low-income quintiles. This indicates that these strata face no restrictions on access to such services; indeed, the question arises as to whether the effect known as "moral hazard" (the tendency for services to be used wastefully when they are cheap or free) does not arise in this situation.[9]

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[8] This grouping has been carried out directly by the Ministry of Planning (MIDEPLAN) in its database, using only autonomous household incomes.

[9] See Sapelli and Vial (2001) for a discussion of the Chilean situation.

In the second block of services, on the other hand, those without resources (in particular, those in FONASA categories A and B) either have to face excessively long waiting lists or times for medical attention or else pay all or part of the cost themselves it they wish to be treated promptly. As soon as any payment is required, there is a striking reduction in demand from the first two income quintiles, presumably because they cannot afford the cost of prompt treatment and so refrain from using services (table 5).

Proportionately, types of provision at which the public service excels in terms of efficacy, coverage and timeliness are used more by lower-income sectors than by higher-income ones. One hypothesis that should be considered here, of course, is that people in these sectors over-react to possible illnesses. There is a good deal of evidence that demand for emergency treatment is often driven more by individual perceptions than by the existence of what might be clinically understood as an emergency, and that a substantial proportion of such treatment could have been provided in a normal primary care setting.

Nonetheless, it has been estimated (Ipinza, 2004) that in 2002 the staffs of health-care professionals at municipally-run primary care establishments (public system) were 50% under strength, which would account for the "flight" of patients at that level. This is compounded by the saturation of treatment facilities, as revealed by the fact that 24 treatment centres have more than 40,000 people registered with them (Ministerio de Salud, 2002b). Together, these two situations help to account for the overloading of the country's emergency services.

In the case of dental care, laboratory tests and imaging, differences in demand by income quintile appear to be due to low-income sectors having to go

TABLE 5

Chile: Deviation of demand from the mean, by provision type, in the bottom two income quintiles and the top two quintiles
(Percentages)

Provision type	Low-income 40%	High-income 40%
Preventive health check-up	12.9	-17.4
General consultation	5.3	-7.7
Emergency consultation	17.7	-33.4
Specialist consultation	-25.7	16.6
Dental care	-28.6	18.3
Laboratory tests	-11.8	8.6
X-rays or ultrasound	-25.2	10.6

Source: Prepared by the author using data from the National Socio-economic Survey (Encuesta de Caracterización Socioeconómica Nacional (CASEN)), 2000.

without these services because they simply cannot afford them.

Where specialist consultations are concerned, on the other hand, more information is needed before any conclusions can be ventured, since there is also evidence that groups with full medical coverage make use of such consultations without professional referral. The "filter" of referral, which is applied in various countries, has proved effective at holding down unnecessary spending on this type of provision.[10]

The information given in table 5, then, shows horizontal inequity in Chile, i.e., the extent to which people with the same need for health services have different utilization rates. This inequity is plain to see in the specialist consultations, dental care and imaging block, but it is reduced by public action, as the following section explains.

[10] The health reform operating in France since January 2005 makes it more expensive for people to go to specialists if they do not have a referral from the primary care level.

III

Public programmes to reduce

health-care inequity

This section looks at three special FONASA programmes that positively target their beneficiary income groups. These are the programmes known as Préstamos Médicos (Medical Loans), Seguro Catastrófico (Catastrophe Insurance) and Programa Adulto Mayor (Older Adult Programme), whose equity goals have since been adopted by Plan AUGE (analysed in section IV below).

1. Medical Loans

Medical Loans, also known as "health loans", are part of the sphere of action of the National Health Plan. They are provided by FONASA to low-income beneficiaries to finance all or part of the amount they are required to pay for health services received from the public-sector provider or from private-sector providers.

Health loans are very important, since they are extraordinary in nature and may be granted to deal with situations where lives are at risk. They can cover:

– The whole of the copayment for services that qualify as emergency treatment or for medicines provided in the specialist surgeries of public establishments

– Up to 42.5% of the total level 1 value of medical care resulting in a programme of treatment or acquisition of orthoses

– Acquisition of prostheses (optical lenses and hearing aids, for example)

– Hospitalization (one night minimum)

– Psychiatric and radiotherapy treatments

– 100% financing for patients undergoing dialysis (this category, now part of Plan AUGE, accounted for the bulk of this type of financing until 2002)

– Surgical operations included in the "Su Cuenta Conocida" ("Know Your Bill") system of Diagnosis-Linked Payment (Pago Asociado a Diagnóstico (PAD))[11]

The baskets of services covered by this method (all subsequently included in Plan AUGE) are:

– PAD Cataracts basket

– PAD Childbirth basket

– PAD Gallstones basket

– PAD Prostatic Hyperplasia basket

Loans may be applied for by FONASA subscribers and their legal dependants (table 6).[12]

As table 6 shows, it is the lower-income groups that are the main recipients of these loans. Furthermore, according to the same source as was used for the table, pensioners and older adults receive 76% and 54%, respectively, of the funds allocated through this mechanism, which confirms that these loans play a compensating role conducive to greater equity.

The principle of gradualism that has been applied in the Chilean health reform is illustrated by the following: in 2003, the amount of PAD resources allocated to the PAD Cataracts and PAD Childbirth baskets fell, essentially because charges were cut and allowances increased for both of these. Then in July 2005, when Plan AUGE had institutionalized medical conditions, broadened coverage and established an enforceable and universal right to treatment for new health problems (see section IV below), these baskets were included in that Plan, so that exceptionality was eliminated as a mechanism for resolving situations of exclusion caused by lack of resources.

2. Catastrophe Insurance

In the mid-1990s the health authorities drew up a register of complex treatment, characterized as being of high cost, being provided by highly specialized professionals, requiring sophisticated and expensive technological support, and accounting for a large proportion of the total spending of public health

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[11] Diagnosis-Linked Payment (PAD) is a payment mechanism used by FONASA in Chile. It is an arrangement between the insurer and the provider whereby payment is made for a fixed sum covering a

set of medical services so that a particular medical condition or diagnosis can be resolved in its entirety.

[12] Those qualifying as indigent (group A) are entitled to free care. Loans are for those who have some income, and are thus required to make a copayment.

TABLE 6

**Chile: Medical loans granted, by beneficiary
income band, 1999 to August 2004**

Income band (in pesos)	Number of loans	Total amount (millions of pesos)	Amount as % of total
0 - 50 000	8 172	8 129	6.6
50 000 - 75 000	24 953	25 920	21.2
75 000 - 100 000	32 616	47 401	38.6
100 000 - 150 000	32 309	19 519	15.9
150 000 - 200 000	20 381	7 447	6.1
200 000 - 250 000	12 510	4 433	3.6
250 000 - 300 000	7 402	3 019	2.5
Over 300 000	13 283	6 983	5.7
Total	*15 626*	*122 850*	*100*

Source: National Health Fund (FONASA) Departamento de Finanzas.

establishments (for which reason waiting lists had been rising sharply) (Jarpa, 2005).

With this information the authorities sought, first of all, to create a programme that would link health priorities to the payment mechanisms in use, with a view to reducing the disincentives to higher-cost treatment provision in the public services, such as the fear of being "marked down" for increasing hospital debt.

A resolution of the Ministry of Health and Treasury (Resolución Exenta 1885 of 28 November 1997) provided guarantes of free treatment for the first medical conditions to be covered by what was legally known at that time as Catastrophe Insurance (Seguro Catastrófico). Products or baskets of products benefiting from PAD financing were defined for this purpose, including medical services (bed/days, tests and procedures, surgery), frequency of use, unit prices and total cost. These baskets (groups of services) were compiled on the basis of expert opinion and reviews of clinical records, supported by Chilean and international studies.

Thus, as health services came to be reimbursed at actual prices for treating the medical conditions now termed catastrophic, they no longer had any reason to maintain long waiting lists. The beneficiaries of Catastrophe Insurance, meanwhile, began to receive 100% financial coverage, with no additional payments. In addition, what was later to become one of the core principles of the health reform began to become established: guaranteed treatment times, along with preferential attention as better information on user rights, a telephone assistance service and a gradually developing complaints system became available.

As table 7 shows, most of the diseases originally covered by Catastrophe Insurance were subsequently "universalized" in Plan AUGE.

AIDS was included among these diseases in 2001, and it too was then covered by Plan AUGE. In 2003, the bulk of the medical services[13] provided consisted in palliative care (45,712), antineoplastic drugs from the National Antineoplastic Drugs Programme (Programa Nacional de Drogas Antineoplásicas) (11,328), complex cancer tests (8,300) and cervical cancer treatments (7,802). The largest spending items, on the other hand, were dialysis (10.25 billion pesos), heart surgery (9.854 billion pesos) and AIDS (8.83 billion pesos).

Between early 1999 and late 2004, about US$ 350 million were spent on relieving the financial impact of medical conditions affecting over 200,000 people. In most cases, these costs could not have been met by them individually.

The risk of health problems being compounded by financial disaster has always been there, particularly for those who have private-sector insurance plans with restricted coverage. In fact, as FONASA brought new diseases into its Catastrophe Insurance (AIDS, for example), the Isapres were obliged to offer similar benefits to retain their customers.

Indeed, Catastrophe Insurance opened the way for a debate which culminated in the reform of financial guarantee coverage in Plan AUGE, when it was finally established that subscribers to FONASA and the Isapres would be subject to a maximum copayment of 20% for health problems covered by Plan AUGE, with the

[13] The difference from table 7 is due to the fact that a given case/person may receive a number of medical services.

TABLE 7

Chile: Catastrophe Insurance, 1999-2004
(*Number of cases*)

Area	1999	2000	2001	2002	2003	2004 (projection)
Heart surgery[a]	2 730	2 933	3 377	4 267	7 745	9 710
Neurosurgery	1 787	1 952	2 257	3 355	6 052	10 210
Kidney transplant[b]	233	248	218	225	221	236
Liver transplant	24	27	27	26	26	36
Peritoneal dialysis[b]	45	55	61	64	72	91
Radiotherapy[a]	4 492	4 499	4 758	5 096	4 568	7 848
PNDA[a c]	104	82	103	956	944	1 172
Immunosuppressive drugs[b]	1 281	1 418	1 639	1 793	2 111	2 145
Scoliosis[b]	251	205	212	263	277	425
Cleft palate[b]	428	595	740	941	1 008	1 427
Major burns	196	271	218	218	212	221
Multiple trauma	88	87	86	82	52	68
Palliative care[b]	4 065	5 662	5 772	6 583	11 428	12 898
Haemodialysis[b]	63	802	823	1 229	1 779	2 549
Bone marrow transplant[b]	4	11	15	18	18	20
Breast cancer chemotherapy[b]	193	518	756	1 169	1 546	1 830
AIDS[b]	0	0	1 657	3 308	4 038	5 700
Cervical cancer chemotherapy[b]	0	0	0	626	469	602
Vitrectomy	0	0	0	740	818	858
Cystic fibrosis	0	0	0	225	280	292
Pre-invasive and invasive surgical treatment for cervical cancer[b]	0	0	0	0	7 902	8 104
Total	*15 984*	*19 365*	*22 719*	*31 184*	*51 566*	*66 442*

Source: National Health Fund (FONASA) Departamento de Comercialización.

[a] As of 2005, part is in Plan AUGE and part remains in Catastrophe Insurance.
[b] As of 2005, forms part of Plan AUGE.
[c] Programa Nacional de Drogas Antineoplásicas (National Antineoplastic Drugs Programme).

additional safeguard of an annual upper limit not exceeding 17%, approximately, of the subscriber's annual income.

3. The Older Adult Programme

The goal of this programme is to improve older adults' quality of life by equipping them with orthotic and prosthetic aids to prevent their functional capabilities from declining, and to expand the coverage of treatment for the most common and costly medical conditions affecting this age group.

The need for special compensating programmes for older adults derives from the low pensioner coverage and benefit levels of the country's social security system, as figure 1 showed. Accordingly, since 2001 older adults have been entitled to free health care under the FONASA Institutional Treatment Method (Modalidad

de Atención Institucional (MAI)), irrespective of income. Those aged 65 and over are expected to make up 9% of the population by 2010, and on present trends the institutional supply of services for them is believed to be inadequate.

The diseases that cause most deaths among older adults are: ischaemic heart disease (i.e., diseases of the coronary arteries), cerebrovascular diseases, and pneumonia or serious lung and bronchial infections. All these are treated under the Older Adult Programme (table 8), which has about 100,000 beneficiaries annually (some 10% of the population in this age group).

The public health system also conducts prevention campaigns aimed at this group, the most important being the so-called "winter campaign". This campaign includes mass vaccination programmes; an expansion in the number of hospital

beds to receive the worst-affected patients who require hospitalization; the preparation of special treatment rooms in surgeries for acute respiratory infections and acute respiratory diseases; and special weekend opening of surgeries in areas where this is called for. The Golden Years Programme (Programa Años Dorados) also provides a food supplement to over-70s who are registered with a surgery in this programme and are up to date with their health and chronic disease check-ups.

All these special programmes and subprogrammes were created in response to needs that were made known by subscribers themselves and that they could not have met on their own, as far as can be judged, had exceptional financing not been made available. As universal provision of all or some services gradually becomes institutionalized under Plan AUGE, targeted compensatory programmes like the ones described will tend to be redefined or subsumed into a broader plan. Indeed, Plan AUGE was created to deal with problems that had been found over time to be of high priority and that were being addressed piecemeal by the programmes mentioned.

TABLE 8

Chile: Beneficiaries of the Older Adult Programme, 2002 and 2003

Older Adult Programme	2002 Number	2003 Number	% change
Lenses	58 550	59 462	1.6
Hearing aids	4 921	4 845	-1.5
Walking sticks	5 542	3 987	-28.1
Wheelchairs	2 265	1 807	-20.2
Walking frames	536	509	-5.0
Ulcer mattresses	1 382	1 123	-18.7
Ulcer cushions	361	313	-13.3
Dental Basket Type I	3 811	2 895	-24.0
Dental Basket Type II	9 694	8 452	-12.8
Other orthoses and prostheses	–	–	
Prostheses and orthoses subtotal	*87 062*	*83 393*	*-4.2*
Cataracts	7 036	6 994	-0.6
Fitting of pacemaker	1 157	1 233	6.6
Full hip replacement	711	654	-8.0
Partial hip replacement	730	757	3.7
Femur neck fracture, osteosynthesis	1 042	1 207	15.8
Photocoagulation	1 865	1 969	5.6
Catastrophic diseases subtotal	*12 541*	*12 814*	*2.2*
Acute respiratory disease	1 677	1 677	0.0
Overall total	*101 280*	*97 884*	*-3.4*
Spending each year, in thousands of pesos	9 852 961	10 759 008	9.20

Source: National Health Fund (FONASA) Departamento de Comercialización, Subdepartamento de Intermediación.

IV

Plan AUGE (Universal Access with Explicit Guarantees)

1. Background

Plan AUGE, the centrepiece of health reform in Chile, was embodied in law 19966 of 3 September 2004 and came into force on 1 July 2005. This plan established explicit guarantees based on principles of clinical efficiency (resolving the most prevalent health problems), timeliness (treatment deadlines), quality (the use of protocols to standardize procedures) and equity (in financing and access).

As a number of studies have pointed out, health goals need to be compatible with the financial resources available; to establish these goals, furthermore, thought must be given to considerations of sustainability, efficiency, effectiveness and equity (BASYS/CEPS/CREDES/IGSS, 2004).

To ensure that Plan AUGE matched the resources available, a technical parameter was developed by means of a model that prioritized health problems in the context of the Plan, the idea being to provide a firm basis for decisions about inclusion and exclusion and also to guide implementation decisions.

The prioritization algorithm (figure 2) used criteria that are commonly employed to establish health priorities (Ministerio de Salud, 1999), and it represents the logic applied in the general design of Plan AUGE.

FIGURE 2

Chile: AUGE prioritization algorithm
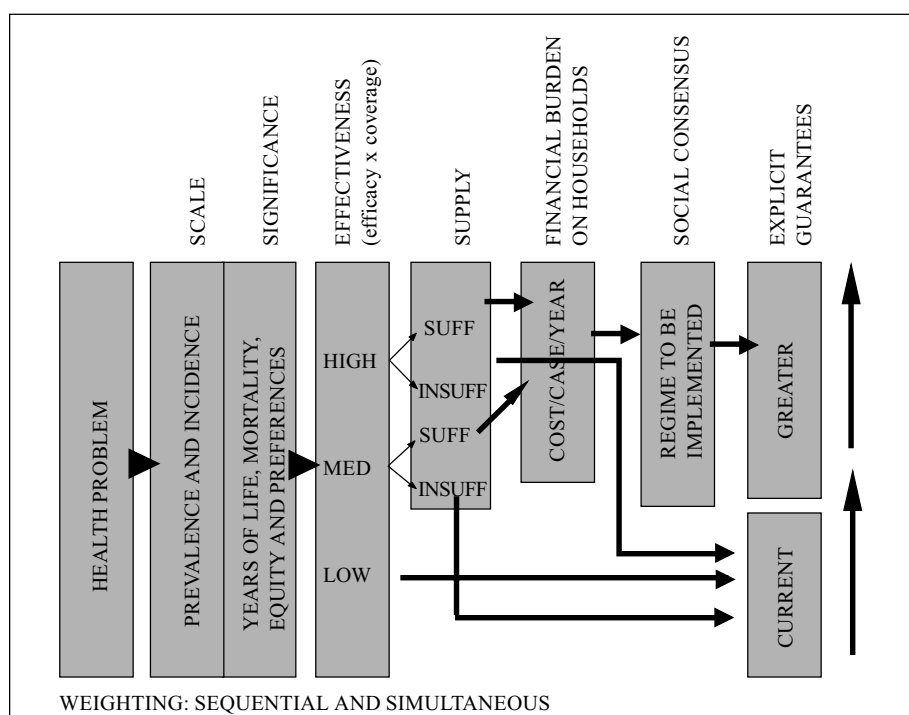
Source: Ministerio de Salud (2002b).

Using criteria of scale (number of cases, adjusted for data quality), significance (years of life lost, mortality, equity and user preferences) and vulnerability (existence of effective treatment), a ranking of scores was constructed to establish health priorities.

The sequencing and structure of Plan AUGE show that it has four priority areas. The first is primary care in the National System of Health Services (Sistema Nacional de Servicios de Salud (SNSS)), which includes an All-round Family Care Model (Modelo de Atención Integral Familiar), with the services and activities that form part of the Family Health Plan (Plan de Salud Familiar). This covers preventive and curative care, delivered by a family health-care team with a family doctor; it also incorporates individual promotional activities, special programmes like mental health and cardiovascular health, preventive tests, general health programmes for children, adolescents, women and older adults, medical check-ups, consultations for acute illnesses, diagnostic tests, referrals to specialists and other activities such as home visits.

The second area is emergency treatment. Plan AUGE requires a review of every area of emergency care to ensure there is a nationwide treatment system in place that can provide appropriate pre-hospital care, transportation, diagnostics, stabilization measures and emergency treatment to prevent loss of life and functional impairment.

The third area is the ranking of health problems by priority, taking into account their scale, significance, cost, equity gaps and the needs and preferences made known by users themselves, and the search for the treatment methods that will be most effective in resolving these problems in their entirety.

The fourth area is the use of the Personal Health Plan (Plan de Salud de las Personas) to relate the medical conditions included in Plan AUGE with all others, since the Personal Health Plan deals with all health problems not covered by the guaranteed treatment system.

Plan AUGE described the medical services and activities deemed necessary and effective from the point of view of all-round health care, identifying the population that would benefit from universal access, maximum waiting times, the use of standardized evidence-based procedures to assure quality, and the

amount of the copayment and/or deductible that would be considered acceptable in the light of the financial protection concept.

It also established certain conditions for access and related these to the guarantees (for example, people will not have access to emergency treatment in the relevant network for a health problem that is not clinically classified as an emergency; in this case treatment must be refused or the patient must be charged the full cost). Thus, it clearly set out people's obligations as well as their guaranteed benefits and enforceable rights.

It also identified priority tasks that needed to be performed in 2002 and 2003[14] to arrive at more accurate estimates of demand and to develop technical instruments (including performance algorithms or treatment protocols), administrative tools and information and follow-up systems.

2. Review of health priorities

Even before Plan AUGE was approved, it was recognized that it would need to specify the scope of coverage for each medical condition (diagnosis, treatment and follow-up) as well as timescales and quality. The scope of coverage can be interpreted as an adjustment variable to ensure a harmonious relationship between the infrastructure capacity and financial resources available and the level of actual demand in each case.

When the baskets of services were designed and reviewed, account was taken of which services were necessary and appropriate to resolve the illness or health condition concerned in its entirety, and also of the services currently provided by FONASA under the Diagnosis-Linked Payment (PAD) system. For each medical condition, an estimate was made of the frequency of occurrence or number of cases expected. National rates of incidence and prevalence were used where available; otherwise, international rates were adapted on expert advice.

Once these specifications had been arrived at, an assumption was applied to determine expected demand (cases to be treated in one year). For serious, high-cost conditions such as cancer and severe trauma, it was assumed that 100% of cases would require treatment. It was also assumed that between 50% and 70% of chronic diseases, including cases where symptoms were more severe, would generate demand for treatment, and

that this percentage would increase over time as promotion and prevention programmes were introduced or strengthened.

For 35% of illnesses, prevalence or incidence rates were calculated using Chilean data. For another 33%, experts estimated needs and forecast demand on the basis of Chilean and international information, while for the remaining 32% expected demand was forecast from the demand met in the last few years.[15] Recalculation will have to be carried out, chiefly to ascertain accurately the effect that the provision of explicit coverage and marginal price guarantees under Plan AUGE has had on demand, as these guarantees did not previously exist.

Differences in the reliability (coverage) of the initial information had a major effect on subsequent projections. Projections for HIV/AIDS, for example, were based on the demand met in the public sector, and the resulting underestimation meant that shortages of drugs for this disease emerged in mid-2004.

3. Rules to assure quality and timeliness of provision under Plan AUGE

One goal of Plan AUGE is universal access, so the relevant guarantee is that coverage will be available for 100% of the population. Where quality is concerned, the objective, from a technical standpoint, is to identify the set of attributes that will maximize the likelihood of treatment yielding the results desired, including greater user satisfaction, on the basis of current knowledge. The quality guarantee also covers the requirements that providers (establishments and individuals) have to meet to ensure the quality of the service they provide.

Measures to improve quality of care are manifold, as the national strategy described in the National Health Goals (Objetivos Sanitarios Nacionales) makes clear: they include the use of epidemiological methodology and information systems to enhance diagnostic and treatment capabilities, evidence-based medicine, procedures standardized by the health authority and accreditation systems.

Furthermore, in its "Construcción de la propuesta técnica del régimen de garantías en salud Año Base" (Ministerio de Salud, 2002b, Volume I), the Ministry

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[14] These were revised subsequently, as the concept of gradualism was introduced in the implementation of Plan AUGE as a whole.

[15] To arrive at these conclusions, use was made of data compilations setting out information sources and the assumptions employed to estimate frequencies.

of Health laid down the following criteria for determining treatment access times for the different groups of problems:
– Perception of urgency or need
– Health problems where treatment delays would cause serious harm
– Health problems declared to be of high priority
– Priority prevention measures

The following access times were determined on the basis of the above:

Immediate treatment: Urgent health problems that pose a risk of death or severe and irremediable after-effects unless treated immediately.

Treatment within 24 or 48 hours: Consultations for acute illnesses. Prioritized health problems for which, as an intervention strategy, preventive or curative treatment is required at specific times and cannot be delayed (for example, care of newborn children, immunization schedule).

Treatment within 7 to 30 days:
– Consultations for non-acute illnesses
– Check-ups after therapy
– Consultations for chronic illnesses that are not in an acute stage
– Consultations with specialists and access to diagnostic procedures

– Evaluation of clinical studies
– Initiation of treatment when the waiting time does not prejudice the outcome

Treatment according to the resolution time that is necessary and practicable for each health problem as measured by:
– Maximum possible waiting time before symptoms worsen or complications or after-effects arise (e.g.: one to three months for elective surgery to deal with a non-acute medical condition currently included in the prompt treatment programme (programa de oportunidad de la atención (POA)): gallstones and prostatic hyperplasia)
– Maximum waiting time within which the therapy is still effective (heart surgery, correction of malformations, hernia of the nucleus pulposus, antiretroviral therapy for HIV/AIDS), depending on severity
– For preventive activities, maximum waiting time that does not affect attainment of the goal (e.g.: frequency of preventive health check-ups for adults)
– In the case of support for basic sense faculties, waiting time that does not affect people's development and functionality (e.g.: lenses, hearing aids, cataract surgery).

V

Financial equity, public-sector provision and payment methods

Once health-care needs have been determined, another important aspect has to be considered: the actual ability of the public sector to provide health services under the Institutional Treatment Method (MAI) with the available financial resources. Since unit costs are lower with the MAI than with the Free Choice Method (Modalidad de Libre Elección (MLE)), efforts could be made to discourage use of the latter, but it does not seem advisable to shift demand to highly congested public facilities. The Reform Commission (Comisión de Reforma) recommended that consideration be given to alternative ways of operating the MLE to boost efficiency and medical impact, such as per capita payments to private-sector providers with responsibility

for a given population or payments per medical condition resolved, and that subscribers be required to opt for one method or the other each year.

There is a long-standing and still unresolved debate about the best methods of payment. A number of studies have looked at the issue of which payment methods can best meet the needs of Plan AUGE in the public health system while remaining consistent with health policy and avoiding possible distortions in incentives.

Change has been faster, deeper and more effective in primary care (Bitrán, Giedion and Gómez, 2004) than in hospital care, which is an argument in favour of payments for services or groups of services provided. Conversely, the historical method of payment, which

is based on past spending unrelated to any specific population or predetermined level of service provision, does not seem to be effective, even though 60% of the Ministry of Health budget is still spent in this way.

The most common proposals are for: i) the adoption of payment mechanisms that link payment to output or results; ii) new mechanisms to make these results enforceable by FONASA; and iii) explicit specification of spending items for public-sector providers which have to be paid for out of a separate budget, or at rates higher than the set prices, for political,[16] technical, legal or practical reasons.

Again, the specialist literature has concluded that the efficiency of payment methods varies depending on the level or degree of complexity of the medical conditions they are applied to. Consequently, there is now a greater inclination to use per capita payments for primary care and gradually extend this method to all types of provision currently paid for through special programmes, when enough epidemiological and financial information exists for this switch to be made. To put it another way, the per capita payment system seems to be easy to implement for the treatment of medical conditions that do not create many uncertainties, either because routine methods of resolving them are strictly prescribed or because they are of relatively low complexity. Nonetheless, payment can continue to be made under special programmes for provision of an exceptional nature.

With the benefit of experience, meanwhile, the health authorities in Chile have been bringing into the Assessed Treatment Programme (Programa de Prestaciones Valoradas (PPV)) a group of programmes of different kinds whose common aim is gradually to reduce the proportion of public health spending allocated on a historical basis. This group of programmes has enabled the best financing methods to be chosen for each situation. The association of payments with specific services (as with PADs) is attractive because it is easy to quantify, but it has been criticized by public service managers on the grounds that it usually fails to take account of the fixed infrastructure, equipment and maintenance costs that have to be met for medical care to be available when needed.

The most important lesson is that, ultimately, there is no one method of payment that is ideal in all circumstances, and there is thus no "cookery book" that

can be used to copy recipes applied in other contexts. The need for good performance in different areas (efficiency, quality, equity) is leading many countries to combine a variety of payment methods with a view to enhancing the favourable aspects of each and mitigating their adverse effects.

1. Copayments

The medical treatment guarantees are partly about making proper use of the funds available, so that copayments are a source of income for public services or the public insurer and represent a key issue in the reform. How effective the system of copayments is at raising more funds will depend on the willingness of individuals to pay for higher-quality services. This assumes that at least some of the resources thus raised go into improving the quality of care, for example by increasing the availability of drugs. In any event, copayments need to be low enough to leave access to care unaffected, but high enough to discourage unnecessary use of medical services.

Most empirical studies that have set out to measure the price-elasticity of health-care demand have found that demand does indeed fall when prices rise, but moderately (price-elasticity below one). This implies that a rise in copayments will mobilize private resources but will have only limited implications for freedom of manoeuvre in reallocating public subsidies, since usage levels among those who pay will vary only very moderately.

A study dealing with Peru (Valdivia, 2002) argues that "the price-elasticities of demand for health services in public establishments would appear to be greater among those of a higher socio-economic level. This being so, a policy of raising charges for better-off individuals in public facilities would result in that demand being displaced to private-sector alternatives, rather than to the medical facilities recovering some of their costs."

As we have seen, a number of groups were already exempted from copayments before the reform laws were passed: users of primary care, older adults and people suffering from catastrophic illnesses. To prevent abuse of treatment services (moral hazard), however, it is normal practice for copayments to be required. Consequently, maximum copayments of 10% and 20% have been set for services provided to higher-income FONASA subscribers, while copayments of 20% apply to Isapre-provided services included in Plan AUGE. Following the logic laid down by the Executive,

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[16] This is a reference to geographical priorities set by the political authorities.

financial protection for health problems covered by Plan AUGE should maintain and/or increase benefits, since health problems have been selected with a view to relieving the burden of illness to the greatest possible extent.

In the case of financial protection too, however, consideration must be given to the cumulative effects that may arise from the simultaneous treatment of a number of problems in one illness or a number of people in the same family. Although maximum copayments have been set at levels that are low for most services, they can add up to large amounts and cause serious financial hardship. To prevent this, a maximum yearly limit has been set, calculated as a proportion of the user's annual income, so that those with higher incomes contribute more in absolute terms.

The law passed provides that the indigent and those without resources (groups A and B among FONASA beneficiaries) are to be treated free of charge. Everyone else (subscribing to Isapres or FONASA) will pay no more than 20% of their treatment costs, in accordance with the scale of charges established for medical conditions covered by the explicit guarantees. Since this percentage may prove excessive in the case of high-cost illnesses, people will be entitled to 100% financing of copayments in excess of two monthly remunerations or thereabouts, or about 1.47 monthly remunerations in the case of group C FONASA subscribers. If there is more than one illness, annual payments may not exceed three monthly remunerations, approximately.

In view of all the above, the decision was taken to implement Plan AUGE gradually, the result being that treatment for 25 health conditions has been guaranteed since July 2005 (table 9). A further 32 will be incorporated over the coming years, until all 57 medical conditions originally identified in the Plan are covered.

2. Risk compensation funds

Risk compensation funds are vital for equity. In Chile, the insurers (FONASA and the Isapres) have to pay a universal premium for each subscriber and for each of their respective dependants into the Social Compensation Fund (Fondo de Compensación

TABLE 9

Chile: Plan AUGE, coverage in 2005

No.	Health problem	Age group
1	Terminal chronic kidney failure	All
2	Operable congenital cardiopathies	< 15
3	Cervical cancer	All
4	Pain relief for advanced cancer and palliative care	All
5	Severe heart attack	All
6	Type 1 diabetes mellitus	All
7	Type 2 diabetes mellitus	All
8	Breast cancer	> 15
9	Spinal dysraphias	All
10	Surgical treatment for scoliosis	< 25
11	Surgical treatment for cataracts	All
12	Full hip replacement for people with arthrosis of the hip entailing severe functional limitation	> 65
13	Cleft palate	All
14	Cancer	< 15
15	Schizophrenia	All
16	Testicular cancer	> 15
17	Lymphomas	> 15
18	Acquired immune deficiency syndrome HIV/AIDS	All
19	Acute lower respiratory infection, treated on an out-patient basis	< 5
20	Pneumonia acquired in the community, treated on an out-patient basis	> 65
21	Primary or essential arterial hypertension	> 15
22	Non-refractory epilepsy	< 15
23	General oral health for children	< 6
24	Disturbances in impulse generation and conduction requiring a pacemaker	> 15
25	Premature delivery. Prevention of premature delivery. Retinopathy in premature infants. Bronchopulmonary dysplasia in premature infants. Bilateral neurosensorial hypoacusia in premature infants	< 1 month

Source: Prepared by the author.

Solidario (FCS)). The contributions for beneficiaries qualifying as indigent are financed by a direct fiscal subsidy.

The main objective of the FCS is to reduce incentives for the "skimming"[17] practised by the private insurers to hold down costs, as this undermines health-care solidarity. The idea is that the FCS should operate as a cost levelling system so that it makes no difference to these insurers, financially speaking, whether they cover higher-risk groups or not. The goal is that, once resources have been redistributed by risk, the actual revenues of the insurers should be the same irrespective of risk weightings.

For this, a universal premium has to be calculated and then adjusted for the risk weights, of which there may be many, although as a minimum they generally include sex and age. If the universal premium were higher than a subscriber's contribution (as with the indigent), the difference would be covered by a fiscal subsidy.

The compensation fund discussed in Chile (it has not been approved) is virtual, i.e., it operates through transfers of balances rather than of the contribution made by each operator in the year the Plan is expected to be operating in its entirety. Although there are different ways of constructing funds of this type, the method applied in Chile was first to arrive at a value for the average health risks of the population. People who are at higher risk, and thus more expensive, will be partially funded from resources paid in by lower-risk individuals, something that implies transfers of funds from insurers with lower-risk subscribers to those with more vulnerable ones. In this case, it is the insurance organizations, not individuals, that receive the funds.

VI

Conclusions

At the time of writing, it is premature to evaluate Plan AUGE and the changes being made to it to ensure that the measures taken are consistent with reality, but this kind of follow-up will need to be carried out and the results presented to the scientific and academic community and the general public.

Everything seems to show that there is no one "right" institutional solution, no single "winning" model that can be applied in all situations to resolve today's health-care challenges. Here we have described the essential thrust of some partial programmes that existed in the Chilean public sector to improve access to health services for those who lacked the necessary resources, as they were explicitly targeted at these groups. The store of experience built up through these plans has been indispensable, too, to the realization of a scheme as ambitious as Plan AUGE in Chile.

For its part, Plan AUGE will provide a universal, enforceable right to treatment in the public and private health systems for 56 medical conditions, of which some are already covered and the rest will have been gradually included by 2007. This enforceability, combined with universal access, timeliness, quality criteria and financial protection, represents a qualitative leap in equity in the Chilean health system.

Public health spending has never recovered from the low levels of the 1980s and still averages just US$ 139 annually per inhabitant, which means that the direct fiscal contribution has had to play a compensating role in recent years. This fiscal contribution reduces the initial inequity between public insurance and the private insurance schemes from a ratio of 1:4 to approximately 3:4.

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[17] See footnote 4.

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Tax reform for human development
in Central America

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Tax revenue in Central American countries accounts for just 13.5% of their gross domestic product; and the resultant resource shortage means insufficient and low-quality public expenditure, and chronic fiscal deficits financed through borrowing. In 2003 interest payments absorbed an average of 18% of the subregion's total tax revenue. In these open economies, whose enterprises need to become more internationally competitive, fiscal policy is crucial both for financing the necessary physical and social infrastructure and for combating the poverty that still afflicts roughly 40% of the population. The economic development of Central America therefore needs second-generation reforms to modernize its tax systems, in order to increase revenue by about four percentage points of GDP.

I

Encouraging tax reform in Central America

Tax reform is essential in Central America if the aim is to achieve the faster growing and more equitable type of society to which its peoples aspire. There are several reasons for promoting tax reform: firstly, and most importantly, the subregion's States are too small and vulnerable to deliver the public goods needed to foster economic growth and raise their populations' levels of well-being. The fact that average tax revenue in the subregion has hovered around 13.5% of GDP in recent years readily explains why these countries are unable improve their levels of education and health care, build the infrastructure needed for development, and provide the legal certainty and citizen safety demanded by private investment.

Secondly, all Central American countries carry heavy burdens of public debt accumulated during years of chronic fiscal deficit. Their Governments therefore need to raise tax revenues to generate primary surpluses (fiscal balances before debt interest), in order to place the public debt on a long-term sustainable footing.

The third reason is that changes in the patterns of the subregion's international participation will require far-reaching reforms in its tax systems. When the free trade agreement (FTA) between Central America and the United States enters into force,[1] their revenue from import duties will drop sharply, and the loss will need to be recovered through other taxation sources.

Moreover, the fact that all of the region's countries have joined the World Trade Organization (WTO) means that they will have to abide by its decisions. The most important of those decisions for Central American countries requires the elimination, no later than early 2010, of income tax exemptions for free zone enterprises. These are viewed as an export subsidy and therefore prohibited by the Agreement on Subsidies and Countervailing Measures (the SCM Agreement) in the Uruguay Round that was concluded in early 1995.

Application of that agreement will mean reconciling the need to expand revenue but avoid

discouraging investment in the most dynamic sectors of the economy, for which corporate income tax will need to be set at moderate rates. To avoid the implicit subsidy, the WTO requires tax rates inside and outside free zones to be equal; but this could cause revenue losses, if rates are lowered for firms located outside free zones. It will therefore be crucial to close off other avenues for avoiding corporate income taxes, such as the numerous exemptions and accelerated depreciation regimes. Rates can be moderate, but the tax bases need to be as broad as possible.

The fact that integration between the Central American countries is being deepened will also have significant effects on the design of tax reform. The implications for tax systems are obvious: in the absence of regionwide tax coordination it will be impossible to avoid tax arbitrage, which will mean undesired production and revenue losses for some countries and gains for others. Income tax in free zones is an obvious example. Without subregional harmonization, countries will have much to lose: competition for investment will force an unnecessary reduction in income tax on enterprises generally, because the WTO norm is to move towards equal tax treatment throughout the economy.

A fourth reason, which poses another challenge for tax systems in Central American countries, is the need to design a suitable strategy for tax decentralization. All of these countries have made decentralization a priority, but none has managed to implement it without a loss of revenue for central government, which undermines its performance. Local taxes need to be strengthened, particularly property tax which currently generates very modest revenue below its potential.

1. Human development and the role of public spending in the social sector

The central premise of this paper is that economic growth and human development are intimately linked through relations of multiple causation.[2] Firstly, the

[2] The term "human development" is used here with the meaning popularized by the United Nations Development Programme (UNDP). The components of this generic term are very broad and

hypothesis that the key aspects of human development depend on per capita income is generally accepted. Secondly, the causation relation also runs from human development to sustained growth. The latter requires a labour force with a minimum level of education, without which labour productivity is too low to make private investment profitable. The same is true of health: a population with poor health means a low-productivity work force. Consequently, health and education, key aspects of human development, are not only ends in themselves, but also an essential input for growth.

Although Central American Governments have introduced major economic reforms, their public social spending is still too low.[3] Tax revenue in the subregion absorbs between 10% and 14% of GDP, with public expenditure between 10% and 18%.[4] These rates are low compared with what would be expected in economies with the structural characteristics of Central American countries.

This statement is the result of an econometric analysis of tax revenue, total public expenditure and public expenditure on education and health care throughout the world as a proportion of GDP, and the relative ranking of the countries of the region. All variables were measured in the late 1990s. The differences between countries in terms of tax revenue and public expenditure are explained by the variation in GDP per capita (measured in purchasing power parity) and by the income distribution as measured by the Gini

coefficient. As per capita income rises, so does the tax burden and public expenditure, because the higher a country's income, the greater is its capacity to finance public expenditure and basic social spending. It is also reasonable to expect that the demand for public expenditure by the population will vary in direct relation to per capita income and inversely with income inequality. The latter hypothesis assumes that the more egalitarian is the distribution of income, the greater the influence of the middle income segments in economic and social policy decision making; and it is precisely these latter groups that demand social public services. The results, which support these hypotheses are shown in the appendix.[5]

Interpolating the values of GDP per capita and the Gini coefficient for the five countries of the Central American Common Market (CACM) in the estimated equations, shows that the expected values of the four fiscal variables are higher than those observed in nearly all cases. This shows that, even when controlling for the structural characteristics of the Central American economies, their States are small. Figure 1 illustrates the results for tax revenue.

There is a large discrepancy between the expected and actual tax burden in Costa Rica, where actual revenue in the late 1990s was below the regional average at just 12% of GDP (it is now slightly over 13%), in circumstances where its per capita GDP is the highest in the subregion, surpassing those of the two poorest countries (Honduras and Nicaragua) by a factor of between three and four (measured in purchasing power parity dollars and adjusting for the underestimate of GDP in those two countries). At the same time, the Gini coefficient in Costa Rica is the region's lowest (0.48 compared to 0.63 Guatemala and 0.58 in Nicaragua).

This leads to the conclusion that, to achieve the estimated norm in terms of income levels and their distribution, tax revenue should rise by 35% or roughly 4 percentage points of GDP, which is the average gap shown in figure 1.

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encompass higher life expectancy, a life of good quality with low indices of disease, good education indicators, citizen participation in decision making, equal opportunities, and gender equality. In the view propounded by Amartya Sen, human development is synonymous with freedom: the capacity of individuals to live in the way they choose (Sen, 1999). Naturally, GDP per capita is an inevitable indicator of human development, but it is not the only one. Evaluating a nation's levels of human development requires weighing up a broad set of variables, such as those summarized by UNDP in its Human Development Index.

[3] All countries of the subregion have substantially liberalized their markets, privatized many public enterprises, and generally opened their economies up to external trade. For a description of these processes see Agosin, Machado and Nazal (2004).

[4] Correcting for the underestimate of GDP in Nicaragua and Honduras –a phenomenon that is well known by specialists in the subregion. For a discussion of this underestimate in Honduras, see UNDP (2000, chapter 3). Estimations made by one of the authors of this article, based on an analysis of all existing data, show that GDP in Honduras and Nicaragua would have to be corrected by at least 40% and 70%, in that order, to bring it close to its real level. After several years of work, the Central Bank of Nicaragua raised its GDP estimate by 63% in the national accounts revisions of 2003. The Central Bank of Honduras has not yet published its revisions.

[5] Note that this theoretical outline contradicts the influential model developed by Alesina and Rodrik (1994), which postulates that tax revenue is greater the more unequal is the income distribution. Those authors use a median-voter model, in which voters prefer higher taxes the smaller are the stocks of physical and human capital among the majority of the population (precisely when the income distribution is most unequal). The statistical data do not support this theory, however. On the contrary, they are consistent with our theoretical approach.

FIGURE 1

Central American countries: expected and observed tax revenue, late 1990s
(Percentage of GDP)
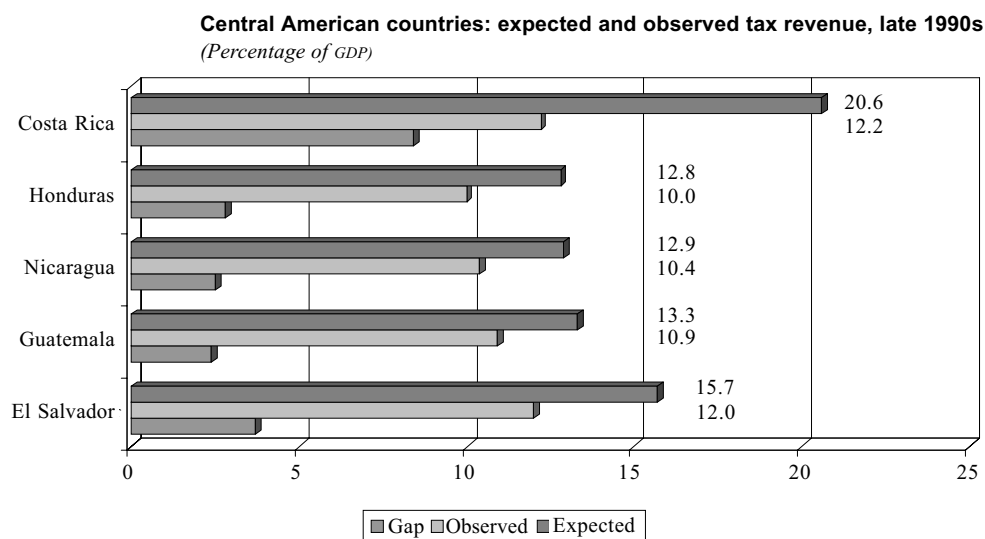
Source: World Bank (2004); Official national figures and authors' calculations.

2. Public Finance: deficit, debt and sustainability

As table 1 shows, in 2004 the fiscal deficit of Central American countries varied between 1.1% and 4.3% of GDP. Although the average had fallen since 2000, individual deficits were still high, especially considering that 2004 was a year of relatively strong growth. The figures show a persistence of deficits, with particularly large imbalances in Honduras and Nicaragua.

TABLE 1

Central America: central government deficit and public debt
(Percentage of GDP)[a]

	Fiscal deficit		External debt		Domestic debt
	1995	2000	2004	2004[b]	2004[b]
Costa Rica	4.0	2.9	3.0	21.1	38.7
El Salvador	0.6	2.3	2.8	31.4	13.4
Guatemala	0.7	1.8	1.1	16.0	9.4
Honduras	3.1	5.7	3.5	61.6	7.5
Nicaragua[c]	11.0	11.0	4.3	76.0[d]	41.3

Source: Agosin, Barreix and Machado (2005).

[a] For Honduras and Nicaragua the GDP figures shown are the official ones, which overstate the levels of the deficit and public debt.
[b] Year-end figures.
[c] Fiscal deficit before grants.
[d] After debt relief arising from the Heavily Indebted Poor Countries (HIPC) initiative.

This has several undesirable consequences. Firstly, it makes it hard to achieve macroeconomic stability, for although most countries no longer finance their shortfalls by placing bonds with their central bank, the deficit still stokes demand pressures that force central banks to maintain austere monetary policies. This raises interest rates for the private sector and sucks in short-term foreign capital, thereby causing local currencies to appreciate. Secondly, to avoid the public debt becoming unsustainable, countries are constantly under pressure to curtail expenditure (generally on social investment or physical infrastructure), or to raise rates on the taxes that are relatively easy to collect. Lastly, the persistence of deficits prevents the economic authorities from deploying countercyclical fiscal policy. Persistent fiscal deficits clearly render the public debt unsustainable in all countries in the region, so they need to be corrected, either by increasing the tax burden or by curtailing expenditure.[6]

3. Tax implications of the free trade agreement between Central America and the United States

Between late 2003 and early 2004, CACM members completed negotiation of the CAFTA agreement, which, once ratified, will have major repercussions for the

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[6] For an analysis of the sustainability of public debt in Central America see Edwards and Vergara (2002) and Vergara (2003).

Central American economies.[7] Its effects will also be felt on those countries' tax policies, given the volume of their purchases from the United States, which in 2004 accounted for one third of total imports in Central American countries (excluding maquila inputs which enter duty-free). The revenue obtained from import duties amounted to between 0.9% and 2% of GDP in that year.

Based on the tariff elimination timetables offered by the countries in the framework of CAFTA, and on imports from the United States and current tariff rates, Barreix, Roca and Villela (2004) calculated the short-run revenue losses associated with the agreement as likely to represent on average 0.4% of GDP. In the medium-term, as imports from the United States become more fully exempted from tariffs, the revenue loss would rise to 0.7% of GDP. Losses would be smaller in El Salvador, Guatemala and Nicaragua (0.4% of GDP), but larger in Honduras (1.1% of GDP), while in Costa Rica the loss is expected to be at an intermediate level (0.6% of GDP).[8] Tax reform will therefore also have to compensate for the revenue losses arising from with CAFTA.

4. Challenges of the new international participation

Application of the "open regionalism" model adopted by the countries of the region in the late 1980s is likely to intensify in the next few years, and this will pose major challenges for tax policy. Once such challenge is the increasing need for CACM member countries to standardize their tax systems, as the economic and financial relations between them grow, and given the WTO requirement that the countries of the region dismantle income tax exemptions for enterprises operating in free zones.

a) *Tax harmonization in CACM*
    The intensification of regional integration includes an effort to standardize taxation policies, which has not yet happened at the Central American level. For

example, to remove customs barriers within the subregion and facilitate the movement of merchandise within it, it is essential to harmonize the criteria used to assess value-added tax (VAT) and selective consumption taxes. It is also important to agree upon joint administrative regulations to replace the controls formerly applied by customs, to avoid tax fraud. Although VAT rates have been converging, the same cannot be said for selective consumption taxes.

The need for coordination is even greater in the case of corporate income tax, to avoid losses of tax revenue in jurisdictions that have the highest rates. In an increasingly integrated subregion, conglomerate groups with branches in various countries will tend to declare their profits in the countries that have the lowest rates. The simplest solution is therefore to ensure that rates do not diverge much between countries.[9] The most complex solution involves adopting a system of transfer prices (and weak capitalization rules) to prevent firms from withdrawing profits from one country through transactions or concerted loans between subsidiaries, especially when the participants in this process include firms located in tax havens. The Central American countries also need to consider signing double taxation agreements with the home countries of foreign enterprises, to strengthen legal certainty for investors based on common foundations, in order to improve their negotiating capacity and avoid harmful competition and misuse of incentives.

b) *Export promotion model and WTO rules*
    Tax reform in the countries of the subregion is also motivated by the need to rethink the strategy pursued by Central American countries in the 1990s both for attracting foreign direct investment (FDI) and for export promotion. This was based largely on granting tax breaks to firms established in free zones, mainly through income-tax exemptions.

At the present time, increasing international trade commitments require homogeneous tax treatment for national enterprises and those established in free zones, and, especially, coordinated treatment of income tax on such firms between the different Central American countries. This would avoid provoking predatory competition between the countries to attract FDI, which would have serious consequences for the revenue capacity and equity of their tax structures.

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[7] See Agosin and Rodríguez (2005), Todd, Winters and Arias (2004), and Hathaway (2003).

[8] These calculations only include the direct effects of gradually dismantling tariffs. There are other effects that would tend to aggravate the adverse revenue consequences, such as increased imports from the United States to the detriment of those sourced from third countries. But there could be positive effects also: for example, CAFTA is bound to attract investments that will in turn generate taxable production and consumption.

[9] As will be shown below, although income tax rates have been converging, substantial differences persist.

The Final Act of the Uruguay Round of multilateral trade negotiations, which concluded in 1995, contains the Agreement on Subsidies and Countervailing Measures (SMC Agreement) mentioned above, which was to have become binding on developing countries as from 2003, except for those with an annual per capita income below US$ 1,000 (Honduras and Nicaragua in the Central American subregion). The agreement expressly prohibits corporate income tax exemptions for exporting firms. Nonetheless, under Article 27, the deadline was extended for a further five years at the Fourth WTO Ministerial Conference held in Doha in November 2001; and while this article was being written, the final deadline was once again postponed until 1 January 2010. Following the national accounts revisions in Honduras (as yet incomplete) and Nicaragua, these two countries should now be near the threshold of US$ 1,000 per capita, and will certainly surpass it in early 2010, so the SMC Agreement regulations will then also apply to them.

II

Tax panorama in Central American countries

Between 1990 and 2003 the average revenue level rose by roughly 40%. Moreover, several countries introduced modern taxes, such as VAT, into their fiscal structures and sharply lowered customs duties. At the same time, major efforts have been made to improve tax administrations.

Nonetheless, the tax burden remains insufficient and is keeping these countries below their revenue-generating capacity. Their tax systems tend also to be regressive, because of weak income tax; and, as they are highly centralized, property taxes are insignificant. Following the 1990s reforms, which could be dubbed "first-generation", the region now needs new reform commitments to modernize their tax systems and equip them to meet the challenges described in the first part of this article.

1. Current tax policy situation

a) *Trend of total tax revenue*

As table 2 shows, the average tax burden has followed a highly variable rising trend. This is essentially due to the constraints imposed on tax bases by the large number of exemptions and reductions, and the levels of non-fulfillment and evasion that exist in Central America, which have made it necessary to introduce periodic tax reforms to restore levels of tax pressure.

Despite the trend of the average level of taxation in the subregion, several countries still have very low tax burdens. In addition, the continuous liberalization of foreign trade in these countries has placed a heavy burden on their tax administrations, which have had to

TABLE 2

Central American countries: tax burden, 1990-2003[a]

(Percentage of GDP)

	1990	1995	2000	2003
Costa Rica	10.8	11.4	11.9	13.0
El Salvador	7.6	11.9	11.0	12.6
Guatemala	6.9	8.0	9.5	10.3
Honduras	15.0	17.3	16.6	15.9
Nicaragua	8.1	12.2	14.5	15.8
Central America (simple average)	9.7	12.2	12.7	13.5

Source: Agosin, Barreix and Machado (2005).

[a] The data do not include income from social security. The GDP of Honduras has not been corrected for the underestimation, because there are no official data that do so. The figure for Nicaragua uses the new GDP estimates made by the Central Bank of Nicaragua in 2003. All tables hereinafter use the official figures published by the respective countries.

struggle to regain revenues that were previously obtained more easily through customs, while also being required to operate a more complex system and oversee a larger number of domestic taxpayers.

As mentioned above, the Central American countries have attempted to overcome the loss of tax revenue caused by external trade liberalization through successive hikes in VAT. Several countries have tried to counter what they see as a regressive effect of this tax, by granting substantial exemptions and inappropriately charging a zero rate of VAT on goods included in the basic shopping basket. Zero-rating entitles the producers of a good subject to that rate to recover the

credits generated by VAT paid on inputs, which gives rise to abuses and undermines the productivity of the tax, thereby reducing the tax burden.

b) *Trend of the tax structure*

Between 1990 and 2002, there were clearly defined patterns in the subregion's tax structures. First, as noted above, import duties were replaced by VAT. The second important change involved lowering the legal top rates of income tax for both individuals and firms, from above 40% to below 30%.

Third, the relative share of direct taxes remained constant throughout the period: while direct taxes generated on average 24% of total tax revenues in the 13 countries considered, indirect taxes provided the remaining 76%. Nonetheless, over the last five years, the share of revenue obtained from direct taxes has been creeping up, despite the lowering of rates, as new taxpayers have been added to the income-tax base and the importance of certain indirect taxes (selective taxes and foreign trade duties) has declined.

Fourth, during this period over 50% of all VAT revenue was collected through customs (when goods were imported). The volume of tax revenue obtained through customs has helped reduce the average rate of tax evasion, since the tax administration is concerned only with taxes generated from domestic sources.

Last, selective taxes, although erratic from one year to the next, contributed roughly 15% of total revenue. The share of revenue raised by selective taxes on fuels displayed a clear rising trend, while the number of goods subject to this type of tax (mainly products such as tobacco and drinks) declined.

In short, and because of these changes, it was indirect taxes that played the largest role in the trend of the tax burden over the last decade. The share of total revenue collected from direct taxes, in the form of income or capital taxes, did not change significantly during the period.

As can be seen in table 3, which shows the structure of revenue in 2002, indirect taxes continue to generate the bulk of the revenue. This probably indicates that the reforms ought to focus on direct taxation, which only raise roughly 3% of GDP.

c) *Incentives for foreign investment and preferential treatment*

The transition from development based on import substitution to an open-economy model was accompanied by a series of incentive measures –many of them with high tax content– which also had repercussions on revenue earned from other taxes. The export expansion was heavily concentrated in firms (both foreign and domestic) located in free zones, essentially assembling manufactured goods using inputs imported from the United States ("maquila"). There were also significant investments in tourism, fishing (especially shrimp farming) and mining. To stimulate these capital inflows, generous and broad-based exemptions were granted that wholly or partly freed

TABLE 3

Central American countries: tax burden by type of tax, 2002
(Percentage of GDP)

Item	Costa Rica	El Salvador	Guatemala	Honduras	Nicaragua
Total tax revenues	12.8	12.0	10.6	16.1	14.3
Direct tax revenues	3.5	3.5	2.8	3.7	2.8
Income tax	3.1	3.4	2.8	3.5	2.8
Property tax	0.4	0.1	0.0	0.2	0.0
Indirect tax revenues	9.3	8.5	7.8	12.3	11.4
General	4.9	6.3	4.8	5.5	5.9
Domestic	..	3.0	1.9	..	..
Imports	..	3.3	2.9	..	..
Specific	1.1	1.1	1.5	1.9	3.7
Petroleum products	..	0.6	0.9	0.7	2.5
Remainder	..	0.5	0.6	1.2	1.3
Trade and international transactions	0.9	1.1	1.2	2.0	1.1
Other indirect	2.4	0.0	0.3	2.9	0.7

Source: Agosin, Barreix and Machado (2005).

the investment from the payment of income and capital taxes. Moreover, the treatment given to foreign investors was also extended to domestic firms established in free zones, and even to their suppliers in those zones.

Analysts disagree on the importance of these exemptions –which, incidentally, have become quasi-permanent– in attracting investments to sectors which, in the final analysis, have significant comparative advantages in the subregion. What is indisputable is that such measures undermined the capacity of Governments to generate tax revenues. As the activities in question have been among the most dynamic of the Central American economies, the low elasticity of revenue with respect to GDP growth should be attributed largely to the exemptions they have enjoyed.

It is hard to justify tax exemptions for domestic firms operating in free zones. For foreign investors, the benefits of income tax exemptions depend on their dividend policy and legislation in their country of origin. In the case of United States enterprises, which account for the vast majority of foreign firms operating in Central American countries, the situation is as follows: if they repatriate dividends immediately after recording the profits, any rate of corporate income tax

rate below that prevailing in their home country (35%) merely transfers revenue to the United States Treasury from the country receiving the investment, with no effect on the firms themselves.

If the firms do not immediately pass the dividends to their parent company, they do not have to pay tax on the corresponding profits in the United States until they are actually repatriated, which gives them a degree of liquidity they would not otherwise have enjoyed. Accordingly, the firms are likely to overstate the value of those exemptions, and the clear result of the process is a loss of revenue for Central American Treasuries.

Another recurrent issue in the countries of the subregion over the last decade has been the proliferation and diversity of incentive regimes, both in domestic activities and in those directly related to foreign trade. The promotion of activities relating to tourism, construction, agriculture and mining, among others, and the proliferation of free and tax-free zones are constants that are repeated in each individual country. Exemptions have been granted not only for corporate income tax but also for import duties on inputs and capital goods and for domestic indirect taxes. Table 4 shows the tax benefits granted in free zones by Central American countries.

TABLE 4

Central American countries: tax incentives in free zones, 2002
(Percentages)

Incentives	Costa Rica	El Salvador	Guatemala	Honduras	Nicaragua
Exemption from import duty	100	100	100	100	100
Exemption from income tax	100% for eight years; 50% for the following four years[a]	100% for 20 years	100% for 12 years	100	100% for 10 years 60% thereafter
Exemption on the repatriation of profits	100	100	100	100	100
Exemption from VAT	100	100% for 10 years and renewable	100	100	100
Exemption from asset taxes	100% for 10 years	100	100	100	100
Exemption from municipal taxes and rates	100% for 10 years	100% for 20 years	100	100	100
Restrictions on/to local sales 50% in services	Up to 25% in manufacturing	None	Up to 20% for manufactures	With approval from the Ministry of Economic Affairs up to 5% in manufacturing up to 50% in services	With approval from the Ministry of Economic Affairs between 20% and 40% depending on the type of firm

Source: Rodríguez and Robles (2003).

[a] The deadlines are extended to twelve and six years in less developed zones.

Lack of information on the identity of the beneficiaries of these exemptions and incentives, and in terms of their order of magnitude, has made it impossible to estimate the total tax revenue that these countries have forgone as a result. The benefits, which are technically known as "tax expenses" and represent the set of taxes and levies that are not generated because they relate to promoted activities, impose an additional cost on the tax administration because the latter has to identify, within the universe of potential taxpayers, who is and who is not benefiting from one of the incentive regimes. Naturally, the exemptions have had to be offset by a heavier tax burden on sectors that are not promoted, which alters the conditions of horizontal equity by imposing unequal tax burdens on economic agents facing otherwise equal conditions.

The scope that these benefits have acquired since the 1990s, and the absence of detailed data on the various systems, makes it very hard to compare the countries of the subregion in terms of the sectors benefited, the type and extent of the benefits, and the results obtained in each case.

2. Main characteristics of existing taxes

a) Income tax

Despite the progress made in modernizing other taxes, income tax (IR) in Central American countries continues to suffer from a number of problems. Generally speaking, personal income tax (IRP) is assessed on a schedule basis rather than globally, which means that each type of income is subject to a specific tax regime with different rates. There are also many exemptions according to the generating source (insurance, interest, dividends and other financial and capital income). This means that nearly all of the tax burden falls, in practice, on the wages of employed workers, thereby distorting both horizontal and vertical equity, and eroding revenue effectiveness. As this situation is aggravated by the high proportions of informal and self-employed workers in Central American countries, it easy to see why the revenue generated by this tax is so low.

Furthermore, IRP is based on a territorial concept of income, so income generated abroad is not taxed. While it is hard to identify such income, adoption of the global income principle would be one way to close off potentially significant opportunities for evasion, and make it possible to provide the tax authority with additional inspection tools.

As mentioned above, corporate income tax (IRS) also offers a set of discretionary exemptions, basically for foreign firms established in free zones and for protected and/or promoted sectors, such as agriculture and tourism. With regard to modernization of the design of this tax, the legislation of Central American countries has generally not introduced regulations on transfer prices, weak capitalization, transfer of profits from and to tax havens, and other mechanisms that are widely used by transnational corporations to reduce their tax burden by shifting profits from one country to another.

Table 5 shows that IR revenue in Central American countries in 2002 amounted to 3.1% of GDP (24.2% of

TABLE 5

Central American countries: income tax[a] 2002

	IRS rates (%)	IRP rates (%)	Revenue from IRS (% of IR revenue)	Productivity of IRS[b] (%)	Minimum exempt from IRP[b] (%)	Maximum IRP bracket[c]	Share of IR in total tax revenue (%)	Revenue from IR (% GDP)
Costa Rica	30	10-25	20.8	3.5	0.8	3.7	23.9	3.1
El Salvador	25	10-30	61.7	7.8	1.2	11.0	28.3	3.4
Guatemala[d]	31	15-31	55.0	3.7	5.0	22.5	26.4	2.8
Honduras	15 and 25	10-25	18.2	8.6	3.6	36.0	22.0	3.5
Nicaragua[e]	25	10-25	..	..	4.7	37.5	19.8	2.8
Average	27.2	11-27.2	38.9	6.7	3.1	22.1	24.2	3.1
Latin America[f]	28.3	8.7-27.7	50.0	6.2	2.1	20.7	27.7	3.8

Source: Agosin, Barreix and Machado (2005); Stotsky and WoldeMariam (2002); Barreix, Roca and Villela (2004).

[a] IR: Income tax; IRS: Corporate income tax; IRP: Personal income tax.

[b] IRS revenue as a percentage of GDP, divided by the top IRS rate.

[c] Multiples of GDP per capita.

[d] Includes the mercantile and agricultural enterprises tax (IEMA).

[e] In May 2003 the top rate was raised to 30% for individuals and legal entities alike.

[f] Includes 17 countries. The figures correspond to the average for 2000-2001.

total revenue), 0.7 percentage points below the average for Latin America as a whole. The origin of these revenues varies greatly from one country to another: on average, 38.9% comes from enterprises - 11 percentage points less than the figure for Latin America as a whole. Legal entities contribute a high percentage of IR (61.7%) in El Salvador, but just 18.2% in Honduras.

Although IRS rates have generally been lowered in recent decades, what has eroded tax productivity in Central American countries has been the shrinking of the tax base. Average productivity has been 6.7%, which means that each percentage point of the IRS rate collects 0.067 percentage points of GDP. Surprisingly, the lowest productivity of this tax is seen in Costa Rica (3.5%), while Honduras records the highest (8.6%), although the latter is probably an overestimate, given the significant underestimation of that country's GDP.

In the case of IRP, as normal, Central American countries have a minimum tax-free bracket, which in this case is equivalent to 3.1 times per capita GDP. Guatemala and Nicaragua offer the highest levels of exemption at more than twice the Latin American average. Although such exemptions introduce a degree of progressiveness into the tax structure, they can be counter-productive if set at very high levels, and they also erode the tax base.

The top IRP bracket is 22.1 times per capita GDP in Central American countries, a figure that is slightly above the Latin American average. Nonetheless, the figure would appear to be very high in Honduras and Nicaragua, at 36 and 37.5 times per capita GDP respectively. Here again, in the case of Honduras however, there is probably a clear upwards bias because of the underestimate of GDP.

In short, despite the rationalization of IRP and IRS rates, net taxable income declared is significantly less than gross income in all countries. This reflects the extent of the shrinking of the tax base, which mainly stems from excessive objective and discretionary exemptions which, apart from distorting the horizontal and vertical equity of the tax system, generate significant revenue losses.

b) *Taxation of assets*

In some countries a minimum tax is levied on the income of legal entities, imputing a minimum return on enterprise assets and levying the tax on the fiscal value thereof or, in some cases, on sales. In countries where accounting rules are unclear or easily interpreted in favour of the firms' interests, this tax is harder to avoid than the tax on net profits. The tax on assets represents a minimum downpayment for IRS, and operates through withholding which is then deducted from the firm's profits tax liability. In cases where the firm declares lower taxes than already paid on account, the assets tax becomes a definitive payment.

As table 6 shows, most countries either have used, or still use this type of tax. Following their initial implementation, such taxes became less and less effective because of the increase in the minimum amount of capital required to apply them, and a steady reduction in rates. In some cases they were abolished in the face of the fierce opposition faced in all countries. Nonetheless, when rates are moderate (with a maximum of 1.5%) such taxes are desirable, because they help improve the IRS capture level, given the absence of trustworthy accounts and the shortcomings in tax administrations. It should also be recognized that design flaws have created problems of double taxation for the subsidiaries of transnational enterprises, because some developed countries do not grant tax credits for downpayments on this tax.

TABLE 6

Central American countries: taxes on net worth or assets, 1992-2001
(Percentages)

Year	Costa Rica	El Salvador	Guatemala	Honduras	Nicaragua
1992	0.36-1.17 on fixed assets	0.9-2.0 on assets	0.3-0.9 on real property[a]	...	1.5-2.5 on net worth
2001	1.0 on assets	..	0.2-0.9 on real property[a]	0.25 on assets[b]	1.0 on real property[a]
			3.5 on assets[c]		

Source: Stotsky and WoldeMariam (2002).

[a] Although the base consists of immovable assets, the tax is seen as an additional tax on enterprises.
[b] Levied on fixed assets worth over 750,000 lempiras owned by companies at the end of the tax period.
[c] Tax levied at a rate of 3.5% of assets or 2.25% of gross income declared in the sworn tax declaration relating to the previous year's profits.

TABLE 7

Central American countries: value added tax, 2002
(Percentage)

	General rate	Special rate	Productivity[a]	Share of VAT in total tax revenue	VAT revenue (% GDP)
Costa Rica	13.0		37.7	38.3	4.9
El Salvador	13.0		48.5	52.5	6.3
Guatemala	12.0		40.0	45.3	4.8
Honduras	12.0	15	45.8	34.3	5.5
Nicaragua	15.0	5 and 6	39.3	41.2	5.9
Average	13.0		40.8	43.0	5.3
Latin America[b]	14.5		42.1	44.2	6.1

Source: Agosin, Barreix and Machado (2005); Barreix, Roca and Villela (2004).

[a] VAT revenue as a percentage of GDP divided by the general rate.
[b] Includes 17 countries. The figures correspond to the average for 2000-2001.

c) *Value added tax (VAT)*

Although VAT was introduced in most Central American countries during the 1970s and 1980s, its revenue share has grown vertiginously since the early 1990s, basically as a result of rate hikes and, to a lesser extent, its extension to services. General VAT rates in the various countries rose by between three and nine percentage points between introduction of the tax and 2002; and as a result the average general rate in the region climbed from 7% to 13%.

The design of VAT in Central American countries suffers from two fundamental problems that erode the tax base, introduce distortions into the economy, undermine equity and make it hard to administer: these are excessive exemptions and use of the zero rate.

The goods and services most frequently exempted from VAT in Central American countries are products included in the basic shopping basket, along with transport, medical and education services, financial and insurance transactions, and energy and fuels. As in the case of income tax, in addition to these objective exemptions there are also discretionary exemptions for various categories of taxpayer such as non-governmental organizations (NGOs) municipalities, non-profit institutions - and for the agriculture sector and enterprises established in free zones.

These distortions are aggravated by zero rating for goods destined for the domestic market. Although this practice is appropriate in the case of exports to avoid undermining local producer competitiveness, in the case of goods for domestic consumption it not only erodes the tax base but also opens up a significant avenue of evasion (and even corruption).

VAT has become the main source of revenue in Central American countries; in 2002, it accounted for 43% of total tax revenue and represented between 4.8 and 6.3% of GDP. Nonetheless, the average revenue obtained from it (5.3% of GDP) is 0.8 GDP percentage points below the Latin American average.

The low productivity of this tax, at just 40.8%, reflects the high levels of evasion, compounded by excessive exemptions and zero rating. The countries where VAT productivity is lowest are Costa Rica and Nicaragua (37.7% and 39.3%, respectively), which is explained by the multiple leakages of the tax in these two countries. Furthermore, in Costa Rica VAT is not levied on services at all. In contrast, El Salvador and Honduras display productivity levels above 45%, although in the latter case the calculations are biased upwards by the aforementioned underestimate of GDP.

The economic literature suggests that the optimal design for VAT involves a single rate levied on the widest possible base.[10] This approach prioritizes neutrality between sectors and administrative simplicity, thereby reducing opportunities for evasion. Moreover, the generalization of VAT keeps domestic production on equal footing with imports. Indeed, in an integrated market with a zero tariff, as CAFTA is expected to be, intrasectoral trade harms domestic producers that are excluded from VAT. This is because the imported good enters the country with no VAT burden, since this will have been reimbursed by the Treasury of the good's country of origin, whereas the domestic producer

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[10] See, for example, Engel, Galetovic and Raddatz (1999).

cannot deduct VAT from inputs purchased because the final product is excluded. The damage will be greater, the less vertically integrated is the production process for the good or service in question. If practically all goods and services are taxed, the domestic producer will be able to deduct VAT from inputs, and the importer will pay VAT at the same rate, putting them on equal competitive footing (Arias, Barreix and others, 2005).

Nonetheless, it is widely recognized that, in economies where all goods are subject to VAT, the tax has a regressive effect on the income distribution. Although some recent studies have called this hypothesis into question,[11] what cannot be disputed is that VAT exemptions or zero rating for goods that make up a large share of the family shopping basket among the poorest families (i.e. food) is not an effective way to improve equity. As it is the better off who consume most of the favoured goods, exemptions and zero rating strongly erode the tax base and reduce the Government's capacity to implement redistributive policies through expenditure. It is more effective to obtain revenue through a uniform VAT and then subsidize consumption by the poor.

In short, while recent years have seen both an increase in the share of revenue obtained from VAT and a convergence in general rates towards increasingly appropriate and similar levels (thereby facilitating the trade integration process), serious problems persist relating to excessive exemptions and zero rating for non-exporters, which significantly erodes the tax base and undermines its productivity. Zero rating for non-exporters is also a formidable mechanism of evasion and generates substantial administrative costs.

d)   *Selective consumption taxes (ISCs)*

In recent years Central American countries have made significant progress in three aspects: ISC levels, the reduction in the number of goods and services taxed, and greater use of ad valorem rather than specific taxes. As table 8 shows, ISCs represented 1.5% of GDP in 2002 (12.2% of total revenue), 0.6 percentage points below

the average for all Latin American countries. Nicaragua is where these taxes collected most revenue, at 3.7% of GDP (equivalent to 26.8% of total tax revenue). Elsewhere, ISCs collect between 1% and 2% of GDP (varying between 8% and 14% of total tax revenue).

In some cases it might be worth raising very low rates, for example in the case of cigarettes and carbonated beverages in Honduras. In El Salvador, systematically low rates explain the low level of revenue obtained from ISCs.[12] In Guatemala, meanwhile, ISC is charged at specific rates, which reduces the elasticity of the tax structure by failing to take account of variations in the price of the goods and services taxed. In view of the low price-elasticity of demand for these goods, a rates hike would not significantly reduce the quantities traded and would therefore expand tax revenue.

e)   *Taxes on foreign trade*

Following trade liberalization in the 1990s, the average tariff in Central America in 2002 was just 5.6%, slightly over half of the average for Latin America as a whole (table 9).[13] There are also many discretionary exemptions and goods that are tariff-free, a phenomenon mainly associated with promotion regimes, including those relating to free zones. This generates a number of problems, such as erosion of the tax base, and provides incentives for evasion.

The strengthening of subregional integration and trade treaties with third countries suggests that the trend towards tariff elimination will continue, which in the future will make tax revenue almost exclusively dependent on domestic taxes. Tax administration will therefore become more difficult, and improvements in the tax collecting agencies will be necessary.

3.   Distributive effects of tax systems

The distributive impact of taxes can only be determined via an analysis of incidence based on a large volume of data broken down by income deciles or quintiles (distribution of incomes and consumption, income sources, definition of the family unit, etc.) and on the elasticities of the supply and demand for consumer goods and factors of production. Such data are not always available.

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[11] See Houghton (2004) and Jenkins and Kuo (2004). The argument is that, in less developed countries, the informal sector is very widespread and products traded on the informal market are not covered by VAT. At the same time, the poorest segments of the population make a high proportion of their purchases in that market (or else produce for self-consumption), whereas the better off buy their goods in formal establishments which do pay VAT. Thus, while all consumption by the higher-income sectors is subject to VAT, a large part of the consumption of lower-income sectors is not.

[12] In the early 2005, the rates of ISCs on cigarettes and alcoholic beverages were raised sharply.
[13] The existence of CACM makes the average tariff between countries minimal.

TABLE 8

Central American countries: selective consumption taxes, 2002
(Percentages)

	ISC tax rates[a]					Share in total tax revenue	Revenue (% GDP)
	Cigarettes	Beers	Rum	Carbonated beverages	Higher octane gasoline		
Costa Rica	70.0	45.0	60.0	30.0	Specific	8.4	1.1
El Salvador	39.0	20.0[b]	20.0[a]	10.0	Specific	9.2	1.1
Guatemala	100.0	Specific	Specific	Specific	Specific	14.2	1.5
Honduras	32.0	33.0	158.0[c]	8.0	Specific	11.8	1.9
Nicaragua	40.0	37.0	37.0[d]	14.5	Specific	26.8	3.7
Central America						12.2	1.5
Latin America[e]						15.4	2.1

Source: Agosin, Barreix and Machado (2005); Barreix, Roca and Villela (2004).

[a] Given the frequent changes in the rates of selective consumption taxes, the levels shown in the table may differ from those currently in force.

[b] To the 20% ad valorem 0.0057 dollars should be added for each 1% of alcohol volume per litre.

[c] For the remainder of alcoholic beverages, the figure is 445 plus an additional 20%.

[d] For the remainder alcoholic beverages, the figure is 37%.

[e] Includes 17 countries. The figures correspond to the average for 2000-2001.

TABLE 9

Central American countries: taxes on foreign trade, 2002
(Percentage)

	Average *ad valorem* tariff	Standard deviation	Share of these taxes in total tax revenue	Revenue from these taxes % GDP
Costa Rica	6.0	...	7.3	0.9
El Salvador	5.6	8.6	9.2	1.1
Guatemala	5.9	8.0	11.3	1.2
Honduras	5.3	...	12.5	2.0
Nicaragua	5.2	5.8	7.9	1.1
Average	5.6	7.5	9.5	1.2
Latin America[a]	10.1	6.9	8.9	1.2

Source: Agosin, Barreix and Machado (2005); Barreix, Roca and Villela (2004).

[a] Includes 17 countries. Figures correspond to the average for 2000-2001.

Moreover, a number of assumptions have to be made, for example relating to tax shifting; for example, it is generally assumed that the direct impact and incidence (the ultimate effect) of direct taxes on individuals fall on the taxpayer himself. The same cannot be said of indirect taxes, where tax shifting is the rule.[14]

Table 10 summarizes results obtained in national studies performed for three countries in the subregion. In percentage terms, the Gini coefficient after-tax is higher than before tax in the three countries for which information is available, which suggests that tax systems actually increase income concentration. In the case of

Costa Rica, the effect of the tax system on the income distribution in 2000 is marginal.

TABLE 10

Central America (three countries): Gini coefficients of income distribution[a] before and after taxes, 2000

Country	Coverage	Gini coefficient before taxes	Gini coefficient after taxes
Costa Rica	National taxes	0.482	0.483
El Salvador	National taxes	0.502	0.517
Honduras	National and municipal taxes	0.543	0.571

Source: Agosin, Barreix and Machado (2005); Bolaños (2002).

[a] The calculations of Gini coefficients are based on household deciles.

[14] The extent of shifting depends on the price elasticities of demand and supply.

III

Recommendations on tax reform

Having identified the reasons for tax reform and described the Central American tax systems in the previous sections, it is now possible to identify the elements that need to be included in the future tax reforms to be undertaken by the countries of the subregion.

1. The key objective: to increase revenue to invest in people

All the recommendations made in this paper aim at increasing the tax burden to provide the region's Governments with additional resources to invest in human development. This is consistent with the long-term aim of all Central American countries: to speed up growth and at the same time improve the income distribution.

Increasing tax pressure requires expanding tax bases and strengthening the tax administration, rather than raising rates. Such measures will also make it possible to improve the elasticity of the tax system with respect to changes in income.

Modernizing tax systems requires striking an appropriate balance between direct and indirect taxation, making it possible to form a tax system based on a few taxes that have broad and general tax bases with moderate rates. Major efforts are needed to expand not only the VAT tax base but also the personal and corporate income tax bases, while eliminating exemptions and benefits that result in unequal treatment for different taxpayers.

Many of the changes that could be introduced, and which have been referred to as second-generation reforms in view of the difficulties involved in implementing them, form part of a process whose results will only be seen in time. For that reason, the reform programme needs to strike a balance between immediate resource needs and medium- and long-term structural reforms.

It is essential to start quantifying the loss that each incentive regime inflicts on the Treasury and hence the opportunity cost it involves. This means undertaking studies of tax expense for all countries in the subregion. In addition, detailed knowledge of that data will make it possible to identify the beneficiaries of tax expenses, the sectors promoted and the goods and services affected, and thus go beyond mere analysis of the fiscal cost of incentive measures to more fully understand their economic effects.

2. The need for subregional coordination

There is an urgent need to define a set of parameters or basic criteria within which each Central American country would be free to choose, according to their particular circumstances. One of the initial aims should be to avert fiscal wars within the subregion, since these inevitably result in the degradation of tax systems. Regional coordination should include both the establishment of reference guidelines on tax incentives and the limits on the selective taxation of certain goods, together with criteria for determining the tax bases of VAT and income tax. In the latter case, it would be very useful for the subregion as a whole (possibly in the context of CAFTA) to negotiate a tax agreement with the United States and adopt regulations on transfer prices.[15]

3. Alternatives for reform of income and wealth taxes

The analysis of individual and corporate income taxes should be included in the debate on reform alternatives. As mentioned above, the highly concentrated distribution of personal or family income in the subregion is aggravated by existing tax systems. While tax policy is not the most suitable instrument for modifying the pre-tax income distribution, it is hard to accept the regressive the impact of the taxes.

It is also worth mentioning that efficiently administering and inspecting taxes on income and wealth is more complicated than in the case of indirect taxes. Additional efforts are therefore needed, combined with progress in generalizing at-source withholding systems as a way of complementing government action.

In the case of corporate income tax, the analysis of the situation in Central American countries shows that the revenue potential of that tax has not been fully exploited because of shortcomings in the capacity of the tax base to capture the changes that have occurred in their economies. Although substantial improvements

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[15] The rules of the Internal Revenue Service of the United States provide a model that could be emulated.

have been made to the tax structure in recent years, with inappropriate progressive taxes on business profits being turned into proportional taxes, tax bases still need to be modernized and generalized. The reform proposal prepared in Costa Rica in late 2001 is aimed in that direction, although its parliamentary approval is not without difficulty.

It would be helpful to resume the charging of minimum taxes on presumed income, based on the value of assets or gross sales. This would help to close the funding gap and strengthen direct taxation, while effectively implementing underlying reforms. In the case of IRP, it would be advisable to move towards a scheme of taxation based on global income, even though the administration of the tax is considered more complicated than that of the existing schedule-based taxes.

4. Improve the income distribution

Additional efforts are also needed to substantially improve the effectiveness and efficiency of tax and customs administration. Otherwise no tax reform will be successful. A start should be made by swiftly approving modern tax codes that clearly establish the rights and obligations of the parties involved, thereby affording certainty, objectivity and transparency to the Treasury-taxpayer relationship.

Moreover, given the highly concentrated nature of the subregion's economies and shortcomings in tax administrations, criteria for tax differentiation need to be established on the basis of the size and characteristics of the taxpayers in question. Large- and small-scale taxpayers should not be treated with the same criteria and administrative rules. Rules for small-scale taxpayers should be adapted in view of their large number and small revenue impact. It would therefore be advisable to design a simplified declaration and payment system for microenterprises and small businesses, encompassing VAT, income tax and, where appropriate, social security contributions. This would facilitate administration and reduce compliance costs and informality.

The trend towards eliminating minor taxes, rates, duties, contributions, and licence fees should also be intensified, since these small levies generate little revenue but require the mobilization of a large number of people and paperwork that distract the Treasury from its main objectives.

Lastly, mechanisms such as tax courts for appealing against administrative decisions need to be strengthened. This type of appeals process, separate from the administrative apparatus, would facilitate the implementation of expeditious systems, making it possible to validate the tax liability assessed by the administration while at the same time protecting taxpayers' rights.

APPENDIX

Econometric estimations

In the estimated model, the fiscal variables normalized on GDP are adequately explained by GDP per capita and the income distribution (Gini coefficient). Two hypotheses were expounded in the text: tax revenue and public expenditure as a proportion of GDP vary (i) directly with per capita income; and (ii) inversely with inequality in the income distribution. The results, calculated for the late 1990s using World Bank (2004) data, can be summarized as follows:

$$T/Y \;=\; 1.45 + 3.97\log YPC - 0.36\,GINI \quad (1)$$
$$\quad\quad (0.18) \quad (5.20)** \quad (-4.93)**$$

Adjusted R^2 = 0.469; Number of observations = 95. Figures in parentheses correspond to the t-statistic; an asterisk indicates that the coefficient in question is statistically significant at the 5% confidence level, and two asterisks indicate significance at the 1% level.

$$G/Y \;=\; 19.50 + 2.66\log YPC - 0.36\,GINI \quad (2)$$
$$\quad\quad (2.42)* \quad (3.57)** \quad (-4.42)**$$

Adjusted R^2 = 0.307; Number of observations = 120.

$$GSAL\,/\,Y \;=\; -4.36 + 1.10\log YPC - 0.039\,GINI \quad (3)$$
$$\quad\quad (-3.54)** \quad (9.67)** \quad (-3.19)**$$

Adjusted R^2 = 0.555; Number of observations = 121.

$$GED/Y \;=\; 0.74 + 0.54\log YPC - 0.02\,GINI \quad (4)$$
$$\quad\quad (0.44) \quad (3.49)** \quad (-1.12)$$

Adjusted R^2 = 0.138; Number of observations = 120.

The variables are defined as follows:

T/Y   = Tax revenues as a proportion of GDP (Y)
YPC   = GDP per capita
GINI   = Gini coefficient of income distribution
G/Y   = Total public expenditure as a proportion of GDP
GSAL/Y = Public expenditure on health as a proportion of GDP
GED/Y   = Public expenditure on education as a proportion of GDP

In all equations GDP per capita appears as highly significant in explaining the behaviour of fiscal variables. The Gini coefficient

is also significant in all equations except (4), which explains the variations between countries in public expenditure on education. Naturally this model is extremely parsimonious. An attempt was also made to include a variable that would measure natural resource wealth (exports of minerals as a proportion of total exports), but this proved not to be significant. The possible endogeneity of the Gini coefficient with respect to GDP per capita (as suggested by Kuznets' inverted-U) does not cause problems of multicollinearity that invalidate the results obtained.

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Public debt sustainability in

the northern countries of Latin America

Igor Paunovic

An analysis of public debt indicators in eight northern countries of Latin America reveals that Nicaragua and Honduras are the most vulnerable; Panama, the Dominican Republic, Costa Rica, and El Salvador are moderately vulnerable; while Mexico and Guatemala have debt levels that are not considered dangerous. Nonetheless, a subsequent review of four indicators of fiscal sustainability shows only Mexico to be well positioned under all criteria; Costa Rica and Guatemala display a number of minor problems, while various special circumstances explain the favourable results obtained by Nicaragua and the Dominican Republic; and El Salvador, Honduras and Panama will be unable to sustain their 2004 fiscal policy for very long. Lastly, analysis of the sensitivity of the debt to a "sudden stop" in foreign capital inflows suggests the need for a cautious attitude towards the future trend of the public debt in the face of rising international interest rates.

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I

Introduction

Thanks to the hopes kindled by macroeconomic and structural reforms and the resumption of growth, the fiscal sustainability of public debt has not been a prominent item on government agendas in the eight Northern Latin American countries for most of the 1990s and the first few years of the new millennium. This could change, however, given the slow pace of economic growth in 2000-2003 and the rise in international interest rates since mid-2004. It is therefore worth considering how vulnerable these eight countries (Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama and the Dominican Republic) are in macroeconomic terms.

The issue of public debt sustainability has recently regained importance worldwide following a series of debt restructurings or moratoria in countries as different as Argentina, Ecuador, Pakistan, Russia, Ukraine and Uruguay. In response to these developments, the International Monetary Fund (IMF) began to develop mechanisms to ensure an orderly resolution of future debt crises. While these will serve in post-crisis situations, an even more important task is to focus on the prevention of debt crises. To highlight a number of worrying trends in developing countries, the Fund devoted a chapter to this topic in its *World Economic Outlook, 2003* (IMF, 2003), and ECLAC included a chapter on public debt sustainability in the region in its *Economic Survey of Latin America and the Caribbean, 2003-2004* (ECLAC, 2004). The latter draws attention to the fact that the curve reflecting the behaviour of such debt has been U-shaped over the last 15 years; the debt as a percentage of GDP declined from 1990 to 1996, before rebounding as from 1997. The latter period coincided with what ECLAC has dubbed the "lost half-decade".[1]

The fact that the debt is higher today than it was seven years ago is not worrying in itself. Nonetheless, the world economy is in the upswing of the business cycle, following three years of very low growth, and

this phase of the cycle is usually accompanied by a revival of inflation and a corresponding reaction by the monetary authorities, with monetary tightening reflected in a general rise in interest rates. A clear sign of this sequence unfolding is the fact that the United States Federal Reserve has been raising its benchmark interest rate since mid-2004.

The phase of very low interest rates has therefore come to an end, and the question now is how far rates will rise and what the consequences will be for the northern Latin American countries. If rates rise to a moderate level and gradually, the debt is unlikely to become a problem; but if they reach high levels and very suddenly, then debt sustainability could become a key economic policy issue.

Against this international backdrop, this article examines the following set of questions: Are the northern Latin American countries likely to suffer a debt crisis in the next two or three years? Are public finance trends in these countries sustainable? If not, what size of fiscal adjustment would be needed to make them sustainable? Given national and international circumstances, what are the prospects for those countries in terms of public debt? And lastly, which countries are most vulnerable at the present time?

Section II of the article examines the public-debt status of these eight countries and describes a number of key debt indicators. These (both stock and flow coefficients) are then compared with the international thresholds suggested in the specialist literature. The indicators, which represent *ex post* measures of indebtedness, serve as an initial approach to the subject.

Section III analyses indicators of public debt sustainability in the northern Latin American countries. Of the numerous indicators of fiscal sustainability proposed in theoretical studies, we chose four: the Blanchard (1990) indicator, the macro-adjusted deficit of Talvi and Végh (2000), the recursive algorithm of Croce and Juan-Ramón (2003), and the currency-mismatch indicator proposed by Calvo, Izquierdo and Talvi (2003). As any analysis of public debt sustainability is at the same time an analysis of fiscal policy sustainability, it will also be possible to deduce the magnitude of the fiscal adjustment needed to put public finances on a sustainable path.

[1] In fact, the public debt as a percentage of GDP in 2004 was higher than the external debt as a percentage of GDP in 1982, when the debt crisis broke. Carrera Troyano (2004) analyses this point in greater detail.

Section IV places the results of the two previous sections in the broader setting of the macroeconomic situation of the northern Latin American countries and their international setting, both now and in the future. The sensitivity of the debt is calculated in the hypothetical case of a "sudden stop" in foreign capital inflows, which translates into a sudden depreciation, rising interest rates, growth slowdown, and the conversion of contingent liabilities into public debt.

This indicates the order of magnitude of the fiscal adjustments needed in the worst-case scenario, in which the four adverse effects indicated above occur simultaneously. Lastly, the paper analyses the behaviour of several major sources of foreign exchange, such as remittances, tourism and the maquila industry.

Section V sets forth conclusions and policy recommendations.

II

Public debt indicators in the

northern Latin America countries

Public debt indicators provide initial information on debt sustainability. They are *ex post* indicators in the sense that they compare observed facts with indicators of sustainability, which in turn show *ex ante* the magnitude of the permanent fiscal adjustment needed to make the debt sustainable. The debt indicators comprise both stock and flow coefficients and assist us with international comparison. The World Bank, the IMF and other financial institutions normally define threshold values for a number of indicators, for early warning and prevention purposes.

Public external debt accounts for over half of the total external debt in all of the countries analysed (see table 1). The smallest share is in Mexico (54%), and the highest in Nicaragua (86%). What happens with public debt therefore determines the trend of external debt, and vice versa.[2]

Another important element is the share of short-term debt in total external debt; and it is usually considered that the economic authorities have no cause for alarm provided this indicator is below 10%. Nonetheless, the short-term debt accounts for over 10% of the total in four of the eight countries analysed, and it is approaching that level in another three, which suggests a dynamic that could be dangerous in adverse circumstances. Accordingly, bearing in mind the current and future international situation, public debt trends need to be analysed and continuously monitored.

Many debt analysts work with the net present value of the debt rather than its nominal value, arguing that this is a more precise figure since it shows how much of the debt is concessional. For the same reason, the debt is normally measured in net rather than gross terms, with the Government's liquid assets deducted. This

TABLE 1

Northern Latin American countries: public external debt and short-term external debt as a proportion of total external debt, 2002
(Percentages)

Indicator/Country	Costa Rica	El Salvador	Guatemala	Honduras	Mexico	Nicaragua	Panama	Dominican Republic
Total external debt	64.9	80.9	77.9	78.1	54.0	86.0	77.2	64.5
Short-term debt/ Total external debt	31.0	17.0	19.9	9.7	7.0	8.5	4.5	32.3

Source: World Bank (2005).

[2] The economics literature has attempted to provide a theoretical framework to explicate the link between public debt and external debt, but thus far the results have only been partial. See for example Horne (1991), Parker and Kastner (1993), and Chalk and Hemming (2000).

would be correct if figures were available on unregistered liabilities that are implicit government debts –a category that includes off-budget and contingent liabilities, obligations arising from the social security system, and others.[3] Their effect is to raise the debt/GDP ratio, but the lack of data on unregistered liabilities in the countries analysed makes them impossible to quantify. Accordingly, we believe that gross nominal debt in relation to GDP is an indicator that is less error-prone than the net debt or the net present value of the debt.[4] The uncertainty surrounding the figures stems from methodological problems in the accounting records of several of the eight countries analysed. Dual accounting practices, omitting certain fiscal operations from the records or using heterodox fiscal accounting (as in Panama until recently), distort the official figures and do not faithfully reflect the fiscal reality of the public sector. Lastly, as problems of under-recording are of an unknown magnitude but probably significant, the best one can do is to draw attention to the situation and use the nominal gross debt instead of the net debt or its net present value.

One of the most widely used indicators is the total public debt (domestic plus external) of the non-financial public sector (NFPS) expressed as a percentage of GDP. There is no consensus as to what level of debt is dangerous, however, and the critical values vary widely depending on the type of economy. A level deemed acceptable for industrialized countries is considered too dangerous for developing countries. For example, one of the Maastricht Treaty criteria for European Union countries to adopt the common currency required public debt to be below 60% of GDP. In contrast, the IMF (2003) argues that the sustainable level of public debt in emerging economies is just 25% of GDP.

This very low level, while controversial, reflects the changes that have occurred in the international economy over the last 35 years. In an increasingly globalized world, in which financial capital crosses national borders without difficulty, international macroeconomic and financial stability is a global public good. Nonetheless, this public good is currently in very short supply worldwide.[5] As a result, the existing international financial architecture forces countries to assume the cost of macroeconomic stability individually, a task which recently proved burdensome even for Asian countries such as the Republic of Korea, whose macroeconomic management is exemplary.

Be that as it may, we live in a world where the problem of public debt sustainability is seen as pertaining exclusively to individual countries, so almost inevitably one must accept that the critical value for such sustainability is just 25% of GDP. Another threshold level recommended by the Fund (IMF, 2002) is 40% of GDP. Below this proportion, the likelihood of a debt crisis occurring is under 5%; but when the level of the debt surpasses the equivalent of 40% of GDP, the probability of crisis climbs to a range of 15%-20%. In other words, the relation between the likelihood of a debt crisis and the level of the debt is non-linear,[6] which makes it even more important to analyse the level of the debt and its sustainability.

How are the northern Latin American countries placed in this regard? Figure 1 shows the debt of the non-financial public-sector as a proportion of GDP for the eight countries studied.[7] Three countries have a higher debt level than the average for Latin America and the Caribbean as a whole; and two of them, Nicaragua and Honduras, have been admitted to the Heavily Indebted Poor Countries (HIPC) initiative. Panama also has a relatively high level of debt. Levels of around 48% of GDP in Costa Rica and the Dominican Republic, and 42% in El Salvador, place these countries above the critical 40% mark, but below the Maastricht Treaty criterion. Mexico is the only country where a debt crisis seems very unlikely, while Guatemala is the only country that fulfils the very stringent sustainability requirement of public debt below 25% of GDP.

In addition to the proportion of GDP, another key indicator is the total public debt in relation to public-sector income (figure 2). A given level of public debt as a proportion of GDP may vary greatly in relation to public revenues. Costa Rica and the Dominican Republic clearly illustrate this with their debt/GDP ratios both around 48% in 2004, but ratios of debt/public-sector income of 136% and 294%, respectively. This reflects the different sizes of the State in the two countries, and serves to nuance

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[3] Further details on this can be found in ECLAC (1998) and IMF (2002).

[4] One of the most perverse characteristics of contingent liabilities is their asymmetric occurrence. In good times they mostly remain contingent, but in bad times a high proportion of them move out of that category and become public debt. In a catastrophic crisis such as the external debt crisis of the 1980s, even private debts become public debt, especially those of the financial sector.

[5] See ECLAC (2002), for example.

[6] Pattillo, Poirson and Ricci (2002) also find a non-linear relation between external debt and economic growth, specifically, that the impact of the external debt on growth becomes negative above a debt level of 35%-40% of GDP and/or 160%-170% of the value of exports.

[7] Except for the Dominican Republic and Guatemala, which only report central government figures.
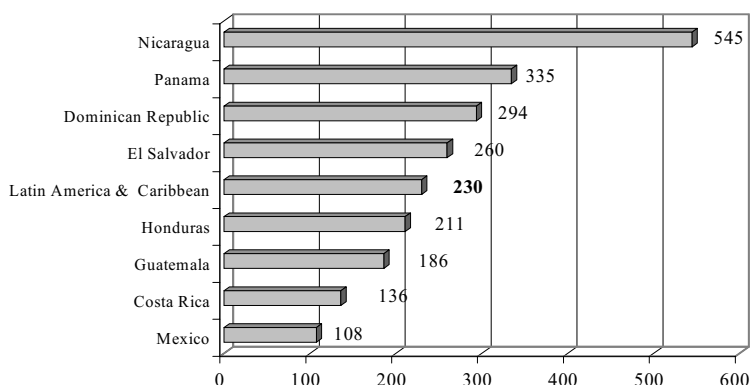
FIGURE 1

Northern Latin American countries: debt of the non-financial public sector as a percentage of GDP, 2004
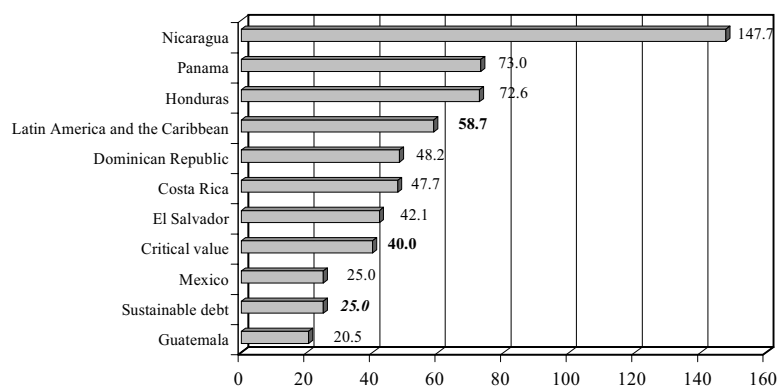
Source: Author's calculations, on the basis of official figures.

FIGURE 2

Northern Latin American countries: public debt as a percentage of public-sector revenue, 2004

Source: Author's calculations, on the basis of official figures.

the debt/GDP indicator by indicating the burden on the Treasury's revenue-generating capacity.

Another important indicator is the ratio between public external debt and exports of goods and services (figure 3). A threshold of 150% was used to identify countries eligible for admission to the HIPC initiative, although measured through the net present value of the public external debt. This provides an indicator of the burden on exports, i.e. on the economy's foreign-exchange-earning capacity. In this regard, the Dominican Republic is one of the countries with the greatest capacity to generate foreign exchange, in contrast to the conclusions drawn from the previous two indicators. Mexico is the best placed country, with Nicaragua and Honduras at the other extreme.

It is also necessary to compare debt amortization with new debt disbursements (figure 4). If this "revolving ratio" is above 100, existing debt is not refinanced by new borrowing; but if the indicator is below 100, old debt is being refinanced with new, thereby prolonging the prevailing debt dynamic. Unfortunately, no northern Latin American country is on the "right" side of this indicator (i.e. over 100). Mexico is best placed, almost reaching the critical value, with Costa Rica and El Salvador also relatively close. The fact that other countries are way below the threshold flags a potentially dangerous trend in the future in the absence of radical changes.

The level of interest payments on the public debt in relation to GDP shows how burdensome such payments are for the country (figure 5). The critical

FIGURE 3

Northern Latin American countries: public external debt as a percentage of exports of goods and services, 2004
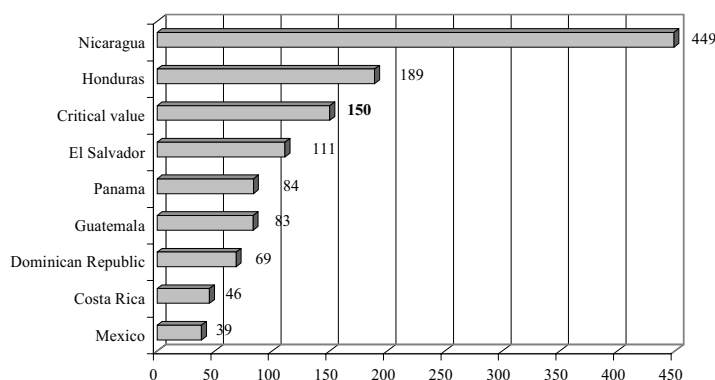
Source: Author's calculations, on the basis of official figures.

FIGURE 4

Northern Latin American countries: ratio between debt amortization and new disbursements, 2004
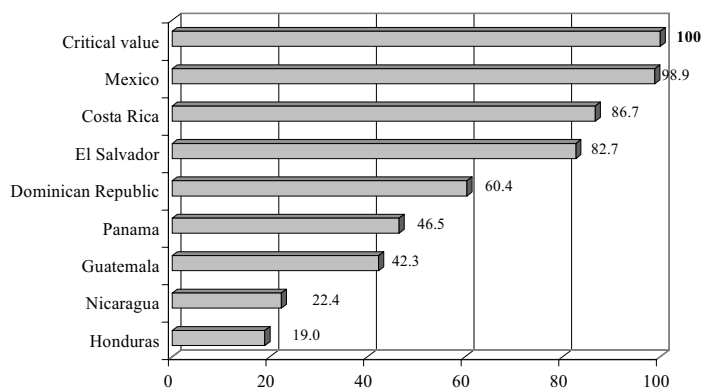
Source: Author's calculations, on the basis of official figures.

FIGURE 5

Northern Latin American countries: interest payments on the public debt as a percentage of GDP, 2004
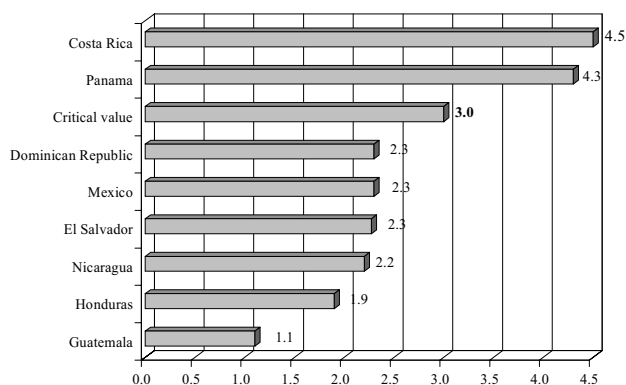
Source: Author's calculations, on the basis of official figures.

value mentioned in the specialist literature is 3% of GDP. On this basis, Costa Rica and Panama are on the wrong side of the threshold. As these two countries also have the highest share of domestic debt in total public debt,[8] it can be inferred that the interest rates they pay on domestic debt are relatively high.

Table 2 displays the indicators analysed along with several others that may be of interest, such as the net international reserves held by central banks in relation to public external debt, public external debt service as a proportion of exports of goods and services, and others. All of these indicators provide valuable information on the scale of public indebtedness and can be used to assess potential risks in the near future.

The debt indicators of these eight countries reflect their tremendous variety. Nicaragua and Honduras would appear to be in the most problematic situation, although the rules of the game for them are different since both are already included in the HIPC initiative. These two countries also have adjustment programmes in place with the IMF, in which a major component is devoted to fiscal tightening. The second group includes Costa Rica, the Dominican Republic, El Salvador and Panama, whose indicators display major vulnerability, but not extreme as in the first group. This could become a problem if the currently favourable conditions were to worsen significantly. Lastly, Mexico and Guatemala are a group apart, given that their indicators do not indicate a dangerous level of debt.

TABLE 2

Northern Latin American countries: indicators of public debt, 2004

	Costa Rica	El Salvador	Guatemala	Honduras	Mexico	Nicaragua	Panama	Dominican Republic
External debt/GDP	21.1	30.2	14.3	68.3	11.5	118.3	52.6	33.9
Domestic debt/GDP	26.6	11.9	6.2	4.3	13.4	29.4	20.4	14.3
Total public debt/GDP	47.7	42.1	20.5	72.6	25.0	147.7	73.0	48.2
Total public debt/public-sector revenue	135.9	283.2	186.2	210.9	107.7	54.0	334.7	293.9
External debt/exports	45.5	111.1	83.4	189.0	38.5	449.3	83.8	68.7
Net international reserves/external debt	51.6	39.5	89.4	33.0	78.8	8.0	…	9.4
External debt service/exports	12.8	22.0	10.0	18.5	12.8	6.4	12.8	15.5
External interest payments/exports	2.8	7.0	4.1	2.5	4.7	9.4	5.7	3.8
Amortization/disbursements (external debt)	86.7	82.7	42.3	19.0	98.9	22.4	46.5	60.4
External interest payments/GDP	1.3	1.9	0.6	1.2	1.0	0.6	3.6	1.9
Domestic interest payments/GDP	3.2	0.4	0.5	0.7	1.3	1.6	0.7	0.4
Total interest payments/GDP	4.5	2.3	1.1	1.9	2.3	2.2	4.3	2.3
Total public debt per capita (in dollars)	2 065	985	436	719	1 594	1 227	3 016	997

Source: Author's calculations, on the basis of official figures.

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[8] Except for Nicaragua.

III

Indicators of fiscal sustainability

1. Theoretical issues underlying these indicators

Economic theory states that the results of current fiscal policies satisfy the solvency condition when future primary surpluses are equal to the public debt, both variables being measured in net present value terms.[9] This means that the Government is solvent on an intertemporal basis, since it can persist with its current policies. Nonetheless, this condition does not easily translate into an operational indicator, for future primary surpluses cannot be known in advance. Moreover, as Horne (1991) points out, government solvency is a necessary but not a sufficient condition for current fiscal policy to be sustainable. The future behaviour of the private sector is also relevant, since this determines future rates of interest and economic growth.

To avoid these problems, the specialist literature has proposed simpler indicators that have far less demanding data requirements than those based on the concept of intertemporal solvency.[10] Nonetheless, indicators of this type lack a clear theoretical basis for their construction. One of the most serious problems is their arbitrary nature; in general they measure the effort needed to keep the debt/GDP ratio at its current level, but that level might either be too high or too low, and these indicators provide no criteria for judging this. Accordingly, they have to be considered along with the debt indicators presented in section II.

2. Four fiscal sustainability indicators in the northern countries of Latin America

We now present four indicators of sustainability, each of which highlights an element that is relevant to sustainability analysis. The first is the short-term primary gap (Blanchard, 1990) which indicates the level

of the permanent primary balance[11] needed to stabilize the debt relative to GDP at its current level:

$$sp^* - sp = (r_t - n_t) \, b - sp \qquad (1)$$

where sp^* is the permanent primary balance needed to stabilize the debt, sp is the existing primary balance, r_t is the trend real interest rate, n_t is the trend rate of GDP growth, and b is the debt/GDP ratio. If the permanent primary balance is larger than the current primary balance, the primary gap is positive. This means that fiscal policy is unsustainable, because it tends to increase the level of debt in relation to GDP. In the opposite situation, where the permanent primary balance is below the current primary balance, fiscal policy tends to reduce the debt/GDP ratio.

Table 3 shows data on the primary balance prevailing in 2004, the required primary balance in 2004, the trend primary balance, the trend primary gap and the required primary gap in 2004. The trend primary balance and the trend primary gap are indicators proposed by Blanchard along with the trend growth rate over the last 10 years[12] and the real interest rate over the last 10 years. We use the "implicit" interest rate, which is calculated as debt interest payments as a percentage of the debt balance outstanding in the previous period, as suggested in ECLAC (2004). Specifically, the real interest rate was calculated as the weighted average of interest rates on domestic and external debt:

$$r_t = r_t^D \, \frac{b_{t-1}^D}{b_{t-1}} + r_t^E \, \frac{b_{t-1}^E}{b_{t-1}} \qquad (2)$$

where r_t^D is the interest rate on the domestic debt, b_{t-1}^D is the domestic debt service/GDP ratio in the previous period, b_{t-1} is the total public debt/GDP ratio in the previous period, r_t^E is the interest rate on public external debt, and b_{t-1}^E is the public external debt/GDP ratio in the previous period.[13]

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[9] See for example Horne (1991), Talvi and Végh (2000).

[10] Another line of research on sustainability uses econometric methods. Nonetheless, there is no consensus on how the problem of sustainability should be analysed (Chalk and Hemming, 2000). Access to large amounts of data is needed to afford sufficient degrees of freedom, which is a prohibitive requirement for many developing countries. For these two reasons we do not explore that line of research here.

[11] The primary balance is the difference between total revenue and total expenditure excluding interest payments.

[12] The trend growth rate was estimated in the usual way using the Hodrick-Prescott filter with $\alpha = 100$.

[13] The real domestic interest rate was calculated using the variation in the consumer price index. To obtain the external real interest rate, we used the variation of the unit value of merchandise exports, as suggested in ECLAC (1988).

TABLE 3

**Northern Latin American countries: indicators of the primary gap
and the existing primary balance, 2004**
(Percentages and percentages of GDP)

Indicator/country	Costa Rica	El Salvador	Guatemala	Honduras	Mexico	Nicaragua	Panama	Dominican Republic
Primary balance existing in 2004	0.5	-0.2	0.2	0.1	2.5	2.0	-0.7	3.9
Trend implicit interest rate	4.9	5.4	5.1	13.2	1.6	1.4	6.6	3.0
Implicit interest rate in 2004	2.8	4.7	1.3	8.8	1.1	-4.6	4.9	-4.4
Trend growth rate	4.6	3.6	3.7	3.0	3.0	4.2	3.9	4.8
Real growth rate in 2004	4.2	1.5	2.7	5.0	4.4	5.1	6.2	2.0
Trend primary balance	0.1	0.7	0.3	7.4	-0.4	-4.1	1.9	-0.9
Required primary balance in 2004	-0.7	1.3	-0.3	2.8	-0.8	-14.4	-0.9	-3.1
Trend primary gap	-0.4	0.9	0.0	7.3	-2.8	-6.0	2.6	-4.8
Required primary gap in 2004	-1.2	1.5	-0.5	2.6	-3.3	-16.3	-0.2	-7.0

Source: Author's calculations on the basis of official figures.

We also made a minor change to the Blanchard indicator, by calculating the primary gap using data on economic growth and the real interest rate in 2004. We call this indicator the required primary balance in 2004. Whereas the traditional Blanchard indicator reflects the primary balance with "normalized" data over at least one business cycle, our modification captures short-term conditions prevailing in the year for which the indicator is calculated. This can be useful both to support its status as a suitable indicator for capturing specific or temporary conditions, and to compare it with more "normal" conditions reflected by the indicator of the trend primary balance.

When interpreting the results, the special characteristics of the current situation need to be borne in mind, since interest rates are at a very low level, while GDP growth is relatively high. For that reason, the trend primary gap is a better indicator than the required primary gap in 2004. For greater clarity, table 3 also presents data on the trend implicit real interest rate, the implicit real interest rate in 2004, the trend growth rate and real growth rate in 2004. As can be seen, the trend implicit real interest rate in 2004 is above the implicit real interest rate in all cases, whereas the trend growth rate is above the real growth rate in 2004 in just four countries. In the other four, the trend growth rate is below the real growth rate recorded in 2004. Lastly, the implicit real interest rate in 2004 is below the real growth rate in 2004 in six of the eight countries. For these reasons, the required primary balance in 2004 in most cases is less than the existing balance.

In the case of Costa Rica these results show that fiscal policy is tending to stabilize the level of public debt in 2004, because the current primary balance is greater than both the trend and the required primary balances. Nonetheless, it is worrying that the country spends over 4% of GDP each year on interest payments. In 2004, El Salvador, Honduras and Panama have positive primary and required gaps, so if they persist with their current fiscal policy, public debt will grow as a percentage of GDP.[14] In contrast, the results for Guatemala and Mexico show that current fiscal policy is sustainable.

Nicaragua and the Dominican Republic are to some extent special cases. The required primary balance in 2004 for Nicaragua is heavily biased by the real interest rate, which is negative as a result of the country's minimal interest payments, given debt payment arrears and payments condoned under the HIPC initiative. Another significant factor is the relatively high growth rate (5.1%), which is reflected in the negative required primary balance. Both factors also appear in the case of the trend primary balance. In contrast, in the Dominican Republic the positive primary balance recorded in 2004 stems from the inadequate coverage of the country's published fiscal data, which only reports the result of central government and excludes the central bank's quasi-fiscal deficit. As the latter was around 4% of GDP in 2004, a broader coverage of fiscal policy results would prove less flattering. Nonetheless, the country made major efforts to regain macroeconomic policy credibility following the banking crisis of May 2003. The required primary

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[14] Panama partially escapes this conclusion with the negative required primary gap in 2004. Nonetheless, the growth rate in 2004 was 6.2%, higher than the implicit interest rate (4.9%); so the question is for how long this situation can last, given the fact that interest rates are rising.

balance in 2004 is also negative because the real interest rate paid by the country on its domestic debt was negative. Inflation, which had reached the annual rate of 60% at the start of 2004 and has been decreasing since then, was the cause of the real negative interest rate in 2004. Lastly, with the more usual parameter values (the very high growth in the 1990s), the Dominican Republic should not have debt sustainability problems: figures for the trend primary surplus suggest that it could indulge in negative primary balances of up to 4.8% of GDP and still maintain the level of its debt as a proportion of GDP.

This indicator therefore suggests that fiscal policy is sustainable in Costa Rica, Mexico and Guatemala.[15] The cases of Nicaragua and the Dominican Republic should be interpreted with care, bearing in mind their special circumstances. According to the Blanchard indicator, the other countries analysed need to take action to return to a fiscal sustainability path.

The second indicator of fiscal sustainability explored in this paper is the macro-adjusted primary deficit proposed by Talvi and Végh (2000). The underlying motivation for this indicator is the great volatility displayed by macroeconomic variables in Latin America, which means that the deficit at a given moment may differ greatly from what it would be under normal macroeconomic conditions. To solve this problem, the authors propose calculating a macro-adjusted primary deficit, which reflects what would occur if the economy followed its long-term path (i.e. GDP at its potential level, fiscal revenues unaffected by short-term situations, etc).

The basic idea behind this indicator is to contrast the macro-adjusted deficit with the deficit that results from considering interest payments actually accruing at a given moment, in conjunction with the country's debt level and growth rate at that moment. The indicator is defined as:

$$I_t^M \equiv \frac{(r-g)}{(1+g)} b_{t-1} + d_t^M \qquad (3)$$

where r is the real interest rate for the year being analysed, g is the real growth rate in that year, and d_t^M is the macro-adjusted primary deficit, i.e. the deficit that would result under normal macroeconomic conditions.[16] The problem with this indicator is deciding

what exactly are the "normal" conditions for an economy. The authors suggest identifying such conditions through a very detailed analysis performed by experts. We, however, employ a relatively simple procedure for the eight economies studied: as a proxy for normal conditions, we use the indicators of the trend GDP gap for each country to identify years when the gap between real GDP and trend GDP was smallest. We then take the primary balance of that year and enter it as the macro-adjusted primary balance in table 4. We also include data on interest payments as a percentage of GDP for illustrative purposes.

As equation (3) shows, fiscal policy sustainability requires this indicator to be no larger than zero, otherwise the debt will be unsustainable through time.

The indicator of the adjustment needed in 2004 is negative in all countries except Honduras, which was therefore the only country in which fiscal policy was unsustainable in that year. The special conditions that gave rise to these results (low interest rates and relatively high growth) were explained previously with the results obtained using the Blanchard indicator. The burden of debt service, even at times of low interest rates, is thus important. Nonetheless, thanks to the fiscal consolidation efforts that have been made, most countries are in a sustainable situation under current conditions.

The third indicator of fiscal responsibility, proposed by Croce and Juan-Ramón (2003), is based on a recursive algorithm derived from the pattern of movement of the debt/GDP ratio, given the reaction function of the fiscal authorities. In simple terms, the fiscal authorities decide upon a certain level of public debt in relation to GDP, and calculate the primary surplus needed to achieve it. This indicator is calculated as follows:

$$I_{sf} = \frac{1+r_t}{1+n_t} - \frac{sp - sp^o}{b_{t-1} - b^o} \qquad (4)$$

where I_{sf} is the indicator of fiscal sustainability, $sp°$ is the primary balance that will prevail once the target debt/GDP ratio is attained, and $b°$ is the level of the debt/GDP ratio that the authorities want to achieve. As the debt levels desired by the fiscal authorities in the eight countries are unknown, we decided to set a uniform target for all countries of lowering the debt/GDP ratio by 10 percentage points. This is obviously excessively restrictive in the case of Guatemala, and too lax in the case of Nicaragua, apart from being entirely arbitrary. Nonetheless, the exercise gives an idea of how the fiscal sustainability indicator works (table 5).

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[15] These conclusions need to be nuanced by the previous note on data quality. If the data used do not faithfully and fully capture the country's fiscal reality, sustainability indicators tend to be less useful. Unfortunately, there is no way to quantify the discrepancy between the official figures and fiscal reality.

[16] Exclusively for the purpose of constructing this indicator, we define the deficit as the difference between expenditure and revenue, such that when the difference is negative there is a surplus.

TABLE 4

Northern Latin American countries: macro-adjusted primary deficit and required deficit, 2004

(Percentages and percentages of GDP)

Indicator/country	Costa Rica	El Salvador	Guatemala	Honduras	Mexico	Nicaragua	Panama	Dominican Republic
Interest payments/GDP	4.5	2.3	1.1	1.9	2.3	2.2	4.3	2.3
Macro-adjusted primary deficit	-4.5	-3.1	-0.3	0.0	-3.5	-2.3	-3.4	0.0
Value of the indicator in 2004	-5.12	-1.75	-0.58	2.66	-4.32	-20.19	-4.18	-3.38

Source: Author's calculations on the basis of official figures.

TABLE 5

Northern Latin American countries: indicator of fiscal sustainability, 2004

(Percentages of GDP)

Indicator/country	Costa Rica	El Salvador	Guatemala	Honduras	Mexico	Nicaragua	Panama	Dominican Republic
Target total debt/GDP ratio	37.7	33.0	10.3	62.6	15.0	138.0	63.0	38.1
Target primary balance/GDP ratio	0.1	0.6	0.1	6.2	-0.2	-3.7	1.6	-0.7
Fiscal sustainability indicator	0.96	1.09	1.00	1.62	0.74	0.87	1.52	0.68

Source: Author's calculations on the basis of official figures.

What is important is that this indicator should have an absolute value of less than 1. If this condition is fulfilled, the country will be in a position to reduce its public debt/GDP ratio to the proposed level, in our case a reduction of 10 percentage points. Consequently, Costa Rica, Dominican Republic, Mexico and Nicaragua could achieve this target without major changes in their fiscal policy, while the other countries could not. Guatemala, with an indicator of exactly 1, is a borderline case. The proponents of this indicator suggest calculating it every three months, once the Government decides the level of public debt it wishes to achieve, to be able to adjust fiscal policy. This would make it possible to track the trend of sustainability on a quarterly basis, taking account of the public debt target, and make timely adjustments.

The fourth and last indicator of fiscal sustainability presented in this paper is the currency-mismatch indicator proposed by Calvo, Izquierdo and Talvi (2003). These authors start from the fact that macroeconomic variables in Latin America are extremely volatile, and capital flows even more so. Accordingly, a key factor in debt sustainability is its composition (which currencies it consists of and in what proportion) compared to the composition of national output (tradable vs. non-tradable). The authors claim that this indicator is essential for understanding the crisis of 1998-2002 in Argentina, which triggered the debt default.

The mismatch indicator compares the ratio of external to domestic debt with the ratio of tradable and nontradable goods production in the economy. At one extreme the result is a perfect match (the indicator has value of 1), when the share of tradables in GDP is the same as the share of external debt in total public debt. At the other extreme there is total mismatch, with an indicator of 0. The indicator is constructed by breaking down the debt into its domestic and external components, and GDP into tradable and nontradable sectors:

$$b = \frac{B + eB^*}{Y + eY^*} \tag{5}$$

where B is the debt in terms of nontradables, e is the real exchange rate, B^* is the debt in terms of tradables, Y is the GDP of nontradable goods, Y^* is the GDP of tradables.[17] Calculating the ratio between nontradable debt/tradable debt and nontradable GDP/tradable GDP, gives the indicator of currency mismatch (I_{dm}) which takes values between 0 and 1:

$$I_{dm} = \frac{B}{B^*} / \frac{Y}{Y^*} \tag{6}$$

[17] The proponents of this indicator suggest representing the latter variable by exports of goods and services.

For El Salvador and Panama, which use the dollar as their currency, this indicator clearly makes no sense, because public-sector revenue is in the same currency as most of its debt (table 6). For other countries, however, it is very important. Costa Rica is best placed, thanks to its larger share of domestic debt in total public debt and the fact that it is more open to trade than the other countries. The indicator is also at an acceptable level in Mexico.[18] In contrast, the Dominican Republic, Guatemala, Honduras, and Nicaragua display significant or even serious currency mismatch. In the case of Guatemala, however, this is not a major problem, thanks to the low level of its public debt in relation to GDP.

3. What conclusions can be drawn from the review of various indicators of fiscal sustainability?

Of the Northern Latin American countries, only Mexico is well placed under all criteria.[19] In that country, the primary balance recorded in 2004 was greater than that needed to keep public debt/GDP ratio at the same level, currency mismatch is acceptable, and fiscal policy is sustainable according to the macro-adjusted primary deficit indicator. The results in other countries are less encouraging, however.

A second group of countries consists of Costa Rica and Guatemala. In the former, the problem is the size of the debt stock, rather than the flow of debt, and the high level of interest payments. In Guatemala on the other hand, the only problem is the serious currency mismatch.

Special circumstances, including negative interest rates, explain the favourable results displayed by the Dominican Republic and Nicaragua. In the former case, with the parameters recorded over the last 15 years, the country could overcome problems of public debt sustainability without major difficulty. Nonetheless, it remains to be seen whether its high GDP growth rates can be repeated in the future. It is therefore hard to correctly evaluate sustainability in these two countries.

El Salvador, Honduras and Panama cannot sustain the fiscal policy prevailing in 2004 for very long, as this would raise the public debt/GDP ratio. Honduras and Nicaragua also display significant currency mismatch, which could be a further aggravating factor in any future debt crisis. The fact that Honduras and Nicaragua are included in the HIPC initiative softens these conclusions, however, since their debt is subject to different rules of the game.

Lastly, four countries would need to take additional measures if they wanted to reduce their public debt/GDP ratios by 10 percentage points. Overall, the public debt sustainability situation is not alarming, but there are amber lights suggesting the need for permanent monitoring.

TABLE 6

Northern Latin American countries: indicator of currency mismatch, 2004
(Percentages and ratios)

Indicator/country	CostaRica	El Salvador	Guatemala	Honduras	Mexico	Nicaragua	Panama	D. Republic
B/eB*	2.90	...	0.60	0.15	1.14	0.42	...	1.03
Y/eY*	3.70	...	7.90	4.70	2.20	5.30	...	4.00
Indicator of currency mismatch	0.78	...	0.08	0.03	0.51	0.08	...	0.26

Source: Author's calculations on the basis of official figures.

[18] Martner and Tromben (2004) suggest that a level of about 0.5 for this indicator can be considered reasonable.

[19] Once again, these conclusions need to be nuanced for all countries, to take account of problems such as the under-recording as mentioned above.

IV

Sensitivity of public debt to external shocks

Macroeconomic volatility in Latin America means that fiscal sustainability indicators can change abruptly in a very short space of time. For example, public debt in the Dominican Republic doubled as a percentage of GDP in 2003 as a result of the banking crisis and its effects on macroeconomic variables, such as recession, depreciation of the real exchange rate, interest rate hikes and bailout of the banking system. Similar elements can be seen in the crises suffered recently by Argentina (Calvo, Izquierdo and Talvi, 2003) and Uruguay (Rial and Vicente, 2004). Accordingly, it is of paramount importance to analyse the sensitivity of the public debt to external shocks such as those suffered, for example, by Argentina: i.e. "sudden stop" in external capital flows, to use the terminology of Calvo, Izquierdo and Talvi (2003).

These authors define "sudden stop" as an unexpected and prolonged halt to capital flows. One such episode followed the Russian crisis of August 1998, with major repercussions especially in southern cone countries. One of the effects of sudden stop is usually a significant depreciation of the real exchange rate, which raises the public external debt/GDP ratio and consequently the total public debt/GDP ratio, thereby complicating debt service. Negative shocks are particularly intense in countries that have a significant currency mismatch between debt and income, which can even trigger a cessation of debt payments. The shock is propagated in the economy through a rise in interest rates, and translates into low economic growth or even recession. At the same time, the fiscal situation worsens because of the increase in debt service, reduction in fiscal revenues and conversion of contingent liabilities into public debt. This dangerous mix can have catastrophic consequences, as happened in Argentina in 2002.

Although this section will analyse the effects of a catastrophic "sudden-stop" shock, the analysis should not be confused with real events. The fact that international interest rates have started to rise does not mean that we foresee a sudden stop in the region. Rather, the rise in interest rates is a sign that the macroeconomic environment is becoming less benign. In this new environment there could be other positive or negative factors that are unrelated to sudden stop. One such is

the high price of oil, which has particularly harmful effects in seven of the eight countries analysed. Another could be the rise in commodity prices, which is likely to cause an additional deterioration of the terms of trade, or slower growth than that recorded in the 1990s. All of this makes the ensuing analysis somewhat hypothetical. Nonetheless, it provides us with the order of magnitude of the fiscal adjustment needed in the worst-case scenario, i.e. when the four adverse effects of sudden stop occur simultaneously.

To ascertain the possible effects of shocks of this type in the northern Latin American countries, we performed four simulations whose results are presented below. The individual effects of each shock should be added together, because in the event of a sudden stop in external capital flows the four usually occur together. The specialist literature makes various assumptions in calculating the sensitivity of the debt. Melhado (2003), for example, calculates the effects on public debt assuming a real depreciation of 30%, lower growth (the historical rate of GDP growth minus two standard deviations) and a rise in interest rates (the historical average plus 2 standard deviations). Yamauchi (2004) visualizes GDP growth decreasing by two percentage points, and the interest rate rising by 200 basis points. Calvo, Izquierdo and Talvi (2003) use a real depreciation of 50%, which is more consistent with the experience of southern cone countries over the last seven years. They also calculate changes assuming a 200 basis-point rise in interest rates and a one-percentage-point reduction in the growth rate.

We wanted to gauge the sensitivity of public debt in response to a 50% depreciation of the real exchange rate. Our second assumption is a reduction of the growth rate by two standard deviations in relation to the rates recorded from 1980 to the present. The third assumption is a 200 basis-point rise in the implicit interest rate - not particularly extreme since this was the norm in many Latin American countries between 1998 and 2002. The fourth and last assumption is an increase in public debt equivalent to 10 percentage points of GDP, resulting from the conversion of contingent liabilities into public debt. We calculate all of these effects with Blanchard indicators in their original form (using the trend growth rate and real interest rate over the last 10 years) and

with the required primary balance using real data for 2004, in both cases adjusted for the various assumptions.

Table 7 shows the impact of a real depreciation of 50% on the public debt. In the case of El Salvador and Panama there are clearly no changes since they are dollarized economies. We then calculated the primary balance needed to maintain this level of debt under the conditions prevailing in 2004, and the average conditions of the last 10 years (the required trend primary balance).

These results replicate the pattern noted in the previous section. Costa Rica, Guatemala and Mexico recorded primary balances in 2004 that are sufficient to overcome the effects of a real depreciation of 50%. El Salvador, Honduras and Panama are at the other extreme, since the required balances are greater than those recorded in 2004. Lastly, Nicaragua and the Dominican Republic have positive results, but the warning made at the end of section III is again valid here.

The effects of a sudden stop in foreign capital flows would be more than just a change in relative prices in the form of a steep depreciation. There would also be a slowdown in GDP growth which might even be dramatic, as happened in Argentina where GDP shrank by roughly 11% in 2002. We use a less drastic assumption, in which growth declines by two standard deviations.[20] Growth is calculated using the rate recorded in 2004 and trend growth as the base. Given that the GDP growth slowdown compounds the effect of the real depreciation, the magnitude of the necessary fiscal adjustment increases with the calculations shown in table 8.

An additional effect suffered by countries in crisis is a rise in interest rates (table 9). As Calvo, Izquierdo and Talvi (2003) note, a 200 basis-point rise in interest rates lasting several years cannot be considered an isolated event. In fact, spreads in the emerging markets bond index (EMBI)[21] stayed more than 200 basis points above their pre-1998-Russian-crisis level throughout

TABLE 7

**Northern Latin American countries: sensitivity of public debt
to a real depreciation of 50%**
(Percentages and percentages of GDP)

Indicator/country	Costa Rica	El Salvador	Guatemala	Honduras	Mexico	Nicaragua	Panama	Dominican Rep.
Imputed public debt with 50% depreciation	59.5	43.0	27.5	106.8	30.8	207.3	73.0	65.1
Primary balance observed in 2004	0.5	-0.2	0.2	0.1	2.5	2.0	-0.7	3.9
Required primary balance	-1.3	2.3	-0.6	4.0	-3.5	-22.1	-0.2	-8.1
Trend required primary balance	-0.3	0.9	0.2	10.7	-2.9	-7.8	2.7	-5.1

Source: Author's calculations on the basis of official figures.

TABLE 8

**Northern Latin American countries: sensitivity of the public debt
to a growth slowdown amounting to two standard deviations**
(Percentages and percentages of GDP)

Indicator/country	Costa Rica	El Salvador	Guatemala	Honduras	Mexico	Nicaragua	Panama	Dominican Rep.
Growth in 2004 minus 2 standard deviations	2.4	-1.9	0.0	4.4	2.8	-0.7	3.8	0.0
Trend growth minus 2 standard deviations	2.8	0.3	1.0	2.4	1.4	-1.6	1.5	2.9
Required primary balance	-0.3	3.0	0.2	4.6	-3.0	-10.2	1.5	-6.8
Trend required primary balance	0.7	2.4	0.9	11.4	-2.4	4.2	4.4	-3.8

Source: Author's calculations on the basis of official figures.

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[20] The standard deviation was calculated for the period 1980-2003.

[21] EMBI: Emerging Markets Bond Index.

TABLE 9

**Northern Latin American countries: sensitivity of public debt
to a rise in interest rates**
(Percentages and percentages of GDP)

Indicator/country	Costa Rica	El Salvador	Guatemala	Honduras	Mexico	Nicaragua	Panama	Dominican Rep.
Implicit interest rate in 2004 + 200 basis points	4.8	6.7	3.3	10.8	3.1	-2.6	6.9	-2.4
Real (implicit) interest rate +200 basis points	6.9	7.4	7.1	15.2	3.6	3.4	8.6	5.0
Required primary balance	0.9	3.8	0.7	6.8	-2.4	-6.0	3.0	-5.5
Trend required primary balance	1.9	3.2	1.5	13.5	-1.8	8.3	5.9	-2.5

Source: Author's calculations on the basis of official figures.

2001. We added 200 basis points to the implicit interest-rate in 2004 and to the trend implicit interest-rate. With this modification we then calculated the required primary balance and the required trend primary balance, which, as expected, continue to rise.

The final calculation involved adding in the effect of contingent liabilities (table 10). In a crisis situation, a high proportion of contingent liabilities become public debt. For that reason we assumed an increase in public debt of 10 percentage points of GDP. The fact that bank bailouts are very costly (in the Dominican Republic in 2003 they absorbed 20% of GDP) means that our assumption is not exaggerated. As before, this is added to the previous adverse effects.

This simultaneity of adverse effects is crucial to an understanding of how dangerous sudden stops in foreign capital inflows can be. If all macroeconomic variables deteriorate at the same time, the authorities have very little room for manoeuvre. It is therefore important to try to avoid events of this type, among other things through a prudent borrowing policy. For the countries analysed, the total adjustment of public finances (i.e. the balance required to keep the public debt/GDP ratio at the same level, and also deal with the

four effects of a potential sudden stop) vary between -1.6% of GDP in Mexico to 14.8% of GDP in Honduras, taking account of the trend primary balance. Once again, the data for the Dominican Republic, which did not include the enormous central bank quasi-fiscal deficit, heavily bias the result. When that deficit is included, the required trend primary balance becomes positive (1.7% of GDP). In the end, taking the four effects into account, only Mexico is unequivocally in a satisfactory situation; the Dominican Republic escapes thanks to the circumstances described, but Nicaragua is unlikely to escape because its balance is below the trend balance required.

What other alternatives do the economic authorities have available to them? The answer depends on the individual circumstances of each country, but our sensitivity analysis of the debt can provide some clues. Table 11 shows the relative importance of each of the four adverse effects discussed above. Specifically, we subtract the trend primary balance in 2004 in the absence of sudden stop from the trend primary balance indicated in table 10. As the difference represents the result of the four effects analysed, we then calculate the percentage contribution made by each one.

TABLE 10

**Northern Latin American countries: sensitivity of the public debt
to an increase in debt arising from contingent liabilities**
(Percentages of GDP)

Indicator/country	Costa Rica	El Salvador	Guatemala	Honduras	Mexico	Nicaragua	Panama	Dominican Rep.
Debt with contingent liabilities (+10% of GDP)	69.5	52.1	37.5	116.8	40.8	217.3	83.0	75.1
Required primary balance	1.2	4.7	1.1	7.4	-2.4	-6.2	3.3	-5.7
Trend required primary balance	2.3	3.9	2.1	14.8	-1.6	8.8	6.6	-2.3

Source: Author's calculations on the basis of official figures.

TABLE 11

Latin America (eight northern countries): contribution to the deterioration of public finances made by the four adverse effects of sudden stop
(Percentages of GDP and percentages)

Indicator/country	Costa Rica	El Salvador	Guatemala	Honduras	Mexico	Nicaragua	Panama	Dominican Rep.
Required trend primary surplus with sudden stop	2.3	3.9	2.1	14.8	-1.6	8.8	6.6	-2.3
Required trend primary surplus without sudden stop	-0.4	0.9	0.0	7.3	-2.8	-6.0	2.6	-4.8
Difference caused by the sudden stop	*2.7*	*3.0*	*2.1*	*7.6*	*1.2*	*14.8*	*3.9*	*2.5*
Contribution of depreciation	1.7	0.0	6.6	46.1	-11.7	-11.7	1.4	-12.4
Contribution of lower growth	39.4	47.7	36.8	8.9	41.7	80.4	43.4	51.4
Contribution of the rise in interest rates	43.9	28.3	26.7	28.2	51.7	27.9	37.1	52.5
Contribution of contingent liabilities	15.0	24.0	29.9	16.9	18.2	3.3	18.0	8.5
Total of the four adverse effects	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*

Source: Author's calculations on the basis of official figures.

The data vary enormously from country to country;[22] the difference caused by sudden stop is just 1.2% of GDP in the case of Mexico, but almost 15% of GDP in the case of Nicaragua. In most cases, sudden stop would require a fiscal adjustment of between 2% and 7% of GDP. Given their relative weight in the deterioration of the fiscal situation, two of the four adverse effects of sudden stop play a leading role. The first is slower growth, which is the most important variable in all the countries analysed apart from Honduras. The second most important is the rise in interest rates, which is particularly relevant since we are in a period of rising international interest rates. The other two effects are less important.

How can this public-debt sensitivity analysis be placed in a broader macroeconomic setting? As we have seen, economic growth is one of the most important variables for public-debt sustainability. In that regard, the situation of the eight countries is neither one of exuberance nor is it critical. According to projections contained in the *Economic Survey of Latin America and the Caribbean 2004-2005* (ECLAC 2005), these economies are likely to record moderate growth on average in 2005-2006 (table 12), albeit below the average for Latin America and the Caribbean as a whole, which is enjoying an economic boom following six years of sluggish growth. Two of the eight countries studied (El Salvador and Guatemala) are growing moderately, barely enough to keep pace with demographic expansion. In contrast, Honduras, Nicaragua and Panama display higher growth rates, which should help reduce the indicators and improve the sustainability of their public debt.

TABLE 12

Northern Latin American countries: projected GDP growth for 2005 and 2006
(Percentages)

Year/country	Costa Rica	El Salvador	Guatemala	Honduras	Mexico	Nicaragua	Panama	Dominican Rep.
2005	3.0	2.5	3.0	4.5	3.6	4.0	4.5	3.5
2006	3.0	2.5	3.0	4.0	3.5	4.0	4.0	4.0

Source: ECLAC (2005).

[22] The table contains three items with negative signs that could be considered aberrations. Moreover, in the case of Panama, rounding makes the figure for the effect of depreciation slightly positive when it should be zero.

Other important factors in the context an analysis of public debt sustainability are family remittances, tourism and the maquila industry. Current transfers continue to grow strongly, thanks mainly to the buoyancy of family remittances. This source of foreign exchange contributes the equivalent of 10%-20% of GDP to all the countries analysed, except Costa Rica, Mexico and Panama. This means that those remittances could be a source of foreign currency that is possibly independent, and perhaps stable and growing, even in the event of a sudden stop in foreign capital inflows.

The tourism and maquila industries are also dynamic. Both suffered setbacks between 2001 and 2003, but they are now recovering strongly in several countries. Nonetheless, there are significant differences between them. While the maquila industry was the engine of growth in the 1990s, it does not look like repeating that role in the new decade. Competition from China and high production costs in some of the countries analysed have reduced its viability. In contrast, tourism is booming in nearly all these countries, specially in Honduras and Nicaragua. This means a large inflow of foreign exchange through foreign direct investment and tourist arrivals.

V

Conclusions

The macroeconomic setting in 2005-2006 is likely to be relatively benign, but with a clear tendency to deteriorate. The fact that economic growth is moderate or even high in some countries facilitates debt service. The rise in international interest rates is a risk factor but, if this occurs gradually as it has thus far, it should not be an insuperable obstacle for economic policy. On the positive side, there is a stable and growing supply of foreign exchange stemming from family remittances, tourism and the maquila industry. This eases the problem of currency mismatch in several of the countries studied considerably.

The analysis above suggests caution with regard to the future trend of the public debt.

Several countries are vulnerable in this respect, even apart from the two most heavily indebted, namely Honduras and Nicaragua. Economic policy needs to give greater priority to public-debt management over the next few years. Permanent monitoring would help identify potential problems early and make it possible to take corrective measures. It would also be advisable to put an end to the under-recording that conceals the true dimensions of the public debt and the fiscal reality of government finances. Lastly, and perhaps most importantly, fiscal policy should continue to work towards consolidation through reforms that strengthen public revenues.

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The accumulation process and agrofood networks
in Latin America

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Within the context of the evolution of world markets and new models of trade openness, several agrofood product lines in MERCOSUR countries have shown strong dynamism in recent decades, becoming focal points (axes) of accumulation and economic growth. The expansion of production and the higher levels of competitiveness achieved have been based on the organization of these product lines in networks or complexes; on the adoption of technology packages from abroad with minimal local adaptation, as part of the globalization of new paradigms; on the emergence or consolidation of groups of big firms in the main stages of these networks, and on clearly defined forms of insertion in external markets. This article argues that the transnationalization of relevant segments and markets of these complexes affects the possibilities of local or regional development, in particular, the generation of locally dense and diversified production networks with equitable distribution of rents, income and profits.

I

Introduction

Ever since the 1990s, within the context of trade openness and market globalization, the countries of the enlarged MERCOSUR[1] have been modifying their specialization patterns towards products based on the use of natural resources. The expansion of production in these years was based on the diffusion and adaptation of technological innovations, the emergence or consolidation of groups of big firms in the main stages of the production networks, and on a clearly-defined pattern of insertion in foreign markets. These factors gave these networks marked dynamism and helped to shape their main technological and productive features. Thus, these production networks are considered as organizational forms inducing the economic growth achieved in those decades, based on their potential capacity to generate genuine competitiveness.[2]

A review of the most successful cases in the region –especially the agrofood industries of Argentina, Paraguay and Bolivia– shows that the basis of this success has been the construction of production networks, i.e., interlinked and coordinated groups of enterprises with long-term relations aimed at the achievement of common objectives. These networks make it possible to assemble abundant high-quality natural resources, substantial individual levels of competitiveness, and suitable mechanisms for inter-relating and linking the actors and/or stages involved up to the final demand level.

The causal sequence behind this dynamism –which will be examined in the present study– may be summarized as follows: i) the MERCOSUR countries have partly redefined their pattern of specialization in order to focus on a set of highly competitive activities based

on natural resources; ii) the expansion in production has been based on the adoption (with only minimal local adaptation) of technological packages from abroad, in the context of the processes associated with the globalization of new productive paradigms; and iii) these elements have been strengthened through a growing tendency to operate on the basis of production networks and the generation of systemic competitiveness.

The potential of these production networks for supporting permanent processes of expansion, however, depend on their characteristics and configuration. In particular, we argue that, over and above the possibilities of boosting the value of natural resources, the achievement of greater joint profits (albeit unevenly distributed) depends on the strategies of a small group of actors (generally big transnational or local enterprises) which coordinate the network from its nodal points.

In this respect, a significant number of recent studies on this matter provide evidence[3] such as the following: i) the main agrofood networks of the enlarged MERCOSUR are efficient forms of business organization for systematically achieving higher levels of competitiveness; ii) within these networks, big disparities are formed and consolidated among the participating firms (disparities based on the control of strategic economic, financial or technological assets), giving rise to hierarchical systems in which some firms control and coordinate the overall group of firms; and iii) except in a few cases, there is a clear predominance in these activities of concentrated and centralized forms of capital, especially as represented by the local branches of foreign-owned firms (or domestic firms which have been absorbed by them) or local economic groups which control the production activities and a significant part of strategy design.

In the light of this evidence, our central hypothesis is that although the agrofood networks of the enlarged MERCOSUR offer great potential for the expansion of production and the achievement of a competitive

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[1] The enlarged MERCOSUR includes the member countries of MERCOSUR (Argentina, Brazil, Paraguay and Uruguay) plus Chile and Bolivia.

[2] In this article, we understand by "genuine competitiveness", from the point of view of the economy as a whole, the permanent advantages associated with the incorporation of new natural or human resources or product or process technologies which are the basis of competitive advantages in international markets. This definition does not consider the domestic distributive or redistributive effects, and it excludes exports based on subsidies (paid for by consumers and/or taxpayers) and those based on the spoliation of natural and human resources.

[3] ECLAC (1995), CNPq (1998), PROCISUR/IDB (2000), ECLAC (2002) and Paulino and others (2004).

position in world markets, the transnationalization of main networks and markets of these production complexes affects the possibilities for local or regional development (understood as the construction of locally dense and diversified production networks with equitable distribution of rents, income and profits). Furthermore, if activities are organized in networks, and if those networks, although generating profits, do not automatically assure significant development for the economy as a whole, the following step is to inquire –as we do in the final part of this article– into the necessary reformulation of public policies to provide a regulatory framework in accordance with the economic and social development goals.

II

Agrofood networks and the competitive dynamism of the countries of the enlarged MERCOSUR

1. Competitiveness, firms and networks

In recent years, new economic approaches have focused their attention of the fact that, in various areas of agrofood production, production networks have arisen in place of the old system of firms operating in isolation. The emergence or consolidation of such networks, partly in response to process externalization strategies (propelled by inter-firm competition and technological change, with consequent specialization in the firm's core activities), leads to forms of vertical and horizontal coordination based on contracts that favour joint productivity and international competitiveness.[4]

The analytical approach to a production network consists of several different steps: i) identification of the technical and economic relations within the network; ii) identification of the nodal firms in the network, that is to say, those with sufficient economic, financial or technological capacity and power to lay down criteria and coordinate the overall functioning of the production cluster; iii) study of the forms of competition prevailing in each stage and the different types of firms taking part (size, capital origin, strategies, business organization); iv) the process of fixing the common objectives of the network (whether agreed, induced or imposed); v) the rules of governance of the group of firms (those imposed by the public regulatory framework, or internal rules laid down in formal or informal contracts, including those on the distribution of benefits and risks, etc.), and vi) the actions and reactions resulting from interaction with the environment.

In this article we will concentrate mainly on analysis of the profiles and behaviour of the main actors and on some rules of governance, which are key aspects for understanding the process of formation of hierarchies within agrofood networks and explain the different technical and productive strategies of the actors in the networks studied.

In line with the central objective of the firms –namely, to obtain profits and rents or seek market competitiveness – the formation of production networks makes possible, in a context of strong vertical or horizontal linkages, cooperation in specific fields and the coordination of the processes, activities and strategies of the firms and institutions involved in the network.

The characteristics of the participating firms and other agents (such as public bodies or consumers), together with their strategies and the regulations applied from outside, help to explain the existence of hierarchies within the networks. Economic power, access to finance, technological inequalities and control of critical assets or know-how are all factors in the formation of these hierarchies. In this way, inequalities of power within the networks are established, induced or practised. These inequalities permit the most powerful firms to appropriate a larger share of the systemic gains in productivity and profits, generating and reproducing differential capacities for accumulation among the participating firms (a process which usually becomes even more marked at times of crisis).

In each of the production segments which make up the network, firms are operating which have: i) different technological capabilities, which are mutually conditioned and complemented, although

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[4] Dirven (1999), Granovetter (1985), Zylbersztajn and Farina (1997), Humphrey and Schmitz (2001), Albu (1999) and Ramos (1998).

some of them are the main determinants of product quality;[5] ii) heterogeneous financial and economic capacities; iii) different linkages with suppliers and with final and intermediate demand; iv) disparities in the levels of information access and quality, and v) different economic scales. These differences lead in turn to different responses to a given change in the environment.

Moreover, the different stages of a network may take place in different geographical locations (regions or countries), which affects the location of employment, income and other variables.

In the evolution of the networks, it is possible to identify the enterprises that act, at different times and stages, as coordinators or command centres, and thus form the nodal points of the network. The control of these nodal points determines the internal hierarchies, generates power, and lays the bases for the unequal distribution of rents. This is why they are the main target of the regulatory frameworks (Bisang, Gutman and others, 2000).

Since the relations or linkages between the firms in the network are governed by formal or (in most cases) informal contracts, the nodal enterprises establish private incentives[6] for aligning the cluster behind certain objectives, achieving them, and subsequently evaluating the overall performance. The acceptance of these parameters –whether agreed by consensus, induced, imposed or accepted in the absence of other alternatives– gives the network cohesion and stability over time. An essential requisite in the contracts is that they should clearly specify the processes and the product or service to be exchanged. The decisions on by whom, how, where, and in line with what criteria the technical norms are fixed usually become key aspects in the subsequent dynamism of the networks.

Operating in networks can increase overall efficiency in some lines of production and, depending on the circumstances, can reduce transaction costs (especially in the case of differentiated goods); minimize faults of market information and coordination, both on the consumption and investment sides; increase the scale in high-risk projects; facilitate the processes of generation and dissemination of innovations; establish mechanisms for spreading risks, and lead to the formulation of more consistent strategies (minimizing errors) for the future evolution of the overall set of firms.

As a result of these dynamics, pronounced technological, economic or financial inequalities are usually generated within the production networks which result in the unequal distribution of the rents generated by the network as a whole. The different rates of accumulation of the various actors in the network are closely related with their structural characteristics.

As particular forms of inter-enterprise organization, networks are specially important in agrofood activities. This is due, among other reasons, to the fact that they make it possible to spread the risks associated with the natural and biological factors and processes characterizing these activities, including unpredictable weather conditions; the autonomous nature of the biological cycles (of harvesting, stock-raising, fermentation, etc.) that set the pace of the production processes; a certain degree of determinism imposed by the quality of the raw materials on the subsequent industrial processes, and the particular and idiosyncratic features of a cultural or regulatory nature which affect food production and consumption from the logistics of marketing to the final consumer (Gutman, 1999a). These characteristics have been reflected from an early stage in the formation of strong inter-enterprise links as the organization backbone of these production activities.

2. Agrofood networks in the enlarged MERCOSUR: recent evolution and challenges

In this context, the main agrofood networks of the countries of the enlarged MERCOSUR have been taking on ever-increasing importance since the early 1990s, thanks to rapid domestic growth and a strong insertion in international markets. With different individual features and intensities, edible oils, dairy products, meat, wine, fruit and other products have registered considerable changes compared with the recent past in various countries.

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[5] The products are sold in concentrated markets, with big inequalities in terms of access to information, and correspond to very specific products and/or processes which involve the use of various complementary technologies at different points in the network. Thus, for example, transgenic soya seeds resistant to gliphosphate are highly specific in their design and predetermine much of the agronomic package and the corresponding technologies (use of direct sowing and gliphosphate) and production process (pre-sowing tasks, sowing and harvesting periods, weed and insect control systems, etc.). They are sold in markets where the supply is very concentrated and there are big inequalities, both technological, information-related and even economic.

[6] The system of incentives is based on a reference price, corrected by schemes of rewards and punishments as a function of quality, delivery times, industrial productivity of the primary input, and other factors.

Some aspects are common to all these cases: growth of production and technology use; the presence of new and renewed agents in the different stages of production, marketing and the supply of inputs; a clear orientation towards exports, and, fundamentally, a growing tendency towards the formation of networks (PROCISUR/IDB, 2000).

The recent dynamism of some agrofood networks in MERCOSUR confirms these assertions (table 1).

The cases of the **dairy products network** and the **oilseeds network** are typical examples of these new dynamics. Through a process of powerful business restructuring, process and product innovations, and the reorientation of its exports towards MERCOSUR, the Argentine dairy products network grew between 1992 and 1998, in its primary stage, at a sustained cumulative annual rate of close on 7%, after having displayed a cyclical performance and an average annual growth rate of less than 1% in the previous six years; industrial production, for its part, grew at an annual rate of 12% between 1992 and 1998 (Gutman, Guiguet and Lavarello, 2004; Gutman, 1999b). The expansion and restructuring of this sub-system in Brazil, driven by domestic demand, was equally strong (Bortoleto and Wilkinson, 2000).

The production, milling and export of **soya beans** and their sub-products are one of the most dynamic agrofood networks in the region. At the primary level, production grew rapidly in Argentina, Brazil, Paraguay, Bolivia and, more recently, Uruguay. In the case of Argentina, this expansion was based on the generalized adoption of a new technological package (transgenic seeds, direct sowing and fertilizers), using a production organization model marked by separation between the landowners and the firms responsible for carrying out the production process and by the growing influence of suppliers of inputs (Bisang, 2003a and 2004). The other countries of the region follow similar models, although in Brazil there are restrictions on the use of genetically modified seeds.

The industrial stage of the milling of oilseeds in Argentina and Brazil (the two main exporters of the cluster, at both the regional and world levels) accompanied this expansion of primary production with heavy investments (largely by transnational corporations) and incorporation of technology. These investments put the milling industry in these two countries on levels of technology and scale similar to the best international standards (Gutman and Lavarello, 2003; Gutman, 2000).

TABLE 1

MERCOSUR, Chile and Paraguay: Evolution of production in some agrofood networks

Network	Argentina		Brazil		Uruguay		Chile		Paraguay	
	1990	2002	1990	2002	1990	2002	1990	2002	1990	2002
Milk (production in thousands of litres)	6 281.0	8 500.0	15 075.0	22 452.0	963.9	1 431.2	1 390.0	2 180.0	225.0	375.0
Powdered milk (exports, in thousands of tons)	14.0	136.0	0.01	1.30	2.21	29.05	1.60	9.98	-	0.14
Meat (production in thousands of tons)	2 650.0	2 700.0	5 008.0	7 314.0	334.0	411.0	242.0	199.0	189.0	205.0
Meat (exports, in thousands of tons)	451.0	348.0	249.0	881.0	192.0	259.0	0.0	1.0	130.0	20.0
Meat (exports, in thousands of dollars)	158.0	160.0	49.0	430.0	132.0	148.0	0.0	1.0	97.0	13.0
Wine (production in thousands of tons)	1 400.0	1 200.0	310.0	320.0	94.0	71.0	390.0	570.0	7.0	6.0
Soya beans (production in vmillions of tons)	11.0	35.0	19.8	42.1	0.0	0.1	-	-	1.8	3.3
Soya complex (exports, in millions of dollars)	2 025.0	5 026.0	2 554.0	6 009.0	6.0	10.0	0.0	3.0	246.0	417.0

Source: Prepared by the authors on the basis of data from the United Nations Food and Agriculture Organization (FAO) and the United States Department of Agriculture.

The production of soya –strongly oriented towards world markets, with innovations in production processes and techniques in the primary sector and a major presence of big transnational corporations in the milling and marketing of oilseeds– doubled in Brazil between 1990 and 2002, while in Argentina it trebled over the same period, with a corresponding increase in milling capacity (Bisang, 2003b). In both countries this was reflected in an increase in exports.

Other important agrofood networks in MERCOSUR registered processes of evolution similar to those of dairy products and soya: the cereals network, for example, registered notable expansion and restructuring of the wheat and maize agrofood chains (PROCISUR/IDB, 2000; Lavarello, 2003).

In meat production –leaving aside the health problems of the 1990s– the countries of the region have made quite important leaps forward in both quantitative and qualitative terms. Although there are still some maladjustments in this activity in some of the region's networks, there are nevertheless sub-circuits linked through contracts in the high-quality meat segments which have shown marked dynamism. At the aggregate level, the cases of Uruguay (which sells over 70% of its production on foreign markets) and Brazil (which doubled its exports in less than five years) are among the most outstanding in this respect. A special case is that of Chile, which, although it has little tradition as a producer in this field, has specialized in high-value market niches and is clearly oriented towards exports.[7]

Other examples of dynamic new areas of growth in the region are the poultry and wine networks. The poultry network, which is better articulated and has greater long-term stability, has registered clear progress in the region, reflected in Argentina and Brazil in improved supply of the domestic market and growing imports.

The case of wine is noteworthy because of its evolution towards products of greater value added, through a reconversion process which was propelled by big investments of capital both from within the region and from outside it. In addition to the advances made initially by Chilean wines, similar progress is now being made by wines from Argentina and, in the case of some specific varieties, from Uruguay (Azpiazu and Basualdo, 2000; INTA, 2003).

The above-mentioned set of activities –without prejudice to the natural heterogeneity within and

between networks in the various countries involves– displays a number of common features in its forms of organization and technical and productive behaviour. Although the linking together of production activities in networks has made it possible to improve the processes of generation of dynamic competitive advantages, especially at the innovation and commercial levels, the dynamism of production has some particular features.

Firstly, it should be noted that in most cases the new forms of production organization raise the technical and economic levels (minimum size of production activities or industrial plants, equipment, labour training). Both at the primary and the industrial and commercial levels, these advances require increasing amounts of fixed and working capital.[8] Consequently, the demands associated with the new technologies (in terms of fixed and/or working capital and minimum) business or labour skills) are reflected in unequal possibilities of access by firms to new techniques, which further accentuates the process of concentration of production.

The special features of some types of final demand, variations in international prices, and the lack of competition in financial markets are other factors that heighten the process of differentiation. As a result, there is a clear tendency towards the concentration and dualization of production structures, because of the generation of two differentiated circuits:

i) The circuit made up of activities over a certain scale, with ongoing technical improvement, quality control and adaptation to international standards, propelled by concentrated retail marketing[9] when

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[7] Bisang (2003c), Buxedas (2003), Paulino and others (2004), and Zylbersztajn and Pinheiro Machado (2000).

[8] The adoption of a technological package based on direct sowing + biocides + transgenic seeds calls for extra capital of at least US$ 100,000 or so, which makes vertical integration is unviable for agricultural producers with less than 100 hectares, especially in view of the weak capital markets of the countries studied. A similar tendency may be observed in the dairy products sector, where mechanization and genetic improvements (together with the associated process technologies) raise the minimum viable size of operations, so that not only is more fixed capital required, but also more working capital. The same is true in key industrial sectors (such as oilseed milling or export packing plants) or in the production of agricultural inputs (commercial development of plant or animal genetics; manufacture of agro-chemical products). In Argentina, for example, the average size of a dairy farm rose from 65.9 cows to 145.1 cows between 1988 and 2000. In the case of the oilseeds industry, the average size of a milling plant rose from 1,100 tons per day in 1990 to 2,300 tons per day in 2003; in the latter year, the largest plant installed in Argentina had a processing capacity of 12,000 tons per day.

[9] That is to say, big retail distributors such as supermarkets, hypermarkets and the like.

production is for the domestic market, and by the dynamics of external markets when production has a high export coefficient. Such activities must also have major potential for increasing exports, output and yields. It is this type of activities (in the case of Argentina, the oilseeds, cereals, wine and –to a lesser extent– dairy sectors) which have a positive impact on the external accounts.

ii) The circuit centered on small or heavily indebted agricultural producers and industrial or commercial enterprises (which we will call henceforth simply "firms") which have difficulty in converting or gaining access to new techniques; generally speaking, their activities are limited to regional or local markets, with low quality standards and few possibilities of entering virtuous circles of production. This production circuit, which accounts for the major part of agricultural units and industrial enterprises and has an undeniable impact on employment, is located even in the best of cases at the minimum levels for keeping going, with low or non-existent possibilities of accumulation and development.[10]

Secondly, the growing presence of new actors (or the growth of other, long-standing actors) in some of the main activities or nodes of the networks leads to the internal redistribution of power over who decides what to produce, how, and for what destination. In this sense, both the producers of agricultural inputs and the big retail distributors tend to establish new areas of power which struggle to gain a share of the levels of accumulation of the network as a whole (Gutman, 2002). In both cases, these processes of reconfiguration have been accompanied by greater concentration and transnationalization of markets.[11] This evolution was accompanied by frequent tension between agricultural producers and firms operating in different stages of the network, at the same time as marked techno-productive dynamism.

The wave of foreign investments which entered the countries of the region in the 1990s further heightened these processes. Foreign direct investment (FDI) –attracted by the new regulatory conditions and the enlarged MERCOSUR, and within the framework of globalized expansion strategies– was focused in particular on some industrial segments, especially the provision of inputs, industrial processing, and large-scale retail distribution. In line with global growth strategies based on technical advances, which require large-scale operations, this investment formed part of a rapid process of concentration or strategic alliances, which led in effect to regional-type expansion strategies.[12]

Thus, the most dynamic networks simultaneously displayed major techno-productive changes, the establishment or consolidation of new forms of organization (networks), growth propelled by foreign markets, and the reconfiguration of the hierarchies and nodes or command points within the networks. All this brings up once again the issues of the rules of governance, hierarchies, and power inequalities in the networks with a capacity for accumulation (Wilkinson, 2002).

3. Changes in the hierarchies and business strategies

The changes in the institutional and regulatory context which took place in the 1990s in the countries of the enlarged MERCOSUR and in world markets gave rise to new forms of governance of the main agrofood networks, based on a larger presence of transnational capital, the emergence and consolidation of agents, and a new set of public regulations in keeping with market deregulation and trade openness. The new rules of governance of the agrofood networks tended to be based on:

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[10] As a result, in the countries studied there are marginal dairy production circuits at the primary level, which have links with small –almost artisanal– factories and supply segments of local or regional markets with lower technical standards and limited possibilities of accumulation. Something similar occurs in the meat and flour-milling circuits.

[11] The evolution of the retail food trade in Argentina is an eloquent example of these processes: in 2000 the hypermarkets and supermarkets stratum accounted for over 50% of food sales, and the seven biggest firms out of the 77 in the chain accounted for 78% of the sales of this stratum as a whole. Four-fifths of this percentage corresponded to branches of transnational corporations (Gutman, 2000).

[12] In the context of the flow of foreign investments into these countries, in the 1990s the enterprises which entered them for the first time or considerably increased their activities in them included almost all the world suppliers of seeds and inputs (Monsanto, Bayer Agrocrop Science, Syngenta, Hoechst, Cargill, Nidera, Ishiara, Dow Chemical, ICI, Bunge, Novo Hydro, and ABS Genetics), as well as USA Genetics, Nestlé, Danone, Parmalat, Unilever, CPC USA, Pepsico, and the Ahold, Wal-Mart and Carrefour/PROMODES marketing chains, among others.

– changes in the structure of suppliers, since trade openness favoured the importation of capital goods and inputs;[13]
– the presence of heavy foreign investments made under a logic of international complementation, which changed the operating dynamics of a number of these networks;
– changes in the legal framework, and especially in the laws on foreign investments, which facilitated this reconfiguration and guaranteed more favourable treatment of these investments and fewer restrictions on the repatriation of the profits of foreign firms;
– technological policies centered essentially on the widespread incorporation of imported equipment, with few restrictions on the flows of technology and capital (SEPCYT, 2003);
– the elimination (in Argentina and other countries) of mechanisms regulating some production activities (in Argentina, the National Grain Board, the National Meat Board, the Dairy Industry Coordination Commission, etc.) and their replacement by the competitive pressure of foreign markets.

In this context, changes took place in the internal hierarchies of several of the most dynamic networks of the region, which were reflected in various ways. Above all, they were reflected in the generalized presence of the main international suppliers of inputs for the primary production of the agrofood chains; in this case, their supremacy over private suppliers and even over public research and development (R&D) bodies was based on their dominating technological position (as in the case of transgenic crops), together with powerful financial domination. At the same time, foreign investments which brought high technology and close international relations to some key phases of the industrial stage entered the region in addition to the local capital of a limited number of economic groups, which rapidly adopted internationalization strategies. In these cases, the rearrangement of the hierarchies was due to technological and economic domination and access to large-scale

international markets, in the case of networks operating in globalized markets. In addition, as already noted, there was a strong entry of big retail distributors as major new actors in most of the networks.

There are various reasons why these latter actors became new nodal points in the networks: above all, their financial power and easy access to international sources of finance; their strategic position in the market for detecting and promoting changes in the consumption patterns and buying habits of the population; their control of key areas such as the logistics of distribution, and in particular their possibility of taking advantage of disparities of prices and quality between the domestic and international markets in the context of economic openness processes (Gutman, 2002).

As may be gathered from the foregoing, innovation and technological change were the main elements in the reconfiguration of hierarchies and, hence, the possibilities of changing one's position in the networks, thus giving rise to marked inequalities between agricultural producers and firms. In this sense, the strategies of the leading firms in the different markets, based on major technological and organizational innovations, were centered above all on:
– the relocation of activities and the opening of new plants;
– greater control over raw materials, in terms of both quantity and quality;
– the establishment of closer relations (contracts or quasi-contracts) with suppliers and clients;
– logistical and commercial advances;
– strategies of differentiation and diversification of production in the industries producing final goods;
– the externalization of functions and activities and the reorientation of core activities;
– linking up of production processes for the overall achievement of greater productivity (efficiency), quality and food security (establishment of quality control systems and systems of maintenance of identity and/or traceability);
– absorption of local firms and their supply and distribution channels by foreign enterprises;
– formulation of regional-scale strategies including the regional distribution of stages and segments of the agrofood chain, the distribution of markets, and regional and global coordination among the big transnational corporations operating in the different stages;
– development of business networks and joint activities in the areas of production, marketing and technology (Bisang and Gutman, 2001).

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[13] The bulk of the Argentine biocide firms were absorbed by a limited number of leading international firms (Monsanto, Syngenta, Dow) which, as well as expanding their production facilities, established nationwide trading networks (Bisang, 2003b). The local machinery and capital goods industry was knocked out of the market by the big international suppliers; in the case of the oilseeds cluster, the firms which entered the area included Alfa Laval, De Smet, Buhler and Crown (Gutman and Lavarello, 2003).

The foregoing places the issue of technological inequalities at the centre of the relation between hierarchical position in the networks, power and accumulation. From this standpoint, we will now examine the profile of the supply of technology in the main agrofood networks studied.

4. The supply of technology in the main agrofood networks of the enlarged MERCOSUR

In the region, the main agrofood networks display wide heterogeneity both among the agents participating in the supply of technology and in the nature of the forms of technology (tacit and explicit) disseminated.

Thus, small-scale artisanal forms of production (in establishments close to subsistence level, with only minimal possibilities of capital reproduction) exist side by side with large-scale enterprises using production techniques of the latest generation (Bisang, Gutman and others, 2000).

Identification of the leaders of these processes in each of the most dynamic productive networks and the way in which they lead them is essential in order to analyse the contribution of these forms of organization to the local accumulation process.

From this point of view, at the primary level, there have been significant changes in recent years in the supply profile, within a rapid process of innovative updating. Improvements in seeds (introduction of transgenic seeds and other techniques), animal genetics, the use of new cultivation techniques (such as zero tilling and complementary rotations between crops) and more intensive use of herbicides and biocides are forming a new technological paradigm which a number of authors have called knowledge-dominated agriculture (Cap, 1997).

As already mentioned, the technical and productive changes within the networks have not only generated two productive circuits –a large-scale, outward-oriented circuit, and a small or medium-scale circuit of a local or regional nature– but have also increased the leading role of the big firms through the scale of their operations.

The process of concentration has restricted the top hierarchies of agrofood networks to a limited number of actors: transnational corporations, cooperatives and local-capital economic groups or large firms. Their presence in each network varies according to the line of activity and the country. In Chile, the dairy products industry displays a strong international presence, while in Uruguay and Paraguay it is centered in two cooperatives; in Argentina and Brazil, there is a certain degree of balance between large local-capital firms and subsidiaries of transnational corporations. The presence of foreign capital in the meat industry is limited to particular niches or processes in most of the countries, but in the wine industry there is a strong international presence, as also in the industrial milling of oilseeds (apart from a few important local-capital business groups).

This is not necessarily reflected, however, in similar forms of technological behaviour by the main actors. Both the cooperatives and the big local-capital firms generally display a very low level of technological dynamism, as shown by recent data for Argentina and Uruguay (Gutman and Cesa, 2002). This fact usually results in a loss of leadership position compared with the technical predominance of transnational corporations which have their own capacity for marking technical advances and eventually selling them or entering into strategic alliances.

In this respect, mention should be made of the behaviour of the public research institutes, which are very heterogeneous in terms of the scale of activities, age, specialization profiles, and human and economic resources. Most of them have tended to adapt to the new circumstances. Apart from their contribution to the formation of local capabilities, however, their performance has been hampered by i) serious lack of links between different public research institutes which deal with partial aspects but have no global strategies for creating critical assets in all the networks; ii) the inertia of work programmes centered on problems of the old form of production, which often become a barrier to entering on updated innovation processes;[14] iii) serious budgetary problems associated with the financial crises of the States in question, especially since the second half of the 1990s, which have led to budgetary cuts affecting research and development institutes (PROCISUR, 2002; Lindarte, 1994).

The weakness of these institutes and the strength of the transnational corporations make the activities of public science and technology institutions very

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[14] At the primary level, the programmes of activities of the main public research institutes –the National Institute for Agricultural Technology (INTA) in Argentina, the Brazilian Agricultural Research Enterprise (EMBRAPA) in Brazil, and the Institutes of Agricultural Research (INIA) in Chile and Uruguay– have a strong flavour of the past. Thus, there is a marked tendency to correct factors which limit the amounts produced, rather than the quality of production, which affects the subsequent industrial stage. Furthermore, despite recent policies, there is a tendency to concentrate on technical problems of production at the farm level, without much attention to the network as a whole.

important, especially in the case of the larger institutions oriented towards fundamental research. In this sense, we wish to stress the need to rethink public actions in respect of these activities at the central level.

On the basis of this profile of the behaviour of the main actors in the networks, changes have been made in the technological supply of the main networks: a supply led by international firms from the industrial field and favoured by the economic openness processes. In all the agrofood networks studied, this supply is complemented by local suppliers of decreasing importance, including both private firms and public agricultural research institutes (Bisang, Gutman and others, 2000). The fact of operating in networks has also facilitated the process of dissemination and adoption of new technological packages.

The process of the spread of new technologies has been facilitated by some market variables (including favourable price movements and particular selective demands deriving from marketing) and by the institutional framework of the networks, in which the supply contracts between industries and agricultural producers and between those producers and the big retail distributors have impelled these changes.

Table 2 shows that, both in the provision of inputs for primary activities and in industrial activities, a large part of the main technologies are concentrated in a limited number of transnational corporations.

TABLE 2

Argentina, Brazil and Uruguay: Main suppliers of equipment and inputs in some agrofood networks

Inputs/suppliers	Uruguay	Argentina	Brazil
Transgenic soya seed (variety RR)	Nidera[a] Don Mario[b] Relmó[b] Others	Nidera[a] Don Mario[b] Relmó[b] Others	Not approved for commercial use
Non-transgenic soya seed			Agroceres/Monsanto[a] Fund. Estaduales/EMBRAPA[c] Sementes do Brasil[a] Others
Transgenic maize (variety bt)		Monsanto Pioneer[a] Monsanto Dekalb[a] Don Mario[b]	
Hybrid maize	Pioneer[a] Dekalb[a]	Monsanto Pioneer[a] 70%	Agroceres/Monsanto[a] 32% Cargill[a] 25% Pioneer[a] 13% Unimilho/EMBRAPA[c] 12% Sta. Helena Sementes Ltda.
Wheat	INIA[c] Buck-ACA and others[a] Pioneer[a]	Bioceres/INTA Buck Klein INTA[c]	EMBRAPA[c]
Tractors		Agrinar[a] John Deere[a] Zanello Pauny	Valmet/Valtra CATERPILLAR[a] Massey Ferguson[a] FIAT[a] Deutz-Fahr[a] SLC John Deere[a]
Harvesters		Vasalli/Don Roque John Deere[a] Claas[a]	Claas[a] John Deere[a] AGCO do Brasil[a] Agrale Deutz-Fahr[a]

Inputs/suppliers	Uruguay	Argentina	Brazil
Seed drills for direct sowing	Bertini[a] Agrometal[a] Mainero[a] Apache[a] Others	Bertini Agrometal Mainero Apache Others	Yanmar do Brasil Massey Ferguson Brasil[a] John Deere[a]
Sprayers		Pla Metalfor Others	
Gliphosphate		Monsanto[a] PASA[a] ATANOR[a]	
Urea		Profertil[a]	Petrobrás Ultrafértil[a]
Other agricultural chemicals	Hydro Agri[a]	Dow[a] Dupont[a] Bayer[a] Monsanto[a] Atanor[a] YPF[a] Mosaic[a] Bunge	Produquímica Serrana Fertilizantes[a] Norsk Hydro[a] Cargill[a] Copebrás Fosfértil
Animal genetics and reproduction	Private breeding facilities ABS[a]	Private breeding facilities CIALE/La Elisa ABS[a] Alta Genetic[a] Bovine Elite Inc.[a]	ABS[a] Alta Genetic[a] Bovine Elite Inc.[a]
Animal health	Lab. Santa Elena Bayer[a] Novartis[a] Hoechts[a] Glaxo[a] Pfizer[a]	Biogénesis Lab. San Jorge Bago Rosenbush Bayer[a] Novartis[a] Hoechts[a] Glaxo[a] Pfizer[a]	Bayer[a] Ciba[a] Novartis[a] Hoechts[a] Glaxo[a] Pfizer[a]
Milking machines		Alfa Laval[a]	
Oilseed solvent milling equipment		De Smet[a] Crown[a] Buhler[a]	De Smet[a] Crown[a] Buhler[a]
Special packaging	Tetrapak[a] American Plast[a]	Tetrapak[a]	Tetrapak[a]

Source: Bisang, Gutman and others (2000).

[a] Transnational corporation.
[b] Under license from Monsanto.
[c] Public agency.

These tendencies are forming a new innovation model marked by:

– the growing importance of information technologies and bio-technology, which have strategic value in the primary stage (especially as regards seeds and animal genetics for the dairy products and meat industries), in subsequent industrial processing, and in marketing; in this stage, the influence of input suppliers predominates, most of which come from the industrial field;

– the redefinition of the nodes from which innovative impulses are generated; in this respect, the most outstanding roles are those of the input suppliers, especially in primary activities and the industrial phases, and the big retail distributors in the case of industrial processing (in this case, through the technical requirements incorporated in the supply mechanisms);

– the increase and higher concentration of the supply of the main technologies in a few private firms, mainly leading transnational corporations with regional scope. The central research and development activities of these firms are concentrated almost exclusively in their headquarters; these activities are much fewer at the local level and are generally for the adaptation of technologies to local edaphological and climatic conditions and to the local consumer profiles. The exceptions to this situation are some advances made by national research institutes and by a few local private firms in a very limited range of activities (such as the development of hybrid seeds);

– the reordering of the internal hierarchies of the networks through the dynamism of some agents and their predominance in the accumulation process, thus establishing a mechanism of technological inequalities in the networks. There is a tendency to form technological packages which dominate the different agrofood networks. These are production functions (of various agricultural producers) which are coordinated on the basis of a small number of main technologies. These production functions are also made up of a varied range of complementary technologies which –despite their diversity– are linked together by the main technologies, which give them a certain direction.[15] Thus, the main technologies tend to

shape the technological package of agricultural producers and affect their subsequent links with other technologies.

The technological packages formed and their dissemination display some common features in the agricultural sector:

– The generation and dissemination of technology takes place increasingly in the form of technological packages prepared by various public and private agents. The degree of codification of the package is increasingly high, and the room for adaptation of the technology is limited.[16] Such adaptation requires high levels of training of rural producers; it calls for a reformulation both of the profile of the entrepreneurs and of that of the organizations which adapt and disseminate technology, and indirectly it leads to a change in public/private relations and a review of public sector actions.

– The degree of codification of the technologies (and of the technological packages) is closely associated with both plant and animal genetics. A growing degree of specificity may be observed in some of the technologies making up the packages used in the primary stage, especially in terms of production environment, scale of production, and the characteristics of the raw material produced.[17]

– There is a gradual increase in the intensity of the interaction between the technological packages of the primary phase and the industrial phase, caused both by the system of prices and by the demands of the final consumer. This obliges firms, on the one hand, to introduce systems of traceability and, on the other, to reformulate their strategies of relations in the case of broader networks.[18]

– In the processes of the generation, dissemination and innovation of technology, there is a progressive tendency to form more complex

[15] Among the main technologies, the most outstanding examples are those of genetically modified seeds, special plant varieties, and certain types of animal genetics, which are accompanied by

particular process scales and technologies in primary production (for example, sowing systems, use of biocides, fertilizers and irrigation, forms of harvesting and type of feeding of livestock) and sometimes in industrial processing.

[16] In order to introduce new plant or genetic varieties, however, they must be adapted to local conditions, which opens up considerable room for adaptation activities.

[17] Different types of flour, chemical composition of vegetable oils and milk, and beef cuts, among other characteristics.

[18] Firms which were previously strictly industrial have begun not only to enter the fields of bio-technology and genetics but also to occupy leading positions in them, as well as to market final products at the end of the agrofood chain.

networks, made up of different public and private agents. The latter occupy important leading positions both in various areas of research and development –some of which were the almost exclusive technological preserve of the public sector in the previous model– and in the processes of dissemination of technology.

– There is an innovation dissemination network, with a heavy predominance of private capital, which is formed on the basis of the marketing networks of input suppliers or the relations established between agricultural producers and the big retail distributors.

Within the framework of this innovation model, with the variants registered in the MERCOSUR countries, the presence of forms of inter-firm linkages based on the control of given technologies places the suppliers of the latter in an important strategic position. Those who control these technologies occupy important roles in the hierarchy of the networks and are in a position to influence the direction and characteristics of the accumulation process.[19] The strategy of the network as a whole is strongly conditioned or induced by the agents who dominate the generation and dissemination of the main technologies. An important part of those technologies is currently developed by transnational private capital.[20]

III

Networks, accumulation and institutions

On the basis of this logic of the functioning of the system (a limited set of agrofood firms with accumulation capacity deriving from control of the nodal points of the networks, primary resources and technology), we may ask ourselves what is the strategic role of the public institutions.

It may be assumed that an important objective of those institutions is to help to ensure that the most dynamic networks locate their operations in the national territory so as to strengthen the trickle-down effect on the rest of economic activities and secure an equitable distribution of rents among the participating agents. If this is so, there are at least two analytical levels: the first refers to the most suitable strategy for achieving those aims, while the second refers to the operational instruments to be used.

At the strategic level, if accumulation is based on the fact that in the hierarchy of the network, high positions are occupied by firms that are clear leaders in the supply of the main technologies, then the actions of the public institutions should concentrate on those activities. Public policies should be directed above all towards the generation, adaptation, appropriation and dissemination (in this latter case, through the formulation of suitable norms) of the main technologies in each of the production networks. From this point of view, the institutions specializing in science, technology and innovation are key actors for the application of the strategies adopted.

Within the framework of such a strategy, it is necessary to adjust the traditional public policy instruments to achieve the overall goal: not only those designed to regulate the levels of profit of the firms (norms on taxation, competition, etc.), but also those

that assume importance when considering the network as an object to be regulated by public policies:

i) the set of norms (in the areas of health, food technology, content, etc.) which define the quality of the products generated in the various networks;

ii) the minimum requirements to be applied to the production processes in terms of quality and safety;

iii) tax policies (including tariff policies) which modify relative prices to favour the local development of stages with greater value added;

iv) restrictions on the free flow of capital, as a counterpart to the local procurement of net rents associated with the occupation of important hierarchical positions in the networks;

v) policies of arbitrage and control of the relations between the various stages making up the network. On another level, and from a broader perspective, another set of policies (in the fields of credit, taxation, etc.) should be aimed at promoting the technological and productive development, by local firms and/or institutions, of the key nodes capable of redirecting the accumulation processes towards the local market.

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[19] In this process, there is constant tension among the different agents over the control of the networks and the appropriation of surpluses, as reflected, for example, in the tensions between some strata of industry and the marketing sector, or between industry and primary production.

[20] The recent processes of mergers and acquisitions led by a few international firms (Monsanto, Syngenta, Bayer, Dow, etc.) in the case of transgenic seeds is a good example of this behaviour.

IV

Conclusions

In recent decades, some types of production based on natural resources and organized in the form of networks have displayed strong dynamism in the MERCOSUR countries. Within the framework of the evolution of world markets and the new models based on economic openness and globalization, this dynamism has turned them into focal points of accumulation and economic growth through their insertion in international trade. Much of this production dynamism is associated with the form of organization adopted –networks–, which facilitates the process of generation and adoption of innovations.

In the main agrofood networks of the region, a small number of large firms, mostly belonging to transnational corporations, have reached important hierarchical positions in recent years. These firms tend to establish growing degrees of control through their ownership of some of the main technologies, within the context of a trend towards the formation of technological packages. Even if softened by the presence of the public sector in some areas, the dynamism of these big firms reorders the previous hierarchical structure of the networks and establishes new internal power balances.

This situation is not neutral, from various points of view; in particular, it is not neutral from the point of view of regional accumulation, since those firms form their global strategies with objectives that do not always coincide with national or regional (strategic) views.

This new scenario –economic openness in the merchandise, capital and technology markets, regional configuration of the networks, reordering of their internal hierarchies in favour of transnational corporations, and the greater weight of private capital in the generation and dissemination of innovations– makes necessary the reformulation of public policies. As one of the main objectives is the strengthening of local/regional accumulation capacity, it is necessary to redefine both the purpose and the implementation of public policies, as a function of a broader strategic purpose. Consequently, when formulating public policies it will be necessary to take account of the structure of the networks and the dynamics of their functioning (their hierarchies, their main technologies, the nodal points of their systems of dissemination) and to design specific instruments to ensure a stronger spillover effect throughout them. It will also be necessary to reformulate part of the previous public institutions, especially in the technological areas. Future policies to establish or strengthen the activity of networks must concentrate on the formulation of strategic criteria to ensure that a substantial part of the surpluses are channelled to the local or regional areas where these organizations are located, within the framework of a growing tendency to generate more local value added and establish agreed, sustainable and equitable ways of distributing those resources.

(*Original: Spanish*)

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The technical skills of information technology
workers in Argentina

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This article makes an assessment of Argentina's human resource skills in the field of information technology (IT). In various of the country's government, business and academic domains the quality and potential of domestic human resources in this area is taken for granted- a belief based on the country's rich, yet contradictory IT history, but not founded on an analysis of the corresponding skills. This study aims to develop and apply a methodology to evaluate the skills of IT workers and highlight their problems and potentials, using the results of an electronic survey. The current features and heterogeneity of those human resources are interpreted in the light of the progress and setbacks experienced by the activity during the course of its evolution.

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I

Introduction

The fact that the information-technology sector has been hailed as the key to Argentina's modernization more than once in recent decades has enabled the country to develop an IT track record, both in the academic world and, to a lesser extent, in business activity. It could be argued that the idiosyncrasies of the sector and the current heterogeneity of its human resources stem from the advances and setbacks that have occurred during its development. Following the demise of the convertibility model (December 2001), keen interest in the development of this knowledge-intensive sector was rekindled, in the belief that there was a critical mass of high-quality human resources available to be exploited.

Nonetheless, the empirical evidence tends to cast doubt on whether sufficient capacities exist to fuel an expansion of the country's IT sector. Many studies of the use and production of information and communication technologies (ICTs), undertaken in Argentina over the last few years, have highlighted the obstacles faced in disseminating and developing a competitive software and IT service industry. Research into the problems of ICT dissemination reveal that these relate directly to firm size, the level of endogenous skills attained by participants, and the presence of business networks (Novick, 2002; Boscherini, Novick and Yoguel, 2003; Martin and Rotondo, 2005; Yoguel, Novick and others, 2004; Cabello and Moyano, 2005; Lugones, Bianco and others, 2003). These studies also show that firms use ICTs mostly for management tasks, which means scant dissemination and unsystematic use of complex tools, with few major changes arising from ICTs being introduced into production processes.

On the supply side, studies have shown that the domestic IT sector lacks a critical mass of top-notch firms, and is dominated by service activities rather than product development (López, 2003; Chudnovsky, López and Melitzko, 2001; Perrazo, Delbue and others, 1999). Moreover, the most dynamic sectors of the economy (the agribusiness and energy complexes) do not generate demands on the domestic IT sector that have

the potential to fuel significant learning and increase the exportable supply of software.

A review of the existing bibliography highlights these problems of supply and demand and suggests that a crosscutting approach focused on human resources would contribute to a partial understanding of the relevant constraints. An assessment of the technical skills of IT human resources would therefore provide additional tools for analysing the sector's potential.

This article aims to develop and apply a methodology for assessing the skills of IT workers in Argentina, based on the results of an electronic survey.[1] The intention is to provide tools to assess Argentina's chances of being able to significantly raise its capacity to solve complex IT problems, for both the domestic and the international market, over the next few years.

Recent publications on business organization and economic development have pointed out that, when studying activities related to new technologies, a human-resource approach complements the conventional enterprise-focused analysis (Markusen, 2002). It is firstly argued that new business forms can be identified that arise from interaction between firms and institutions rather than within them; and, secondly, that workers tend to carry out tasks in various places simultaneously, or frequently change firm or institution (Micheli, 2003). As a result, workers tend not to clearly identify with a given firm or institution, but rather with projects or crosscutting epistemic communities, on the legal boundaries of organizations (Nemirovsky and Yoguel, 2001). In information- and-knowledge-based activities, the relevant entities are "communities and networks of practice" (Brown and Duguid, 2000) and "knowledge communities" (Henry and Pinch, 2000), which serve as vehicles that traverse the formal boundaries of enterprises and institutions. Workers' skills are the key to creating dynamic competitive advantages, constructing networks and knowledge circulation, and explaining innovation within enterprises (Metcalfe, Ramlogan and Uyarra, 2002). Most studies agree that, given the nature of the activities

[1] The survey was performed jointly by the Argentine Society for Informatics and Operations Research, and Universidad Nacional General Sarmiento (the SADIO-UNGS survey).

they undertake, human resources are an excellent lens through which to understand and analyse the sector (Ducatel, 1994).

To evaluate human resource capacities in the IT sector, a number of questions need to be answered, including the following: What are the different profiles of IT workers, and to what extent do those profiles stem from the sector's evolution? Do these workers have the capacities needed to develop a competitive local software and IT services industry, capable of meeting the challenges of more dynamic sectors in both the domestic and external markets? Does the local economic structure help to invigorate the sector? Do IT workers identify with any project in which they participate, or do they undertake individual activities?

Is the education system forming human resources capable of dealing with complex software and successfully adapting to ongoing technological changes? What is the relation between technical-skill creation and participation in networks and institutions? This article aims to answer some of these questions.

Following this introductory section, section II summarizes a number of structural elements of the IT sector and provides a stylized description of its evolutionary path in terms of capacity formation over the last few decades. Section III presents the conceptual and methodological framework and working hypothesis. Section IV reviews the data and tests the proposed hypothesis through cluster analysis. Lastly, section V sets out the main conclusions.

II

Structure and evolution of information

technology in Argentina

1. Structural features and differences with respect to successful late-entrant countries

Argentina occupies a relatively marginal position among late entrants to the international IT market (Anlló, Bezchinsky and others, 2003). Its IT sector is very small compared to those of successful entrants over the last 10 years, such as India, Ireland and Israel (Arora and Gambardella, 2005). The IT sales of Ireland and India are respectively 33 and 30 times larger than those of Argentina, while Israel's are 10 times larger. From the employment standpoint, the differences are 16 times in the case of India, but less marked in relation to the other two countries: Ireland has double the number of IT employees and Israel a relatively similar number to Argentina (roughly 15,000 people). This translates into major differences in sales per employee between the countries mentioned. Whereas in India this indicator is double that of Argentina, in Israel it is 10 times larger and in Ireland 17 times. In the latter country, the difference is largely explained by sales per employee in transnational enterprises (28 times higher) and to a lesser extent by local agents (four times higher).[2]

There are other significant differences in terms of international participation: Argentina has a much lower export coefficient (17%) than the other three countries (75%); and its IT sector is relatively speaking also significantly smaller.

There are also substantial differences in relation to other Latin American countries: in Brazil sales and employment levels are, respectively, eight and nine times higher than in Argentina, despite basically serving the domestic market. Chile and Uruguay have relatively small IT sectors in terms of sales, although the latter has a particularly high export coefficient (33%).

Nonetheless, various authors (including López, 2003; Anlló, Bezchinsky and others, 2003) agree that significant progress has been made in the IT sector in Argentina, at least in quantitative terms. This trend has been associated with the history of the sector, as noted

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[2] The high levels of sales per employee in Ireland and Israel basically reflect the fact that the IT tasks performed in those countries are

less labour-intensive. This is largely due to the prevalence of outsourcing in countries such as Ireland, where less complex and more labour-intensive tasks, such as codification and verification, are outsourced to countries such as India, where the hourly wage paid to programmers is lower. The indicator of sales per employee therefore cannot be equated to productivity, given the weight of imports (particularly in the case of Ireland, where the presence of transnational enterprises is crucial).

below, and also with the creation of human resource capacities. Despite efforts made in the education system, there are significant shortcomings that arise partly from directional changes in programmes once considered strategic, and the recent haphazard emergence of a variety of IT courses and training institutes[3] –at the technical, professional and postgraduate levels– in the wake of the sector's vigorous expansion. This was accompanied by great diversity in terms of courses, contents, skill creation and course duration (Aguirre, 2003; Monteverde and Pérez, 2005), which has generated considerable uncertainty over the capacities of graduates at the various levels of training.

The first level –technical-professional secondary education– aims to develop programming, design and codification capacities and currently accounts for one third of the country's almost 60,000 IT students. The second level –higher non-university technical education– aims to train systems analysts for the design, development, implementation and verification of software systems. It attracts over half of the students and involves some 30,000 people in courses lasting roughly three years. The third level –university degree– trains software engineers and graduates in IT systems, capable of establishing technological and methodological standards, constructing tools to enrich the development environment, and managing software processes. This group accounts for just over 10% (7,000) of the country's IT students at all levels. Lastly, the postgraduate level, created only recently in Argentina, contains 37 programmes and presumably accounts for less than 1% of all IT students.[4]

Courses offered by the first three levels vary widely in terms of contents and contact hours, sometimes operating under similar names.[5] Moreover, it is doubtful that there are sufficient teachers to provide quality education in all of the institutions currently operating. Despite the rapid growth of such institutions, there are still many people who are self-taught in IT, or who

acquired their training on the job.[6] As a result, it is hard to ascertain the scope and skills of existing human resources.

Furthermore, quality assessments are only available for a few undergraduate courses and postgraduate studies, and there are cases in which university training programmes are placed on the same level as those of non-university tertiary education.[7] This reveals a considerable lack of knowledge of the quality of secondary and tertiary non-university training, and major variety in undergraduate and postgraduate studies.

The most significant shortcoming in many university courses concerns the lack of research that accompanies teaching activity. In some cases this results in low-productivity research areas and in other cases its nonexistence. Lack of research makes it impossible to distinguish between university courses and non-university tertiary training institutes, thereby potentially devaluing university degrees. Moreover, the research areas of national universities are often more reflective of individual efforts than long-term institutional policies, which renders their activities highly unstable and atomized.

2. Historical development of the IT sector

The IT sector in Argentina has a long tradition, dating back to the late 1950s, which cannot be understood independently of the development of science and technology in the country, particularly during the period of import substitution industrialization (ISI). That development model established a pattern of specialization along with a set of institutions that contributed to local technological progress. The sector's evolution was not linear, however, but progressed in fits and starts (Azpiazu, Basualdo and Nochteff, 1990; Babini, 2003).

Local development of the IT sector continued during the 1960s and 1970s. In the first half of the 1960s, the Argentine IT sector became the Latin American leader of an incipient activity that was in its infancy worldwide; and progress was far more hardware-related than it would become a few decades later. In the 1970s and

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[3] Between 1997 and 2002, the number of graduates from IT courses grew by 151% (from 1,000 to 2,627). Graduates in applied sciences represented 12% of the total in 1997, and had risen to 20% by 2002.

[4] For more disaggregated information see the annual report of the National Office for Educational Quality Information and Evaluation (DINIECE), reports issued by the University policy secretariat, and Anlló, Bezchinsky and others (2003).

[5] These courses include systems analyst, IT technician, software engineer, systems engineer, graduate *[licenciado]* in systems, graduate *[licenciado]* in IT, and graduate *[licenciado]* in computer sciences.

[6] A situation that is revealed in the results of the SADIO-UNGS survey.
[7] Reports issued by the National University Evaluation and Accreditation Commission (CONEAU) contain recommendations such as the following: "A major effort needs to be made to change curricula and the profile of the teaching body to differentiate it from the training provided by many tertiary institutes" (www.coneau.gov.ar).

1980s significant progress was made through both foreign direct investment (FDI) and domestic firms. The latter grew particularly strongly during that period, in the framework of an import substitution programme and technology transfer agreements with leading transnational enterprises operating in the sector.

While it is impossible to identify an clear breakpoint in the import substitution model, the interruption of democracy in 1976 was certainly a key date. The ISI development scheme was gradually dismantled, both as a specialization model and in terms of the institutions and regulations that were functional to it. The economy moved towards specialization based heavily on exploiting static comparative advantages, with market deregulation and reduced State participation in the economy.

The attempt to open up the economy in the late 1970s, founded on the monetary approach to the balance of payments, did not necessarily entail a smaller State share in the production of goods and services, but it did mean a clean break with the institutions most closely associated with knowledge production. Following the debt crisis, and with the return of democracy in 1983, an attempt was made to revive some of the country's scientific and technical institutions. Nonetheless, the lack of a serious effort to replace specialization based on natural resources and intermediate products (commodities), with a scheme of static comparative advantages, helped to create a substantial mismatch between the capacities and knowledge developed in universities and research institutes and those needed by the productive system.

In the 1980s IT policy guidelines were drawn up for the first time, which were similar to proposals circulating in developed or rapidly industrializing countries. These guidelines, aimed at development of the electronics complex in general and the IT segment in particular, originated in material developed by the National Information Technology Commission which was created in 1984. The targets and instruments included tax reductions based on public tenders, preferences for domestically owned enterprises and "national purchase" policies for software products. There were also actions aimed at generating increasingly complex linkages, connecting local software supply with demand, forming specialist human resources, negotiating agreements with Latin American countries and promoting the creation of software in Spanish (Aspiazu, Basualdo and Nochteff, 1990).

Within that framework, the Argentine-Brazilian Programme of Research and Advanced Studies in Information Technology (PABI) was created in 1986, through an agreement between the two countries for joint projects, exchange of human resources and the holding of events. The start of this programme revealed that, given of the lack of consolidated clusters in Argentina, the first stage had to be devoted to forming the necessary human resources. As a result the Argentine-Brazilian Information Technology Schools (EBAI), were created to help train a critical mass of researchers, upgrade degree-level teaching, and create a regional school of thought in the discipline[8] (Aguirre, 2003).

As part of this process of exchange with Brazil, and with a view to significantly improving human resource training, the Escuela Superior Latinoamericana de Informática (ESLAI) was established in 1986. Although this school prepared top-quality human resources, it failed to forge links with the business world which would have made it possible both to start new activities and to carry out work in conjunction with industry and the public sector (Aguirre, 2003). This shortcoming, caused by the predominance of the linear innovation model and compounded by an unfavourable macroeconomic framework, limited its chances of establishing itself in society and even called its continuity into question. Nonetheless, ESLAI partly helped to counteract the deficiencies in the quality and quantity of human resources working in IT: many people who joined the sector came from a previous generation trained in the context of the import substitution industrialization model (Aspiazu, Basualdo and Nochteff, 1990).

Policies designed in this period differed both from those implemented during ISI and from those associated with the economic liberalization of the 1970s, and thus constituted an innovative contribution that was unique in the sector's history. Nonetheless, these policies could not be sustained because of: (i) the absence of a global development vision that included a more complex specialization profile and the forging of links between the academic sector and the productive system; (ii) macroeconomic instability; and (iii) the regressive restructuring of the manufacturing sector and the State.

In the 1990s, trade and financial liberalization and market deregulation processes intensified, State participation in the economy was cut back, and the

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[8] Between 1986 and 1989, four experiences were undertaken in Argentina and Brazil, and the human resource training process was interrupted in the late 1980s. As a result, 2000 students received training, and 60 original titles were published in Portuguese in Spanish; these were still being used on IT courses in the mid-1990s.

pattern of specialization was deepened. During this period, the predominant view of technology was that the knowledge embedded in imported capital goods would percolate through the productive structure and society, serving as the key to productivity increase. The substantial growth of software and hardware imports that occurred during the period essentially relegated the sector's workers to tasks relating to the adaptation and modification of imported products. At the same time, the existence of closed standards and proprietary platforms in the imported products restricted possibilities for learning and intensified the sector's technological dependence. In contrast, the modernization of services triggered by the privatization process led to heavy demand for new software products, which was partly satisfied by local firms.

In the first half of the 1980s, the policy instruments conceived in the previous decade were dismantled, in what represented a break in institutional continuity. Then, from the second half of that decade onwards, investments were made in the scientific and technological system that led to the creation of universities and various programmes to strengthen training and research activities. Examples include the founding of the National Science and Technology Promotion Agency, which manages competitive funds for scientific and technological projects; and the Fund to Improve the Quality of Degree-Level Teaching in the Sciences (FOMEC), a programme that aims to strengthen university training capacities. In the mid-1980s, the initial assessment of this programme confirmed the diagnosis later made by PABI in the second half of the decade, highlighting the human-resource weaknesses of the domestic IT sector.[9] Of the US$ 202 million granted by FOMEC, the 5% channelled into IT projects made it possible to improve hardware, replenish libraries and, in particular, to embark on significant human resource training at doctorate level.[10]

Although this programme, which ended in 1999, contributed to human resource formation, it unfolded against a backdrop of a significant separation between

science, technology and the productive system, and the consolidation of a pattern of productive specialization that meant low-complexity demand for the sector. Accordingly, despite the efforts that were made, the mismatch between the needs of the productive system and the capacities being generated by the education system were once again revealed.[11] The human resource profile that the educational system was generating in the science and technology area was more attuned to the sectoral structure of imports than to local productive structure and specialization (Nemirovsky and Yoguel, 2004). This contradiction, which has been recurrent in different periods, resulted in a brain drain[12] (Albornoz, Luchilo and others, 2003; Suárez, 2004).

The crisis in the predominant economic model of the 1990s, following the 2002 devaluation, has rekindled debate on the need to introduce more complex elements into the country's pattern of specialization. Inclusion of information- and knowledge-intensive activities, which are associated with increasing returns to scale and network creation and are subject to high income-elasticities of demand in a rapidly growing international market, would make it possible to exploit dynamic comparative advantages and reduce macroeconomic vulnerability (Reinert, 2002; Lall, 2001; Guerrieri, 1993; Dosi, Pavitt and Soete, 1990).

Against that backdrop, there has been growing interest among economic agents and the Government in the development of IT sector, which is seen as a key to the country's modernization. In particular, these protagonists recognize the sector's major potential, based essentially on its human resource capacities and the historical development that has helped generate the corresponding skills.

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[9] The 21 national universities offering IT courses had nearly 5,000 students with a graduation rate of just 3% of those entering in the same period. The entire teaching body included just two PhDs, and hardware availability was minimal –in some cases one workstation for every 50 students. The same was true of libraries, which had 0.65 books per student. Only three universities had recently started to offer externally supervised PhD courses.

[10] Nearly 30% of the funding channelled into IT was destined for PhD courses, which contributed to the fact that the number of PhDs had risen to 70 in the early 2000s.

[11] The lack of public-policy emphasis on overcoming the separation between these domains is not peculiar to Argentina but also occurs in other countries of similar development level. In Brazil, for example, there are over 20 programmes promoting the IT sector, but apart from two that include human resource training and linkages with demand, the remainder target enterprise development, business creation and the incorporation of venture capital funds. The situation is similar in Uruguay, although the number of programmes is fewer. This contrasts with what is happening in India, where all these issues are addressed systematically and the importance of skill training processes in the creation of advantages for the sector is emphasized (Anlló, Bezchinsky and others, 2003).

[12] According to Jacovkis (2003), the history of computer science in Argentina was seriously affected by political events in the country between 1966 and 1983. Despite attempts to use neutral criteria, it is impossible to gain a realistic view while ignoring the terrible damage caused by the military dictatorships to the sector's incipient development.

III

Working hypothesis and analytical model

Taking as a precedent the historical background reviewed above and the importance of workers' skills for the IT sector's performance, this section sets forth an analytical framework that relates the skill level achieved by workers both to the education system and to other factors, including the role of demand (via an analysis of the projects in which they participate) and the networks to which they belong. It can thus be seen that the sector's development potential depends partly on the workers' individual skills, but also on the various groupings and systems in which they participate. This approach to the problem evokes various authors and schools of thought that view competitiveness as a systemic phenomenon (Esser, Hillebrand and others, 1996).[13]

A number of authors have also shown that, given the inherent characteristics of this type of activity, IT workers are a very heterogeneous group, as revealed by productivity differences among similarly trained programmers (Cusumano, 2000). The definition of worker profiles depends not only on the type of technology with which they work or the products or services they develop, but also on other factors such as: (i) progress in the science and technology system; (ii) the coordination of workers in trade and technical associations and academic institutions; (iii) the characteristics and volume of local demand; and (iv) the evolutionary path of IT (Castells, 1996).[14]

Figure 1 offers a stylized version of the structure of possible relations between the various dimensions listed. From a theoretical standpoint, the most virtuous situations would feature strong interaction between all three dimensions. Supply from the education system

FIGURE 1

Argentina: Structure of relations between the factors characterizing IT worker profiles
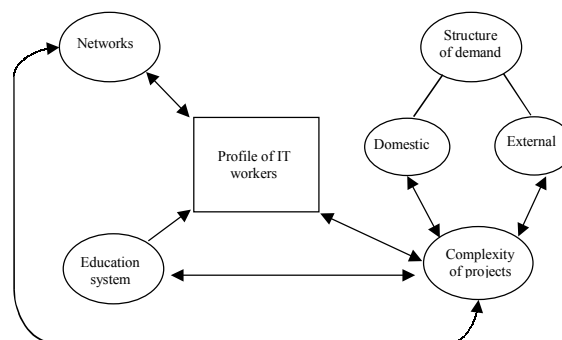
Source: Prepared by the author.

and the profile of domestic and external demand (influenced by the pattern of productive specialization and the type of dominant agents) both play key roles in project complexity, and hence in the level of IT workers' technical skills.

In this context, it is interesting to consider the extent to which the structure of demand and the complexity of development projects affect workers' learning possibilities, since complex activities present challenges that allow workers to learn through experience and interaction with others ("learning by doing" and "learning by interacting").

Although IT activities unfold inside firms and institutions, many are increasingly organized in projects that involve individuals from different firms, in conjunction with technologists and researchers attached to universities and laboratories, both State and private. This scale of project is particularly suited to measuring the skills possessed by workers, firms and institutions at a more aggregate, albeit still intermediate level; and for studying knowledge- and information-intensive activities (Lam, 2002), since the development level of virtual, institutional and personal networks is decisive for the circulation of codified and tacit knowledge. In virtuous cases in which networks are very important, "epistemic communities" are generated that facilitate innovation processes, which are thus shown not to be an individual phenomenon (David, Cowan and Forey,

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[13] On the specific case of ICTs, see National Research Council (1998).

[14] Castells (1996) argues that a new division of labour is emerging, based on three dimensions: activities that generate value, those that generate relations with the surroundings, and those that affect decision-making processes. Those dimensions give rise to following three overlapping worker typologies: (i) the commanders, the researchers, the designers, the integrators, the operators and the operated (in the value-making dimension); (ii) the networkers, the networked, the switched-off (in the relation-making dimension); and (iii) the deciders, the participators, and the executants (in the decision-making dimension).

2000). In the specific case of IT, the development of the Internet and virtual networks constitute a fundamental tool for communication and skill development.[15]

In terms of the relation between IT workers' technical skills and the formal level of education they have attained, the literature shows that this is a problematic issue that needs to be studied in terms of its conceptual and policy connotations. It has been argued that the ability to use knowledge and skills effectively and creatively –i.e. manipulation of words and data, oral and visual representations– for a large proportion of IT workers is more important than credentials expressed in terms of education level and field of study (López-Bassols, 2002; Micheli, 2003).

The significance of the relation between university and the IT sector goes beyond issues of training, to embrace aspects such as joint research and the establishment of formal or informal networks that link firms, universities and other institutions (Hetzkowitz and Leydesdorf, 1997). The literature on this subject has highlighted the importance of "bridge institutions" (Casalet, 2003), capable of coordinating supply and demand and creating a market.

Consequently, in activities that are closely related to research and development, various firms are operating with a network model that makes it possible to connect a firm's internal knowledge base to new knowledge generated in networks that traverse organizational boundaries (Lam, 2002). According to Lam, innovation activities in high technology sectors are increasingly being organized through a network of some type, with university-enterprise relations being encouraged in particular.

Networks that participate in knowledge circulation and skill formation include personal contacts, virtual networks and those belonging to institutions that bring IT workers together. In the last few years these have been included as research topics in several analyses made of information- and knowledge-related activities. Much of the corresponding work deals with formal and informal networks in highly developed local systems, such as Silicon Valley (Brown and Duguid, 2000; Castilla, Hwang and others, 2000; Saxenian, 2000).[16]

These and other studies argue that recognizing the importance of such networks is no longer sufficient; their nature and mode of operation need to be understood.

In the special case of relatively less developed countries, the theoretical relations suggested in figure 1 are less evident. Thus, for example, in Argentina the domestic demand generated by smaller firms is centred on national software supply, while external participation by the domestic IT sector is very weak. On the other hand, the demand for imported software and IT services means that numerous problems faced by the most dynamic sectors of the Argentine economy are being solved externally rather than by the domestic IT industry.[17] All of this explains why IT projects carried out locally remain of low quality. Apart from anything else, the education system has a very low-key and somewhat one-way relation with IT development projects, while networks are tenuously linked to the education system, and more directly related to project complexity. This is particularly important in the case of personal networks and, to a lesser extent, in the case of virtual and institutional ones. Relations between the domains identified thus lose their systematic focus and affect the level and use of IT workers' skills.

Given the analytical approach used, the central hypothesis of this paper is that there are different profiles of IT workers based on their technological skills. These profiles are likely to be determined by the following elements: the tools they master (technologies and languages); the activities they undertake (services and development); the complexity of the projects in which they participate; the extent of their network use; and their level of formal education in IT.

The establishment of IT worker clusters by skill level will depend on the evolution of the sector and, in particular, the employment history of each cluster. Thus, the higher-skill cluster would be expected to include human resources whose employment histories reflect involvement with the sector's most successful experiences over the last few decades, or else younger human resources that have trained with them.

The fact that the formal education of IT workers is insufficient to explain their accumulated skills is

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[15] An example of an epistemic community in the IT sector is the community of creators and users of free software. This is based on the existence and reproduction of a knowledge network, structured on the Internet and driven by collaboration that faces no other entry barrier than minimum skill requirements (Dale and Julien, 2003).
[16] The study of the social dimension of economic activity (Granovetter, 1985) has spawned numerous papers on the various types of personal and institutional networks that exist in economic

activity. These include studies on immigrant networks in Silicon Valley (Saxenian, 2000) and on the diaspora and its potential contribution to development.
[17] For example, those linked to traceability (quality assurance) in the agrifood industry, knowledge circulation in networks, codification of tacit knowledge, internalization of codified knowledge, and other items.

shown by the presence of occupations requiring lower skills (the educational devaluation hypothesis), and also by the opposite hypothesis that self-training and tacit knowledge are important. Within this framework, the evolution of IT workers' skills would depend on their initial level, the role of the education system in their training, and the complexity of demand.

IV

Main results of the survey
and evaluation of the hypothesis

This section describes the main characteristics of the panel of IT workers interviewed, and evaluates the paper's central hypothesis by jointly considering the relevant variables and applying factorial analysis of multiple correspondences to the main indicators that emerge from the survey (see appendix A). This technical statistical instrument is applied here basically to analyse factors that can help explain technological skills from a systemic point of view.

The survey questionnaire was designed by an interdisciplinary group involving professionals (mainly economists) from Universidad Nacional General Sarmiento and IT professionals from the Argentine Society for Informatics and Operations Research (SADIO). This entailed a demanding adaptation process to reconcile the working hypotheses with methods of capturing information in the sector without losing its complexity.[18] The questionnaire, which was applied electronically, contained eight sections relating to: (i) the employment situation of the interviewees; (ii) the organization in which they work; (iii) the specific activities they carry out; (iv) the characteristics of the development projects in which they participate; (v) the use and creation of open-source software; (vi) institutional linkages and participation in networks; and (vii) their formal and informal education.

The panel interviewed included IT workers drawn from private enterprise, the public sector, training centres, specialist consultants and universities. They were asked to reply to the electronic questionnaire through various media. The survey was conducted between November 2003 and March 2004, and encompassed 197 workers. Following analysis and filtering of the replies, 167 records remained for statistical analysis.

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[18] The questionnaire can be consulted at www.littec.ungs.edu.ar.

1. The main characteristics of the panel surveyed and cross-section variables

The panel displays several key features in terms of gender, age and geographic location. It is dominated by young men; 80% of its members are under 40; and 58% live in the Metropolitan area, with the remainder distributed among the province of Buenos Aires (11%), Cordoba and Santa Fe (9% in each case), and other Argentine provinces (8%). The final 5% of those interviewed are Argentines resident abroad.

Most of the interviewees have a high skill level. While half of them have completed university training, 17% have done postgraduate studies linked to IT, and just over a quarter possess incomplete university education. Among those holding university degrees, 60% are engineers and computer studies graduates, 29% systems analysts and graduates, and just 11% have studies unrelated to IT. These credentials are complemented by the fact that 30% of the interviewees hold some type of certification from firms providing the most widely used technologies, and nearly three quarters of the panel have a knowledge of English rated as good or better.

The employment rate among those interviewed is very high, with just 1.2% unemployed. Generally speaking, these are individuals with less than 10 years' work in IT (50% of the panel), a feature that is closely related to their age. Only 10% have been working in this activity for more than 25 years. A predominant feature is the high degree of heterogeneity in the job turnover rate among those interviewed. Whereas practically half of the panel had not changed job in the last five years, one fifth had changed at least three times, and 40% of the panel had been in their current job for under two years.

In terms of occupational category, most of those interviewed are employees (57%), while just under one

fifth are contracted for specific works or services, and the remainder are owners. Sixty percent of employees work in private firms, just under one fifth in the public sector (national, provincial, or municipal), and the remainder in academic or technological institutions or in non-governmental organizations. In contrast, among those working on fixed contracts, the relative share of the State and private enterprise is quite similar (45% and 42%, respectively).

Forty percent of those interviewed work in firms whose main activity is IT, while 60% are in firms or other types of organization involved in activities of other kinds. Among the former, 84% are engaged in activities of IT development and services, 6% in services alone, and the remaining 10% only in development activities.

Lastly, with respect to the variables used to evaluate the hypothesis, just under one fifth of those interviewed have no mastery of computer languages or technologies. Nonetheless, the overall proportion of IT workers who do not use such languages is even larger, thereby highlighting problems of under-used skills. In terms of network use, personal contacts are extremely important; over half of those interviewed claim to have obtained their current job through such networks, and 78% of the panel uses them to find out about new technologies. The Internet communication tools use most frequently are specialized forums, followed by bulletins (newsletters) and mailing lists. Local workers made little use of tools such as Internet related chat (IRC). Lastly, nearly 30% of the panel are not involved in development projects. Projects tend to be short-term (50% of them lasting less than a year) and involve a small number of people (under 10 individuals in 76% of cases), which highlights their lack of complexity.

2. Cluster analysis

The use of cluster analysis made it possible to construct homogeneous groups by taking simultaneous account of the different factors affecting IT workers' technical skills. Multiple correspondences factorial analysis (MCFA) was used to summarize the relations that exist between the different modalities of the variables in the data matrix (active variables), and to obtain a small set of clusters comprising individuals displaying high levels of intra-cluster homogeneity and high extra-cluster heterogeneity.[19] Illustrative variables were then taken

into account that had not been considered when specifying the factorial axes, with a view to enriching the description of the axes and clusters.

The cluster analysis included seven active variables: (i) the complexity of the languages mastered by the interviewee; (ii) the complexity of the technologies mastered; (iii) the complexity of the development activities undertaken; (iv) the complexity of the services provided; (v) the level of formal education attained; (vi) the complexity of the projects in which the interviewee has participated; and (vii) network participation (see appendix A). Various illustrative variables were considered, as listed in appendix B, such as the type of course and level of the interviewee (table B.1), the medium in which interviewees consider they have gained most of their skills (table B.2), the type of organization in which they work (table B .3), job turnover (table B.4), age and years of work experience (tables B.5 and B.6), and gender (table B.7). Although the evolution of the sector is fundamental for defining the profiles of IT workers, the difficulties of incorporating such information into cluster analysis results in this factor being considered only in a contextual and descriptive fashion.

The MCFA was used to perform cluster analysis, and five homogeneous clusters were identified,[20] which can be ranked by the level of technological skills achieved: very low, low, medium, high, and very high.

The fact that was possible to classify individuals in different homogeneous clusters, characterized by consistent combinations of modalities pertaining to different variables, reflects the strong interdependence of the dimensions mentioned in the hypothesis. Those dimensions can therefore be interpreted as helping to explain the different levels of technological skills among IT workers. The clusters listed in the previous paragraph are now described.

a)   *Clusters with very low technological skills*
This cluster, which accounts for 18% of the panel, is dominated by service tasks (53% of its members are not involved in development activities); little or no mastery of information technologies and languages

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[19] This method operates by reducing the number of variables in the phenomenon being studied and forming factorial axes defined to focus the analysis on the variables and modalities that contribute

most to explaining the problem at hand, thereby providing a manageable view of it.

[20] When interpreting the results, it should be borne in mind that the modalities of the variables relating to a given cluster show that individuals with the characteristic in question are significantly more represented in the cluster than in the sample as a whole; but this does not necessarily mean that all individuals in the cluster display that characteristic.

(80% of the cluster have no mastery of technologies, and 67% have no mastery of languages); and the non-use of virtual networks (30% of the cluster do not use networks, and 60% of all those who do not use networks are in this cluster). The illustrative variables (i.e. those not used in the cluster analysis) include a set of characteristics[21] that are useful for descriptive purposes: these are workers of over 40 years of age, who have been in the firm for an average of 4½ years, but whose length of service ranges from under two years to over four (tables B.4, B.5 and B.6).

Older individuals in the cluster display two possible employment paths. The more virtuous of these encompasses those who participated actively in the major progress made by the sector in the last few decades, and who were associated mainly with scientific and technological activities; they currently work mainly in academic institutions. The other employment path, applicable to most workers in the cluster, corresponds to individuals who came to IT through their employment and acquired training that was strictly functional to their working environment.[22]

An essential characteristic of this cluster involves having university training unrelated to IT (table B.1), little or no knowledge of English, and knowledge acquired in previous jobs. In this context, being self-taught is not a typical feature of the cluster (table B.2). Its members have low analysis and programming capacities, and their low proclivity for development activities means they tend to fulfil tasks that are not organized in projects. They also work in the private commerce and service sectors.

Other features of this cluster, while not characteristics, include belonging to firms whose main activity is not IT (57%), and a higher relative proportion of women than in the other clusters (27%) (table B.7).

b)   *Cluster with low technological skills*
This is the largest cluster in the panel (39%). It consists of workers who do not master information technologies and languages, or who have mastery of low complexity tools[23] and undertake development tasks at the same level. Their activities are not organized

in projects. The cluster is dominated by individuals with incomplete university training.

The characteristic features of this cluster include the prevalence of young people (between 20 and 30 years of age) with less than 10 years' work experience (tables B.5 and B.6) and who have been in their job for an average of 4½ years (table B.4). These are individuals who have only recently joined the labour market, a large percentage of whom are working in the public sector (table B.3). Almost three quarters of the members of this cluster work in organizations in which the main activity is not IT. With regard to the trajectory of the members of this cluster, it might be thought that they are at a moment in their career when they can either move into medium- or high-skill clusters, or else stall, which would mean forming part of the previous cluster.

c)   *Cluster with medium-level technological skills*
This is the smallest cluster, encompassing 10% of IT workers in the panel. Its members tend to have mastery of medium-complexity technologies and perform tasks in development activities. It is the first cluster notable for its mastery of IT languages and technologies and for participation in development projects. Its members have complete university education in the IT area (table B.1).

The characteristic features of the cluster include youth and high job turnover. Its members are under 30 years of age, and half of them have been in their current organization for less than three years. At the same time, almost 40% have changed their job three times in the last five years (table B.4). Although the members of this cluster participate in projects, these tend not to be very complex: they are relatively small (occupying between nine and 16 people), are undertaken basically for third parties in the form of specific assignments (i.e. they are custom-made products and are not intended for commercialization to several customers or en masse). In the opinion of the interviewees, the criticality[24] of the projects is high and the technical skills needed are of medium complexity. At the same time, undertaking such projects required links with large software firms and IT services. A relation can be established between the nature of the projects and the diversified nature of the demand from various sectors.

One characteristic of this cluster, which is absent from the previous ones, is that its members tend to

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[21] A feature is considered a characteristic if in the contingency tables the difference between the proportion of the attribute in the cluster and in the total panel (Z test) differs significantly from zero (at the 10% confidence level, at most).

[22] In that sense, their training was limited exclusively to the mastery of tools.

[23] Visual Basic, Clipper and Cobol among the languages; web platform and unified process among the technologies.

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[24] As indicated in the survey form, the criticality of the software is measured in terms of the objective it pursues: e.g. the seriousness of the damage that could result from a possible failure.

belong to firms in which IT is the main activity: 56% work in such firms.

d) *Cluster with high-level technological skills*

This cluster accounts for 15% of the panel. The development and service activities performed by its members are less complex than the skills they master. In terms of illustrative variables, the cluster is dominated by workers under 30 years of age (table B.6); turnover is very high, comparable to that of the previous cluster; but time spent in the current job is significantly less - a feature that is directly related to age since half of them have been in the labour market for fewer than nine years (tables B.4 and B.5). Although formal education is not a characteristic feature, nearly half of the cluster's members have university education related to IT, although not all of them have completed the respective course (tables B.1 and B.2). An element that distinguishes such individuals is their high level of English. The development projects they participate in seem to be inferior to the previous cluster, as indicated by the following: they last less than one year and involve between five and eight people; the criticality and complexity of the technical skills needed are evaluated by the interviewees as low; and, lastly, few linkages are required with large software and IT services firms. Most of this cluster works in private firms whose main activity is IT, and the presence of owners is a characteristic feature. The cluster could be identified as under-used (educational devaluation hypothesis), since the workers comprising it have significantly higher technical skills than those needed by the complexity of the tasks they are required to perform. If this mismatch serves to discourage them in their work, it would explain the high turnover.

e) *Cluster with very high level technological skills*

The remaining 18% of IT workers belong to this final cluster which has more complex skills;[25] the activities their members undertake, and the languages and technologies they have mastery of are both more advanced. They also make intensive use of virtual networks, have formal postgraduate education and carry out highly complex projects (table B.1). The characteristic features of the cluster are as follows: predominance of intermediate age groups (between 31 and 40 years), very little job turnover and much longer time spent in the current job than in other clusters – seven years on average, with 50% reporting over five years in the job (tables B.4, B.5 and B.6). This feature, together with the level of formal education indicated and excellent mastery of English, are factors that determine the high level of technological skills among members of this cluster. At the same time, the quality of the projects in which they participate and their intensive network use help to ensure that their skills develop further over time. The projects in which they participate last more than 18 months,[26] involve more than nine people, involve major technical difficulty and require high-capacity human resources. Carrying out this type of project requires establishing significant linkages with large software and IT firms, which marks a significant difference between this cluster and the others. A characteristic feature is that its members tend to hold permanent positions in academic or research institutions, so it is not surprising that the demand for their services comes from the IT and research and development sectors (table B.3). As mentioned above, the employment paths of workers in this cluster have been enriched by the most virtuous experiences in the evolution of the IT sector, despite its fits and starts.

Two further distinctive characteristics of this cluster are the high proportion of its members who are resident abroad (20%) and the low proportion of women (13%) (table B.7). A number of questions arise from this. Firstly, what role could Argentine IT workers located outside the country play in the development of the sector in Argentina? Secondly, why is the proportion of women in the IT sector generally low, and particularly among clusters with high technological skills?

3. The dynamic of the different clusters

From an evolutionary standpoint, it is essential to include a number of dynamic variables that explain the development of individual skills (Freeman, Soete and Efendioglu, 1995; Lall, 2001). To that end, the proportion of human resources that either performed no development or service activities at all, or else their activities of that type were of very low quality, was measured for 1991 and 2004 for each cluster.

In general terms, differences between clusters were detected in the evolution of such activities between 1991 and 2004. In clusters with low or very low technological skills, the proportion of individuals working in very low-complexity activities tended to rise, both in services

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[25] Languages such as C++, PHP, Perl, Lisp and Haskel, and others.

[26] This duration accounts for 54% of the projects in the cluster, but only 32% of projects in the total panel.

and in development: whereas in 1999, 61% of their members were engaged in low-complexity development activities, in 2004 the figure was 79%. In contrast, in the cluster with very high level technological skills, the trend was very positive: while in 1999 almost half were not involved in complex development activities, by 2004 that proportion had fallen to 16%.

This brief review of the employment dynamic suggests a number of interesting conclusions for reflection on IT human resources skills in Argentina. IT shows that there are significant blockages in the skill accumulation process which the dynamic of the labour market and activities within firms seem unable to resolve, whether for workers with less formal education and those carrying out simple tasks, or for a cluster with high skill levels that cannot raise the quality of the tasks undertaken. Accordingly, skill under-use does not seem to be a temporary phenomenon but for many individuals is a constant. Two distinct problems can therefore be identified. One is that individuals with low technological skills cannot find a virtuous career path, because of institutional constraints, the heterogeneity of the educational system, and lack of demand pressure. The other is the persistent under-use of resources, which stems basically from the weakness of demand for complex products.

V

Conclusions and final reflections

This paper has evaluated the hypothesis that there are different IT worker profiles characterized by their technological skills; and it has reviewed how those profiles are determined by variables such as network participation, the educational system, the complexity of the projects undertaken and the structure of demand. The hypothesis was validated by analysing homogeneous clusters of IT workers based on the main variables that determine their technological skills. It was possible to place individuals in different homogeneous clusters because of the high level of interdependence between the dimensions considered in the hypothesis and their systemic nature. The dimensions considered thus help to explain the different levels of technological skills among IT workers.

The structure of demand seems to be fragmented and unspecialized. Few sales are made to the more dynamic sectors of the economy in which more complex demands could be generated. The main purchasers come from commerce and services generally; but in these sectors and in manufacturing industry, demand targeting the local market is less complex than that directed abroad. This affects both the type of projects undertaken and the skill training of IT workers, and at the same time results in those workers being underused. Domestic IT sectors are thus being asked mainly for adaptations to incorporate specific local features, whereas more complex demands from the most dynamic sectors of the domestic economy would encourage local IT firms to deal with more complex problems, in keeping with the competitive pressures they face. The productive sector and the institutional system still have difficulties in expressing their requirements in a way that local supply can decode and satisfy adequately.

Furthermore, there is little participation by IT workers in virtual and institutional networks, yet this type of linkage could generate skills that would complement those acquired in the formal education system. Personal networks seem to be used predominately for technological updating or job search, which makes knowledge circulation dependent on individual effort. Accordingly, the potential for self-training and the creation of individual and cluster capacities offered by networks is neither fully nor systematically exploited by institutions, despite their being in a position to act on a broader cluster of individuals, firms and other organizations.

Although there is a positive relation between membership of the highest-skill cluster and the level of formal education attained, on-the-job and self-training are also factors that help develop workers' skills. The formal education system creates a minimum threshold, from which workers should be able to internalize knowledge acquired in on-the-job training processes and through relations that are forged and created in their own professional development process.

The survey reveals that the IT labour market in Argentina suffers from problems that obstruct training processes and block progress towards higher-skill

clusters. There seem to be obstacles that prevent workers with the necessary know-how from undertaking the activities for which they are trained, and hinder those with a mastery of simple tools from learning to use more complex ones.

Firstly, there are latent or potential capacities that are under-exploited, because of the supply and demand weaknesses indicated above. Secondly, there is limited growth and a lack of capacity for self-training in clusters that perform simple activities. Many workers with low technological skill levels have few opportunities to move into more virtuous clusters, because they lack the minimum skill threshold that would enable them to self-train by internalizing existing codified knowledge. The process of IT skill generation therefore needs to be improved to foster a virtuous circle of interaction between supply and demand.

In this paper we have presented a typology of individuals working in the Argentine IT sector, which is the outcome of a complex historical process involving construction (and destruction) of institutions and technical skills in the various attempts made by Government and the private sector to promote incipient national progress in the sector. This typology at least partly reflects that past history and the conflicting intentions of Argentine society towards building an IT sector within its borders.

The typology presented and reviewed in this paper, together with a description and analysis of the history of information technology in Argentina, raises a number of questions as to the potential of the Argentine IT sector in general and its human resources in particular. It can hardly be claimed that we are witnessing an imminent

and spectacular expansion in exportable software supply, although the exportable supply of IT services has actually grown substantially in recent years. In this regard, a number of lines of action can be suggested based on the foregoing analysis.

In terms of projects, actions should be centred on: (i) raising the general complexity threshold of the software projects and IT services that the country can take on; (ii) strengthening relations between the IT sector and more dynamic activities, such as manufacturing, agriculture and mining; (iii) fostering demand for software and IT services from transnational enterprises located in Argentina; and (iv) exploiting the experience, contacts and knowledge possessed by Argentine IT professionals living abroad.

In terms of institutions and relations with the education sector, there is a need to improve the institutional framework of the IT sector and promote actions aimed at enhancing its relations with the education system.

With regard to more specific actions to develop technical capacities in IT human resources, it would be important to: (i) overcome the barriers that currently exist in the labour market to exploit all existing capacities and promote genuine careers or development paths that raise the general level of the country's IT human resources; and (ii) formulate and apply specific policies based on the heterogeneous nature of the worker profiles in the sector.

Lastly, it would be interesting to complement the dynamic view of IT workers offered in this paper with a systemic account of the multiple factors that determine the quality of the respective human resources.

APPENDIX A

Construction of indicators

Tools mastered by the interviewee

IT languages and technologies were ranked in terms of four criteria: up-to-datedness, importance in the local and international market, academic relevance and future prospects. Each language and each technology was graded on an exponential scale (2, 4 and 8) as best captured variability in terms of the criteria listed. The average points score was calculated for each individual, taking total non-mastery as zero. The capacities indicator was the simple average of the indicators of complexity of the different languages and technologies.

Activities carried out by the interviewee

Using a similar procedure, the tasks undertaken were divided into development activities and services, with points again being awarded on an exponential scale. This indicator was

also defined as a simple average of the indicators of the various development and service activities. The basic difference between the capacities indicator of tools mastered and the indicator of activities undertaken is that, in the second case, zero points were not awarded if a given activity was not undertaken. Thus, while an individual's mastery of more than one tool was positively recognized, carrying out more than one activity at a time was not rewarded.

Indicator of the degree of network use

Data from the survey indicated the degree of use of each virtual communication tool with points ranging from one to five: a score of 1 being assigned to non-use and 5 to the highest frequency of use. The continuous indicator, which also ranges from one to five, is calculated as the average of the scores awarded for each instrument.

Indicator of project complexity

This indicator was calculated as an average between (i) project duration in months; (ii) number of people involved; and (iii) a cross between the project's objective and the destination market. Table A.1 gives details of these variables.

TABLE A.1

Argentina: Project variables

Points	Duration (months)	Size (No. people involved)	Objective and target market
1	0-6	0-2	Internal to the firm
2	7-12	3-4	Specific order from a customer in Argentina
3	13-18	5-8	To be commercialized in Argentina
4	19-24	9-16	Specific order from a customer abroad
5	25 or more	17 or more	To be commercialized abroad

The final indicator is calculated as the average of points awarded on these three variables.

Indicator of formal education

The interviewees' level of formal education was divided in four levels:

(i)   Formal education unrelated to IT
(ii) Incomplete university education related to IT
(iii) Completed university education related to IT
(iv) Postgraduate education related to IT

APPENDIX B

Statistical data

TABLE B.1

Argentina: Relation between formal education and technological skill level in IT worker clusters
(Percentages)

Skill level of each cluster	Formal education classified by type of course and level						
	Tertiary complete	University incomplete	University unrelated to IT	Analysts and graduates in systems	Engineers and graduates in computers cience	University with postgraduate studies related to IT	Not specified
1. Very low	8.7	8.7[b]	16.7[b]	16.7	33.3	10.0	10.0[b]
2. Low	7.6	45.5[b]	3.0	15.2	24.2	3.0[b]	1.5
3. Medium	0.0	12.5	6.3	18.8	43.8	18.8	0.0
4. High	11.5	23.1	3.8	11.5	30.8	19.2	0.0
5. Very high	6.5	9.7[c]	0.0	6.5	25.8	48.4[b]	3.2
Total	*7.1*	*25.4*	*5.3*	*13.6*	*29.0*	*16.6*	*3.0*

Source: Prepared by the author on the basis of data from the SADIO-UNGS survey on the technological skills of IT workers.

[a] The probability of accepting the null hypothesis of no association is 0%.
[b] Z-test significant at 1%.
[c] Z-test significant at 10%.

TABLE B.2

Argentina: Relation between the medium in which skills were acquired and technological skill level in IT worker clusters[a]
(Percentages)

Skill level of each cluster	Medium in which workers consider they acquired their main skills				
	Self-taught	Formal education	Training courses	Previous jobs	Current job
1. Very low	2.0[b]	22.0	18.7	42.0[c]	15.3
2. Low	16.7	27.3	10.6	19.7	25.8
3. Middle	20.0	20.0	13.7	26.2	20.0
4. High	23.1[c]	34.6	15.4	19.2	7.7
5. Very high	16.1	35.5	3.2[c]	29.0	16.1
Total	*15.3*	*28.3*	*11.7*	*25.9*	*18.8*

Source: Prepared by the author on the basis of data from the SADIO-UNGS survey on the technological skills of IT workers.

[a] The probability of accepting the null hypothesis of no association is 0.06%.
[b] Z-test significant at 1%.
[c] Z-test significant at 10%.

TABLE B.3

Argentina: Relation between the type of organization in which employed and technological skill level in IT worker clusters[a]
(Percentages)

Skill level of each cluster	Type of organization in which employed			
	Private enterprise	Non-governmental organization	Academic or research institution	Public sector
1. Very low	76.7	3.3	0.0[b]	20.0
2. Low	49.2	4.8	7.9	38.1[c]
3. Medium	75.0	6.3	6.3	12.5
4. High	88.0	0.0	0.0[b]	12.0
5. Very high	56.7	0.0	33.3[c]	10.0
Total	*64.0*	*3.0*	*9.8*	*23.2*

Source: Prepared by the author using data from the SADIO-UNGS survey on the technological skills of IT workers.

[a] The probability of accepting the null hypothesis of no association is 0%.   [b] Z-test significant at 10%.   [c] Z-test significant at 1%.

TABLE B.4

Argentina: Relation between job turnover and technological skill level in IT worker clusters
(Percentages)

Skill level of each cluster	Job turnover			
	No turnover	Turnover once	Turnover twice	Turnover three times
1. Very low	50.0	23.3	16.7	10.0
2. Low	47.0	15.2	15.2	22.7
3. Middle	31.3	18.8	12.5	37.5[a]
4. High	38.5	19.2	7.7	34.6[a]
5. Very high	60.0	23.3	10.0	6.7[a]
Total	*47.0*	*19.0*	*13.1*	*20.8*

Source: Prepared by the author on the basis of data from the SADIO-UNGS survey on the technological skills of IT workers.

[a] Z-test significant at 10%.

TABLE B.5

Argentina: Relation between work experience and technological skill level in IT worker clusters[a]
(Percentages)

Skill level of each cluster	Years of work experience in the sector			
	Less than 10	11 - 20	21 - 30	over 30
1. Very low	40.0	36.7	23.3	0.0
2. Low	62.1[b]	27.3	9.1	1.5
3. Middle	62.5	31.3	6.3	0.0
4. High	61.5	23.1	7.7	7.7
5. Very high	16.1[c]	48.4	22.6	12.9[b]
Total	*49.7*	*32.5*	*13.6*	*4.1*

Source: Prepared by the author on the basis of data from the SADIO-UNGS survey on the technological skills of IT workers.

[a] The probability of accepting the null hypothesis of no association is 0.02%.

[b] Z-test significant at 10%.   [c] Z-test significant at 1%.

TABLE B.6

Argentina: Relation between age and technological skill level in IT worker clusters[a]

Skill level of each cluster	Age			
	21-30	31-40	41-50	51 and older
1. Very low	13.3	36.7	33.3	16.7[b]
2. Low	47.0[c]	28.8	19.7	4.5
3. Middle	50.0	31.3	12.5	6.3
4. High	46.2	38.5	7.7[b]	7.7
5. Very high	9.7[d]	51.6	29.0	9.7
Total	*34.3*	*36.1*	*21.3*	*8.3*

Source: Prepared by the author using data from the SADIO-UNGS survey on the technological skills of IT workers.

[a] The probability of accepting the null hypothesis of no association is 0.07%.

[b] Z-test significant at 10%.

[c] Z-test significant at 1%.

[d] Z-test significant at 1%.

TABLE B.7

Argentina: Relation between gender and technological skill level in IT worker clusters
(Percentages)

Cluster skill level	Sex of worker	
	Female	Male
1. Very low	26.7[a]	73.3
2. Low	18.2	81.8
3. Middle	6.2	93.8
4. High	15.4	84.6
5. Very high	12.9	87.1
Total	*17.2*	*82.8*

Source: Prepared by the author using data from the SADIO-UNGS survey on the technological skills of IT workers.

[a] Z-test significant at 10%.

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Regional integration and the labour market:
the Brazilian case

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Brazil is currently engaged in various trade negotiations. One of the aspects that must be taken into account when appraising these negotiations is their impact on employment. This article estimates the effects on employment of two of the main trade agreements in which Brazil may participate, based on the labour content of its trade, by the workers' skill level. Brazil is a net exporter of labour, especially less skilled labour. Our results show that, in the three alternatives considered here –the agreement between MERCOSUR and the European Union; the Free Trade Area of the Americas (FTAA), and the entry in force of both of them– nearly 230,000 jobs would be generated, representing an increase of 0.4% in Brazilian total employment. In aggregate terms, FTAA is the option which would generate more jobs. The workers benefiting most from these agreements would be those with the lowest levels of skills.

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I

Introduction

Brazil is engaged in negotiations for the expansion of existing agreements (MERCOSUR) or the signing of several new free trade agreements (MERCOSUR-EU FTA, FTAA, MERCOSUR-CAN agreement, among others). The results may differ considerably due not only to the different formats and depth of the agreements being negotiated but also to the composition of Brazil's foreign trade. Thus, for example, whereas Brazil's exports to Latin America show a higher proportion of manufactures and hence a high degree of processing, its exports to Europe are concentrated in primary commodities with little degree of processing. Likewise, there are also differences in the import structure by area of origin, although these are not as marked as in the case of exports.

Sectoral differences and disparities in the degree of processing of products lead to different effects of trade on employment, depending on the labour-intensity of the goods and the level of skills of the workers producing them. The differences in terms of the possible results of trade agreements therefore open up different prospects as regards their impact on the country's labour market.

There is ever-increasing discussion in Brazil on the effect of the different trade agreements, especially in terms of their macroeconomic aspects or their effect on trade flows. It is still rare, however, to come across analyses focusing on their impact on employment. The literature on integration and the labour market in Brazil is limited to Computable General Equilibrium (CGE) Models estimating the macroeconomic and sectoral effects on employment, but seldom is any distinction made between the labour factor categories in terms of their levels of skills. There are, however, an increasing number of studies seeking to evaluate the effects of the

multilateral openness process initiated in the early 1990s on the labour market (employment and wages).

At the international level, the debate on integration and employment is usually confused with the discussions on the *effects of trade* on employment in general, without making a distinction between the integration of a country into the world economy and its integration into a particular group of countries (regional integration). This was so, for example, in the case of the North American Free Trade Agreement (NAFTA), which gave rise to a controversy in the United States on the impacts of the integration with a developing country on North American jobs and wages. In fact, this controversy formed part of the heated debate begun in the late 1980s on the influence of trade with developing countries on the developed countries' labour markets. This debate, in turn, was generated by the changes in those labour markets (increases in wage inequality or unemployment) and the concomitant growth of trade with the developing countries. The result was a large number of interesting theoretical and empirical studies on trade and the labour market, which provided analytical instruments for studying the effects of regional integration on employment.

The present article analyses the different effects that the main integration schemes can have on employment in Brazil, considering the skill levels of the workers. The analysis is based upon the calculation of the labour content of Brazil's imports and exports, by trading partners and by workers' years of schooling (as a proxy for their skill levels).

After the present introduction, section II presents the methodological framework and reviews the available empirical works. Section III contains the actual analysis of the Brazilian case, including a brief analysis of Brazil's foreign trade, the results concerning the current labour content of the country's trade and then the simulations on the effects of the free trade agreements on Brazil's employment.[1] Finally, section IV presents the conclusions.

[1] For the sake of brevity, FTAA and the Mercosur-EU FTA will henceforth be referred to as "agreement with the United States" and "agreement with the European Union".

II

The labour market and trade integration:

methodological notes and applications

The literature on the effects of trade on the labour market provides a number of instruments for analysing the particular case of regional integration. At the theoretical level, the literature generally analyses the effects on employment and wages caused by changes in the levels of trade –or in the degree of openness–, without necessarily distinguishing whether the growth in trade is due to regional or multilateral integration. For this reason, the theoretical framework for analysing the effects of trade integration on the labour market is based on the traditional Ricardian and factor models and the critiques of those models.

With regard to the empirical studies on regional integration and the labour market, the methodologies used to evaluate the effects of greater regional and multilateral openness are fundamentally the same. Normally there are three types of methodologies: computable general equilibrium (CGE) models, calculation of the labour content of trade, and econometric estimation of the elasticity of wages and employment with respect to international trade-related variables. This article focuses on studies using the methodology selected here –factor content calculation– in order to investigate their limits and characteristics in greater depth.

1. Methodological notes

The great majority of the available empirical studies which seek to evaluate the effects of regional integration on the labour market deal with the impact of NAFTA on United States workers. These studies, along with the natural fear of United States workers of losing their jobs, have led to the resurgence of the debate on the impact of competition from the developing countries on the developed nations. In reality, this is an ongoing concern of the latter, since they are interested in the effect of trade integration, but with special reference to the developing countries.

In Brazil, there are relatively few studies on regional integration and the labour market, and they are limited above all to CGE models which naturally deal with the evolution of employment, at least at the macroeconomic level. As regards the impact of

openness on the labour market, the supply of studies has been larger and growing since Brazil embarked on a process of trade liberalization in the 1990s (Soares, Servo and Arbache, 2001; Raposo and Machado, 2002).

There are basically three methodologies available for evaluating the links between trade, on the one hand, and employment or wages on the other: CGE models; labour demand estimates, which measure the influence of trade on employment or wages, and calculation of the labour content of trade. CGE models are sophisticated models which represent the totality of the economic relations of one or more countries. In order to make them, it is necessary to have a large amount of information and, sometimes, to formulate robust hypotheses on elasticities or other economic phenomena.

Econometric estimates of the links between trade and employment or wage levels, which are frequently used by labour market specialists, involve a very wide range of equations which differ considerably depending on the available data bases, the econometric techniques used and, of course, the specifications adopted. As may be gathered from the various studies summarized in Cortes and Jean (1995), the results are ambiguous and, all in all, do not appear to be conclusive as regards the influence of trade on the labour market.

Factor content calculation is a simple methodology whereby an estimate is made of the amount of labour contained in the goods exported and imported, corresponding to the jobs generated in the export sectors and those lost in the sector competing with imports. The calculation is made on the basis of employment multipliers which are normally estimated from local production (employment/currency unit) and then applied to the trade flows of a given country. The origin of this methodology lies in the techniques for breaking down the factors that explain the variation in employment. Starting from the accounting identities

$$C = Q - X + M \text{ and}$$
$$P = Q/E,$$

where the variables represent consumption (C), production (P), exports (X), imports (M), productivity

(P) and employment (E), for sector i (not shown), we have:

$$\Delta E = (^1/P_0) \, [\Delta C + \Delta X - \Delta M - E_0 \Delta P]$$

In order to evaluate the impact of trade on employment, if we suppose that changes in the external sector do not affect consumption and productivity, then the variation in employment will correspond to the variation in the trade balance multiplied by the employment multiplier (inverse of productivity). This methodology, as we will see below, suffers from various limitations, such as the assumption that there is no interaction between the various terms in the first equation.[2]

The coefficients may be direct or indirect, depending on whether or not the use of intermediate goods is taken into account through the technical coefficients provided by the input-output matrices. The calculation of factor content may or may not take account of two production factors, depending on the objective of the study. Calculation of the relative intensities of factor use (more than one factor) is normally used to verify the Heckscher-Ohlin model, while calculation of the use made of a single factor is employed to analyse the effect of variations in the level of trade on the stock of the factor in question.

Although this methodology has good explanatory power and is supported by a number of economists, it has various limitations.[3] The first of these are related with its static nature. As pointed out by Leamer (1996), it does not take account of trade-induced changes in prices, wages, productivity, trade structure or consumption, so that it disregards the trade benefits obtained through price changes. Nor does it take into account the fact that the mere threat of trade competition can have profound effects on the labour market. According to Borjas, Freeman and Katz (1992 and 1996), this aspect can make the use of this methodology questionable, as shown below. Lastly, as noted by Cortes, Jean and Pisani-Ferry (1996), this methodology assumes that the labour market operates in conditions of perfect competition and that adjustment to outside competition will be effected entirely through the amount. This latter criticism is open to question, however: the calculation of factor content shows what the equivalent amount would be in terms of trade flows,

but obviously the actual effect of this variation on employment depends on the conditions prevailing in the labour market (i.e., how much of the adjustment will take place through prices and how much through the amount).

Other limitations concern measurement problems. Wood (1994 and 1995) argues that if an "average" coefficient is used for employment by sectors, this ignores the differences between firms in the same sector. According to this author, competition by the developing countries does not affect all the firms in a given sector, because of the differences in productivity between them; only the least productive firms would be forced out. The employment coefficient used should therefore reflect this fact. As we will see below, Borjas, Freeman and Katz (1992 and 1996) propose the use of a coefficient which reflects the technological gap of the developing countries. According to Cortes, Jean and Pisani-Ferry (1996), this problem reflects an aggregation bias: the indicators are calculated by industry, according to the classification of the input-output matrices, but international competition takes place at the product level.[4] This not only leads to a skew in the estimation of the number of jobs lost, but also takes no account of the movements of labour which may take place within a sector.

Another criticism, made by Hinojosa-Ojeda, Runsten and others (2000), is that it would be wrong to use the same employment multipliers for imports and exports, since it would be a mistake to conclude that trade impacts are symmetrical.[5] We do not agree with this assertion, however, if the aim is to measure how many jobs would be lost in domestic firms through competition from imports. In this case (despite Wood's criticism) it would be reasonable to assume that domestic firms use the same technology.

Lastly, Borjas, Freeman and Katz (1992 and 1996) propose two conditions that must be fulfilled if the factor content methodology is to be "useful" (for analysing the impact of trade). The first of these is that the local determinants must be important in fixing

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[2] For a detailed description of the methodology, see Cruz (1996).
[3] For a defence of this methodology, see Davis and Weinstein (2002).

[4] As argued by Wood (1994), in calculating the factor content of trade non-competitive imports (such as East Asian tee shirts) are confused with equivalent products from rich countries (such as high-fashion tee shirts), although there are big differences in their respective contents of labour and labour skills (Cortes, Jean and Pisani-Ferry, 1996, p. 25).
[5] The first reason would be that, if they are not exported, products would not necessarily be produced and, above all, there is no guarantee that, if particular products were not imported, there would be local production that would take their place.

amounts and prices in the labour market; otherwise, if the levelling of factor prices operates perfectly, it would be more reasonable to calculate the international rather than the national coefficients. The second condition is that the observed trade must be effectively reflected in the pressure on the labour market. According to these authors, if the mere threat of foreign competition is enough to alter the amount of labour employed by domestic firms, there will be no changes in the level of trade.

Other criticisms of this methodology are related with its use to validate trade theories. Calculation of the factor content was initially used to verify the validity of the Heckscher-Ohlin theory. Its best-known results are those of Leontief (1953), who questioned the applicability of that theory to the United States economy. According to Leontief, factor content calculation indicates that the United States does not display a form of specialization in line with that theory, according to which that country would import capital-intensive goods and export labour-intensive products, because of its initial factor endowment. Subsequently, however, Leamer (1980) questioned Leontief's criticisms, arguing that the calculation of the relative intensities of factor use should be made on the basis of net exports and not imports and exports separately, and it should even take into account the trade balance of the year studied. As a result of Leamer's criticisms, a wide-ranging debate arose on the validity of the method and the theory itself.[6]

In the present article, however, our aim is not to verify the validity of the Heckscher-Ohlin model in the case of the Brazilian economy –a matter which has been dealt with in various studies–[7] but rather to estimate the amount of employment that would be created or threatened by increases in exports and imports due to trade agreements.[8] We will therefore not examine here the usefulness of this method for validating that method.

2. Empirical works

In spite of the limitations pointed out by various authors, most analysts continue to use this methodology. As Cortes, Jean and Pisani-Ferry (1996, p. 21) rightly say, in spite of all this, we still consider it a good starting-point.

Among the studies in which that methodology is used to evaluate the impact of competition from the developing countries on employment in the developed nations, particular mention may be made of the controversial contributions by Borjas, Freeman and Katz (1992 and 1996) and Sachs and Shatz (1994), as well as the more recent article by Kucera and Milberg (2002).[9] In the following paragraphs, we will refer to some of the contributions made to the debate on the effects of regional integration.

In two articles, Borjas, Freeman and Katz (1992 and 1996) attempt to measure the effects of immigration and trade on the labour market of the United States between 1980 and 1995. Basically, they use the same methodology in both articles: in a first stage they calculate the variations in employment levels on the basis of the labour content of net trade flows with the developing and developed countries, and in a second stage they apply wage elasticity to variations in the amount of labour offered, in order to see what the effect would be on wage differentials. The method for calculating the labour content, taking account of the different educational levels of the workers, is basically the same in both articles. The most important innovation in the second article is that it seeks to reply to the criticisms made by Wood (1994 and 1995) regarding the homogeneity of firms in a given sector, to which we already referred earlier. The authors establish three scenarios in which they apply the labour multipliers of 1970, 1980 and 1995, respectively: that is to say, they consider the technological gap between the developing and developed countries. They conclude that the intermediate scenario –in which the gap for 1995 is 15 years– is the most reasonable; its results indicate a bigger negative impact of trade with the developing countries than that of trade with the developed nations, as well as suggesting that the least educated workers would be most seriously prejudiced by the competition

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[6] See, for example, Deardoff (2000) and Davis and Weinstein (2002).

[7] See, for example, Machado and Moreira (2001), Faria and Silva (2003), Ferreira and Machado (2001) and Gonzaga, Terra and Menezes-Filho (2001), although different methodologies are used in these studies.

[8] In the present study, the emphasis is on the "quantity" of labour, and we are therefore not interested by the various articles which evaluate the impact of openness on wages. Analysis of the effects of the exchange rate on the labour market (see Klein, Schuh and Triest, 2002) is also outside the scope of this article.

[9] Gregory, Zissimos and Greenhalgh (2001) and Cortes, Jean and Pisani-Ferry (1996) make similar analyses for the United Kingdom and France, respectively. Behar (1988) applies the method to the Mexican economy in order to analyse the impact of multilateral trade liberalization on the labour market of that country.

of foreign workers through trade or immigration. Moreover, the effects of immigration on employment and wages seem to be greater than the effects of trade.

Sachs and Shatz (1994) calculated the labour content of the net imports of the United States between 1978 and 1990, in order to measure the impact of trade with the developing countries on industrial employment in that country. First, they simulated what the level of trade would be if the penetration of imports in 1990 was the same as in 1978, and they then applied the employment multipliers, distinguishing according to the level of qualifications of the labour force. These authors attributed a 5.9% reduction in employment in the manufacturing sector to the effects of trade; almost all of this reduction (5.7%) was due to trade with the developing countries, whereas trade with the developed nations only caused a reduction of 0.2%. Production workers were most seriously affected by outside competition (a 7.2% reduction in employment), and most of this reduction (6.2%) was due to trade with the developing countries.

Kucera and Milberg (2002) calculated the sectoral coefficients of factor content in order to examine the changes in labour content in the trade flows of the Organisation for Economic Cooperation and Development (OECD) countries between 1978 and 1995. The change in labour content was calculated separately for trade among the OECD countries and trade with countries which are not members of that group. These authors concluded that, although the sectors making most intensive use of labour showed the biggest variations in employment and faced the strongest competition from the developing countries, the share of the latter in the OECD countries' imports was only quite small (7% at the most). They also showed that the net loss of employment attributable to non-OECD countries was due to the reduction in exports to those countries rather than an increase in imports from them. In the case of trade with other OECD countries, although some of them registered increases in the number of jobs due to an increase in trade among OECD members, the authors estimate that the overall loss of jobs reflects the phenomenon of the de-industrialization of those countries. They consider that the alleged threat of competition from low-wage countries has been brought up wrongly to account for the effects of the loss of dynamism by the economies affected. During the last period of buoyant growth of the United States economy in the 1990s, the share of imports from the developing countries increased significantly, but competition from low-wage countries was not considered a threat.

With regard to the relation between regional integration and employment, most of the cases where the factor content method was applied concern the North American Free Trade Agreement (NAFTA).

Hufbauer and Schott (1992) made an optimistic (and erroneous) projection of the growth of the United States trade surplus with Mexico and then proceeded to apply the employment multiplier calculated by the United States Department of Commerce. The findings of these authors were optimistic –creation of 130,000 jobs– and at first the Clinton administration used them to defend the agreement. The application of this same methodology on a more realistic basis, however, would change this increase into a significant loss and provide arguments for the opponents of the agreement, as shown by Hinojosa-Ojeda, Runsten and others (2000). There were many criticisms of the above-mentioned study by Hufbauer and Schott, ranging from the projection of the trade balance to the fact of having an aggregate coefficient. In a second version (Hufbauer and Schott, 1993) the increases in employment were calculated sector by sector and indirect multipliers were used. The increase in employment now rose to 170,000, but according to the methodological problems persisted. These authors asserted that there was an error in the interpretation of the sectoral results, because the same multipliers should not be applied to both imports and exports, and that Hufbauer and Schott's calculations did not take account of the indirect effects of exports, although this latter argument is not as sound because in the second version indirect employment coefficients were used. The use of the same multipliers for both imports and exports can also be justified with the hypothesis (although this is questionable) that the technology used by domestic firms is uniform throughout a sector, so that the same technology is used by both import substitution and export firms.

Rothstein and Scott (1997) used a similar methodology but applied the indirect multiplier calculated by the United States Bureau of Labor Statistics. The most significant change, however, was the concept of the trade balance used, since these authors calculated the net exports, deducting the portion of exports produced in other countries[10] and considering only imports for actual consumption. With regard to the growth in the United States trade deficit with its trading partners, the authors identified a loss of almost

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[10] These are goods that pass through the United States for re-export to other countries.

400,000 jobs between 1993 and 1996, mostly (57%) attributable to Mexico. They even disaggregated the results by states and by demographic characteristics of the labour market. The results of both studies are controversial, since they arrived at significantly different findings, using different methodologies (see Hinojosa-Ojeda, Runsten and others (2000)).

With regard to European integration, Pugacewicz (2004) calculated the factor content of Poland's trade with the European Union during the 1990s in order to determine the impact of trade openness on the trade structure. He considered 14 production factors, including seven categories of labour –by skills and by sector– and the coefficients used were indirect and took account of inter-sectoral relations. The result in terms of employment was of an overall nature, however, and was not disaggregated by sectors. He found that in 2000 Poland became a net exporter of unskilled labour to the European Union, which represents a change from that country's pattern at the beginning of the period, when it was a net exporter of skilled labour. This study, which was a preliminary version, does not make it clear what input-output matrix was used, whether it was the same for the whole decade, and whether it corresponds specifically to the Polish economy.

In the case of Brazil, there are few examples of the application of the labour content methodology. Barros and others (1996) used this method to evaluate the effect of trade openness on industrial employment in Brazil between 1987 and 1995. The methodology used was quite simple: the direct coefficient (inverse of productivity) was applied to the trade surplus, both overall and by sectors. These authors stress that they only considered the direct effects of openness (on trade flows) and not the effects on productivity, although they could have done so by taking the levels of productivity at the end of the period.[11] After analysing Brazil's trade openness and trade flows, these authors find that there was a loss of 500,000 jobs, of which 390,000 were lost in 1994 and 1995 because of two factors: the poor performance of the Brazilian economy between 1987 and 1993 (1% drop in real GDP) and the very gradual nature of trade liberalization, especially as regards tariffs, which extended from 1991 to 1994. As regards the sectoral results, the authors did not have trade data for 1993 and 1994, and this reduces the interest of the results, because the consequences of trade openness began to be felt as from 1994. Up to 1993 the effects of openness on employment were not significant, but the sectors most affected by job losses were textiles, metal products and machinery and electrical equipment.

One of the authors of that article (Cruz, 1996) used a similar methodology for another period –1980-1993– to analyse the evolution of trade-related employment in the Brazilian economy. For this purpose, he made an extensive analysis of the evolution of trade flows over the period in question, concluding that the growth of trade in the 1980s had a positive effect on employment, while the openness at the end of that decade had a slight impact in the early years of the following decade. On disaggregating the effects on imports and exports, the author highlights the growth in employment associated with exports, due to the increase in the propensity to export displayed by manufacturing in the 13 years studied. This growth offset the loss of employment due to imports, which increased significantly at the end of the period (between 1990 and 1993 the loss of jobs grew by nearly 50%). Methodologically, Cruz's work differs from that of Barros and others, because it uses direct coefficients of labour content (inverse of productivity) for each year, rather than a constant value for the whole period.

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[11] The productivity indicator applied to the variation in the trade balance was for 1987.

III

Integration and employment in Brazil

The effects of the various integration schemes of which Brazil is a member depend on the features of the particular scheme and also on the present trade configuration. With regard to the labour market, the sectoral composition of trade implies different amounts of labour (by level of skills) for each trading partner. In this section, we will calculate the labour content of Brazil's foreign trade and then analyse the probable impact on Brazilian employment of the country's entry into an agreement with the United States and into one with the European Union. We will therefore begin by briefly presenting the differences in specialization of the Brazilian economy, according to the trading partner concerned. We will then examine the labour content of trade and the variation in employment due to integration.

1. Sectoral patterns of Brazilian trade with its main trading partners

Brazil's trade structure is quite diversified, both in terms of geographical distribution and of products. Its most important trading partners are the European Union and the United States, each of which accounts for nearly a quarter of its trade. MERCOSUR also has significant weight in Brazil's trade, even considering that the years dealt with in this case (1999 and 2001) were marked by a slackening of intra-regional trade. Among the other trading partners are the other Latin American countries and China, whose share in Brazil's foreign trade is growing.

Brazil's specialization varies considerably depending on the trading partner involved, as may be seen from table 1. There are three different trade patterns: i) the typical North-South pattern, marking Brazil's trade with the European Union; ii) trade in which there is a predominance of manufactures, as in the case of Brazil's trade with the United States, Canada and Mexico, and iii) trade in which Brazil basically exports manufactures and imports primary commodities, as in the case of the country's trade with its partners in MERCOSUR, the Andean Community and Chile.

At a more disaggregated level, Brazil imports large amounts of electrical and electronic equipment, transport equipment and chemical products from the European Union and the United States. It also imports a considerable volume of transport equipment (especially automobiles) from MERCOSUR, together with agricultural products and petroleum. With regard to its exports, Brazil's specialization in its trade with the European Union differs considerably from its trade with the United States and MERCOSUR. Almost half of Brazil's exports to the European Union correspond to agricultural and food products, whereas in the case of the two last-named partners these products account for less than 10%. On the other hand, manufactures such as transport equipment, electrical and electronic equipment and iron and steel account for a much higher proportion of Brazil's exports to the United States and MERCOSUR.

The different forms of specialization have different repercussions on employment in the export sectors and those competing with imports. In other words, an increase in trade with a trading partner who mainly imports products which make intensive use of labour – some manufactures, for example– can have positive consequences for employment, depending obviously on the patterns of imports.

2. Employment and foreign trade in Brazil

In this subsection we will show the calculation of the labour content of Brazil's exports to and imports from its main trading partners, according to the level of schooling of the workers. In this calculation of the labour content we will take into account not only sales and purchases of final goods but also the use made of intermediate goods. The labour content of trade which takes account of such use can be calculated in two ways, however, which give results that are the same at the aggregate level but differ in sectoral terms.

The first way consists of calculating the "indirect coefficient" of labour and then applying it to the trade flows of final goods, in the following manner:

$$E^1_j = N'_{jxj} * X_{jx1}$$

where E^1 is the amount of labour contained in the trade flow according to the first calculation formula; N' is a

TABLE 1

Brazil: Composition of foreign trade, by trading partners, 1999-2001

(As a percentage of total for each partner)

Sector code	Description	Imports			Exports		
		European Union	United States	MERCOSUR	European Union	United States	MERCOSUR
1	Agriculture and stock-raising	0.4	0.6	18.7	12.0	1.4	1.0
25	Food products	2.9	0.8	14.0	31.4	8.0	8.8
2	Mining	0.2	0.2	0.4	9.2	2.3	1.9
3	Oil and gas extraction	0.0	1.7	9.0	0.4	0.2	0.5
4	Non-metallic minerals	1.2	0.6	0.1	0.6	1.0	2.2
5	Iron and steel and metal products	5.9	4.6	2.2	9.1	14.9	8.7
8	Machinery and tractors	21.2	10.1	3.0	2.4	3.9	6.8
10	Electrical and electronic equipment	16.4	31.4	1.6	1.9	10.5	12.4
12	Transport equipment	17.0	13.4	22.2	12.0	24.7	19.4
14	Wood and furniture	0.6	0.2	0.5	4.8	5.0	2.3
15	Paper and printing	2.1	2.4	1.7	4.8	3.7	5.4
16	Rubber industry	1.5	1.1	1.2	0.5	1.6	2.4
17	Chemical industry	10.0	10.6	3.6	2.6	2.0	6.7
18	Oil refining	5.0	8.7	11.1	1.6	6.9	7.4
20	Pharmaceuticals and perfumery	8.2	4.4	1.9	0.3	0.2	2.7
21	Plastic products	1.4	1.7	1.2	0.1	0.2	0.8
22	Textile industry	1.2	1.2	4.2	1.1	1.6	5.1
23	Clothing	0.2	0.1	0.3	0.1	0.3	0.5
24	Footwear	0.1	0.1	1.6	4.0	9.0	2.6
32	Miscellaneous manufacturing	4.3	6.2	1.5	1.1	2.7	2.5
	Total	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*

Source: Secretariat of Foreign Trade of Brazil.

diagonal matrix in which the terms of the main diagonal correspond to the terms of the vector resulting from the multiplication of *A* by *n*, *A* being the Leontief matrix of technical coefficients for *j* sectors and *n* is the vector of the direct employment coefficient calculated from the sectoral production and employment (amount of labour per unit produced, *N/Q*); *I* is the identity matrix which allows us to multiply *n* by *X*; and *X* is the vector of exports (the same calculation can be made for the flows of imports and/or net imports).

The results obtained in this way will give us the employment generated by the export sector. In other words, each line of the final vector represents the sum of the jobs generated (in all sectors) by the exports of the sector in question (here the sector corresponds to exports and not to employment).[12]

The second way consists of first calculating the total amount effectively exported (or imported) by each sector, taking into account the inputs used, and then

applying the direct employment coefficient. The calculation is as follows:

$$E_j^2 = N_{jxj} * [A_{jxj} \cdot X_{jx1}]$$

where the terms correspond to the definitions of the previous equation, except for *N*, which is a diagonal matrix in which the terms of the main diagonal correspond to the direct employment coefficients contained in *n*. We thus obtain the employment for each sector generated by the overall exports (of the various sectors), i.e., each line of the final vector represents the employment generated in each sector by the exports of the various sectors.[13] In this case the sector corresponds to employment and not to exports. This is the calculation which was made in this study.

The total number of jobs generated in the economy is obviously the same for both forms of calculation,

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[12] For example, the jobs found in the first line of the final vector correspond to those generated in all sectors of the economy as a result of the output of the agricultural sector.

[13] The first line of the final vector represents the employment generated in agriculture thanks to the exports of the 32 sectors which indirectly use agricultural products. It should be noted that the classification of the national household survey is different from that of the input-output matrix, but if the second form of calculation is used it is possible to multiply the direct labour coefficients (32 sectors) by the "effective" exports (originally with 43 sectors).

only the sectoral results being different. The data used were the following:

i) the Leontief matrix corresponding to 1996, which was the last year provided by the Brazilian Geographical and Statistical Institute (IBGE);

ii) for calculating foreign trade by trading partner, the breakdown obtained from information provided by the Secretariat of Foreign Trade for 1999 and 2001, based on export and import data supplied by the Department of National Accounts of IBGE, at 1996 prices and in millions of reales;

iii) the coefficient n corresponding to the quantity of labour per unit produced (N/Q), where N is employment, by bracket of skills of the workers. This coefficient was obtained by applying the weight (share in total employment) of each bracket of skills (IBGE National Household Survey, 1999 and 2001) to the figure for total employment supplied by the Department of National Accounts of IBGE (average for 1999 and 2001). Q corresponds to the total output at current 1996 values, in millions of reales.

a) *Employment and labour-intensity coefficients*

The following tables show the intensity of labour use in the various sectors of the economy, that is to say, the amount of workers per million reales produced, and the total number and skills (years of schooling) of the workers. These indicators are calculated from the most recent available employment data (from the IBGE National Household Surveys for 1999 and 2001 and the Department of National Accounts), but the production data are for 1996. As it was impossible to obtain all the data for the same year, and in order to give preference to recent employment statistics, it was decided to use the production data –above all the value of production and the technical coefficients– for the same year (1996), since these were data of the same nature.

The labour coefficient (or multiplier) for the economy as a whole (table 2) –including the services sector– is 45 workers for each million reales produced. This value is lower in the primary and secondary sectors (agriculture, mining and manufacturing): 38 workers per million reales produced.[14]

TABLE 2

Brazil: Direct employment coefficients (total), 1996 and 1999-2001

Sector	Description	Direct employment coefficient (workers per million reales produced, 1996)	Exports 1999-2001 (% of total)	Imports 1999-2001 (% of total)	Value of output, 1996 (% of total)
23	Clothing	160.3	0.2	0.3	1.7
1	Agriculture and stock-raising	154.0	5.5	3.4	15.6
14	Wood and furniture	65.6	3.6	0.4	2.3
24	Footwear	59.2	4.2	0.4	1.0
4	Non-metallic minerals	28.4	1.4	0.7	2.6
2	Mining	27.6	6.2	0.8	1.3
32	Miscellaneous manufactures	22.6	1.8	4.1	1.8
21	Plastic products	18.5	0.5	1.2	1.7
8	Machinery and tractors	18.1	3.5	10.0	4.0
15	Paper and printing	17.0	4.2	1.9	4.3
5	Iron and steel and metal products	13.7	10.9	4.9	9.7
22	Textile industry	13.6	2.0	2.5	3.1
25	Food products	13.4	24.0	4.1	19.1
20	Pharmaceuticals and perfumery	10.5	0.8	4.9	2.1
10	Electrical and electronic equipment	8.8	6.3	20.0	5.0
16	Rubber industry	7.8	1.2	1.4	1.2
17	Chemical industry	7.4	6.2	16.0	5.4
12	Transport equipment	7.2	15.3	12.7	7.0
3	Oil and gas extraction	4.1	0.7	5.7	1.1
18	Oil refining	1.1	1.5	4.7	10.0
	Subtotal (sectors 1 to 32)	38.2	100.0	100.0	100.0
	Total (sectors 1 to 43)	45.2	–	–	–

Source: Prepared by the author on the basis of data from the National Household Surveys and the Department of National Accounts of the Brazilian Geographical and Statistical Institute (IBGE).

[14] Tables 2 and 3 only show the coefficients for the goods-producing sectors, for which detailed trade statistics are available. Since these sectors use various kinds of services, however, in the appendix, which is broken down by sectors, we added the employment of the services sectors at the end.

The coefficients are classified in descending order, showing first the sectors that use most labour.[15] The sectors with the highest coefficients are clothing and agriculture and stock-raising. In these sectors, the amount of labour needed to produce one million reales is over 150. Of the total of 31 sectors analysed, only four exceed the average for the economy: the two cited above, plus wood and furniture and footwear. At the other extreme, with the lowest labour requirements, are the sectors making intensive use of capital, such as petroleum extraction and refining, transport equipment and chemical products.

The other information given in table 2 is designed to provide some data on the specialization of the Brazilian economy. Brazil does not appear to form part of the group of countries whose comparative advantages are based on the labour factor: products which make more intensive use of labour do not have much weight in Brazil's export structure. With regard to the value of production, the agricultural sector continues to account for 15% of the total, while the share of clothing is quite small. Of the three sectors with most weight in the export structure, two –food products and iron and steel and metalworking– have intermediate coefficients, while the third –transport equipment– has a very low coefficient. With regard to imports, there is heavy concentration in products of low labour content: 60% of imports are in sectors with an employment coefficient of less than 10.

According to table 3, the employment coefficient goes down significantly with a rise in the level of skills of the labour force. For the economy as a whole, the intermediate skills segment has a relatively high coefficient, while in agriculture and stock-raising, as well as industry, the difference between the unskilled and intermediate-level labour coefficients is quite marked. Furthermore, industry is the sector which generates least employment, as we can see from the coefficients for all skill levels.

TABLE 3

Brazil: Direct employment coefficient/output, 1996 and 1999-2001[a]
(Workers per million dollars produced)

Sector	Description	Level of skill of workers (years of schooling)						
		Up to 7		8 – 11		12 or more		Total
23	Clothing	93.0	(2)	62.1	(1)	5.3	(1)	160.3
1	Agriculture and stock-raising	140.7	(1)	11.8	(4)	1.6	(8)	154.0
14	Wood and furniture	44.1	(3)	19.5	(3)	2.0	(5)	65.6
24	Footwear	35.5	(4)	21.7	(2)	1.9	(6)	59.2
4	Non-metallic minerals	18.9	(6)	8.4	(9)	1.1	(12)	28.4
2	Mining	22.5	(5)	4.2	(15)	1.0	(14)	27.6
32	Miscellaneous manufactures	9.8	(7)	11.2	(5)	1.6	(9)	22.6
21	Plastic products	6.7	(11)	10.4	(6)	1.3	(10)	18.5
8	Machinery and tractors	6.8	(10)	8.7	(8)	2.5	(3)	18.1
15	Paper and printing	4.8	(13)	9.6	(7)	2.5	(4)	17.0
5	Iron and steel and metal products	6.0	(12)	6.7	(10)	1.0	(15)	13.7
22	Textile industry	7.0	(9)	5.8	(11)	0.7	(18)	13.6
25	Food products	7.3	(8)	5.4	(13)	0.7	(17)	13.4
20	Pharmaceuticals and perfumery	2.4	(16)	5.4	(12)	2.7	(2)	10.5
10	Electrical and electronic equipment	2.0	(18)	5.1	(14)	1.7	(7)	8.8
16	Rubber industry	3.2	(15)	4.1	(17)	0.6	(19)	7.8
17	Chemical industry	3.2	(14)	3.0	(18)	1.2	(11)	7.4
12	Transport equipment	2.0	(17)	4.1	(16)	1.0	(13)	7.2
3	Oil and gas extraction	1.1	(19)	2.1	(19)	0.9	(16)	4.1
18	Oil refining	0.3	(20)	0.5	(20)	0.3	(20)	1.1
	Subtotal (sectors 2 to 32)	8.6		7.0		1.2		16.8
	Total (sectors 1 to 43)	*26.8*		*14.7*		*3.7*		*45.2*

Source: National Household Surveys and the Department of National Accounts of the IBGE (1999 and 2001).

[a] Numbers in brackets indicate the order in terms of labour-intensity.

[15] The order of the sectors by direct labour coefficient calculated by Behar (1988, p. 195, table 10.7) for the Mexican economy is similar to that found here for Brazil.

Generally speaking, the sectors making the most intensive use of labour are also those that make most use of the two least qualified categories (the correlation coefficient between the two vectors is 0.62). The clothing sector is also the sector that makes the most intensive use of more highly skilled labour. This sector and that of wood and furniture are an exception, however, since the other sectors which make most use of "highly qualified" labour –the pharmaceutical and perfumery industry, machinery and tractors, and pulp and paper– generally do not make intensive use of labour.

On the other hand, the sectors which make least use of labour generally maintain this behaviour in the case of all levels of skills (in absolute terms). The correlation between the coefficient for the labour force as a whole and that for the most highly skilled labour is –0.52. In terms of the relative intensity of use of labour from the three main categories, the sectors which make least use of labour generally use a relatively high proportion of the most highly skilled labour. This is so in the petroleum extraction and refining industry and, to a lesser extent, the transport equipment, chemical, electrical and electronic equipment and pharmaceutical and perfumery industries.

In the case of labour with an intermediate level of skills, the degree of correlation with the total amount of labour per sector is –0.57, which indicates that more use is made of this category in the sectors making least use of labour.

b)   *Labour content of Brazil's trade*

After applying the labour content coefficients to the trade flows, we obtain the amount of labour incorporated in Brazilian exports and imports. Table 4 shows the results for Brazil's trade with its three main trading partners.[16]

The amount of labour contained in the country's total exports is greater than that contained in its imports; in this respect, Brazil is a net exporter of labour, according to our calculations. The labour content of the country's total exports is equivalent to 7.1 million jobs, or 11.9% of total employment in Brazil in 1999 and 2001, while the labour content of imports is equivalent to 4.3 million jobs, or 7.1% of total employment. In other words, there is a positive balance of labour incorporated in the country's total foreign trade, corresponding to 4.8% of the total employment of Brazil.

Brazil is a net exporter of labour at all skill levels, but the most important category is that of less skilled labour. The balances for the other categories in the overall total are 13% for labour of intermediate skill levels, and 0.5% for the most highly skilled labour. This reflects two aspects which have already been addressed: first, the specialization of the Brazilian economy, and second, the fact that the sectors using the most highly skilled labour are normally those displaying a low level of labour intensity.

Of the three trading partners analysed, the North-South trade pattern mentioned earlier is most clearly seen in Brazil's trade with the European Union. In this trade, Brazil exports less-skilled labour and imports more highly-skilled labour. Out of the total positive balance that Brazil maintains with its trading partners as a whole, almost half comes from its trade with the European Union. In its trade with the United States, although Brazil exports more less-skilled labour than the other categories, this pattern is not so pronounced and the balance is a good deal smaller than that generated in trade with the European Union. In the case of MERCOSUR, Brazil exports to its partners in the bloc labour which is relatively more skilled than that which it imports from them, which is not surprising if we analyse the composition of trade in the Southern Cone. As may be seen from table 4, in its trade with MERCOSUR Brazil has a deficit in the less-skilled category and a surplus in the more skilled category: the opposite to the situation observed in its trade with the European Union.

In terms of its share in the "exports" and "imports" of labour, the European Union figures as Brazil's most important trading partner, since the trade with that bloc, because of its composition, makes more intensive use of labour than trade with the country's other partners. The share of the United States in such exports and imports is around 19%, while that of MERCOSUR is much greater in the case of imports (24%) than exports (10%).

These results are explained by the situation at the sectoral level.[17] The sectors in which exports generate most employment are agriculture, commerce, food products, iron and steel and metal products, and

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[16] Although no simulation is made for MERCOSUR, it seems interesting to present the results for that bloc for comparison with those for the other blocs.

[17] To see the corresponding results in detail, readers may view the web page http://www.ipea.gov.br/pub/td/2004/td_1028.pdf or contact the author.

TABLE 4

**Brazil: Labour content of its foreign trade, by trading partner,
1996 and 1999-2001**
(In thousands of jobs)

Skill category of labour, by years of schooling	European Union	United States	MERCOSUR	Others	Total
Total exports					
0-7	1 884	813	404	1 841	4 942
8-11	528	433	225	641	1 827
12 or more	98	84	48	128	357
Total	2 509	1 330	677	2 610	7 127
Percentage of each trading partner	*35.2*	*18.7*	*9.5*	*36.6*	*100.0*
Total imports					
0-7	574	426	762	697	2 459
8-11	419	336	214	479	1 448
12 or more	100	82	44	118	344
Total	1 094	844	1 020	1 294	4 252
Percentage of each trading partner	*25.7*	*19.8*	*24.0*	*30.5*	*100.0*
Balance					
0-7	1 309	388	-358	1 144	2 483
8-11	108	97	11	163	379
12 or more	-2	2	4	10	13
Total	1 415	487	-343	1 316	2 875
Percentage of each trading partner	*49.2*	*16.9*	*-11.9*	*45.8*	*100.0*

Source: Prepared by the author.

footwear. With regard to imports, the sectors whose amount of employment would be most seriously affected would be agriculture, commerce, food products, iron and steel and metal products, and machinery and tractors. In terms of the number of jobs generated, the sectors which would benefit most from trade are agriculture, food products, wood and furniture, and footwear. In contrast, the competition of imports is most clearly reflected in the jobs "lost" in the machinery and tractors and electrical and electronic equipment sectors. These results obviously vary according to the level of skills of the labour involved and the trading partner in question.

With regard to less-skilled labour, the largest amount is exported to the European Union, because of the weight of agriculture. In the case of imports, the content of such labour is relatively similar for the United States and the European Union, but is higher in the case of MERCOSUR (table 4). This is because both the developed trading partners have similar import structures, while agriculture carries considerable weight in the imports from MERCOSUR.

For the intermediate level of skills (8 to 11 years' schooling), the sectors accounting for the largest amount of labour traded (in both directions) are agriculture, petrochemicals and petroleum refining, and miscellaneous manufacturing. In terms of exports, the footwear and food industries generate the largest number of jobs, the main factor being trade with the United States in the first case and trade with the European Union in the second. With regard to imports, the labour content is quite high in the machinery and tractors sectors –especially in the case of imports from Europe– and in electrical and electronic equipment, due in this case to imports from the United States. In this category, Brazil registers a deficit in its trade with all three of its main trading partners: the lowest deficit is with MERCOSUR and the highest with the European Union.

In the case of workers with the largest number of years of schooling, Brazil has an overall surplus in terms of the labour content of its trade. Some sectors, however, show heavy deficits: machinery and tractors, electrical and electronic equipment, and the pharmaceutical and perfumery industry. In these sectors, Brazil has a negative labour balance with its developed partners (the United States and the European Union) and a positive balance with its partners in MERCOSUR, which is in keeping with the sectoral and geographical pattern of Brazil's foreign trade. The largest surpluses are in agriculture and the food industry.

As the use of intermediate goods was duly considered in the labour content calculations, the amount of labour in the services sector is taken into account. The balance in terms of labour is positive for this sector, with the major part corresponding to the European Union. In all cases, the most significant balance is that of less-skilled workers (up to 11 years' schooling).

c)   *Effects of trade integration with the United States and the European Union on employment in Brazil*
     In order to calculate the effects of trade agreements with the United States and the European Union on employment in Brazil, we used the growth rates of imports and exports simulated by Tourinho and Kume (2002) in a for a country with three alternatives: suppression of tariffs and other non-tariff barriers by the United States (in the event of the realization of the Free Trade Area of the Americas (FTAA)), elimination of trade barriers by the European Union (in the event of an agreement by MERCOSUR with that bloc, and lastly, the entry into force of both agreements at the same time. The simulation of these three alternatives is particularly interesting for the debate on Brazil's foreign policy options: in some cases, the two agreements (with the European Union and with the United States under FTAA) are considered as competing with each other, although in the parallel holding of the negotiations it was stated that they are basically complementary (which justifies the simultaneous evaluation of both of them).[18]

The simulations give variations in GDP of nearly 4.5% and of trade flows (always with a trend towards a deficit) of between 7% and 8%. The results of the simultaneous entry into force of both agreements on the trade balance are naturally higher, but the growth rates are not cumulative.[19]

Naturally, the results in terms of labour content and generation of employment will depend on the

alternative involved, and the deeper the trade liberalization, the higher the growth rates of exports will be. In this sense, the alternative chosen conditions our results, providing us, in some ways, with a yardstick for analysing the impact on employment due to trade integration with Brazil's two main trading partners.

Table 5 shows the labour content of Brazil's total imports and exports for each of the three alternatives (columns), by level of skill of the labour force (rows). The last column refers to the situation observed in 1999-2001, taken as a comparison parameter. In the column headed "Net generation of jobs" of each of the alternatives, the variation in employment for the corresponding situation is shown with respect to the average for 1999-2001.

Because of the greater volume of trade resulting from the simultaneous entry into force of both agreements, the content of labour "exported" by Brazil would be greater than in the previous two alternatives. This increase is not significantly greater than the growth generated by the liberalization processes taken separately, however: whereas the simultaneous entry into force of both agreements would create 694,000 jobs, FTAA would create nearly 577,000, while the agreement with the European Union would create nearly 539,000. The growth is strongest in the case of less-skilled labour, and is more marked in the case of FTAA. The simultaneous application of both agreements would give rise to more marked growth in the less-skilled category –507,000 jobs, corresponding to 10.3% of the 1999-2001 level– followed by the intermediate category (8.6%) and slightly smaller growth of the most highly skilled category (8.3%).

On the import side, the increase in the labour content in the event of the simultaneous application of both agreements is also greater than for liberalization separately: the two agreements together would produce an increase of 465,000 "imported" jobs, compared with

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[18] As this is a static model, there is no variation in installed capacity, but the authors did in fact use a stylized means of modelling one of the dynamic effects of integration: the increase in foreign direct investment, which would lead to an increase in installed capacity.

[19] These simulations were chosen for two reasons. First, the magnitude of the growth rates found by Tourinho and Kume (2002) is quite plausible when compared with other studies. In Castilho (2002), a considerable number of texts (including several general or partial equilibrium models) on the analysis of these agreements were analysed, and their results display considerable variations. In this respect, the growth rates of trade and GDP in the study by Tourinho and Kume are in the middle range: they are in between

the growth rates of exports found by Monteagudo and Watanuki (2003), for example, which amount to as much as 36% in the case of the FTAA + European Union case, and the less optimistic figures calculated with a partial equilibrium model by De Negri and Arbache (2003) and De Negri, Arbache and Silva (2003) for the European Union and the United States (4.6% and 4.3%, respectively). Second, the situations simulated correspond perfectly with the objectives of the present study –simulation of the effects for Brazil (and not for MERCOSUR) caused by the agreement with the European Union and the liberalization of the North American market (FTAA)– as well as using the same classification of goods. This point is important because of the use of the input-output matrix to calculate the indirect labour content coefficient.

TABLE 5

Brazil: Labour content of its foreign trade, by destination/origin of trade and skill level of labour, for three integration alternatives
(In thousands of jobs)

Category of labour, by years of schooling	Free Trade Area of the Americas (FTAA)		European Union (EU)		FTAA + EU		1999-2001
	Total	Net generation of employment[a]	Total	Net generation of employment[a]	Total	Net generation of employment[a]	Total
Total exports							
0-7	5 357	415	5 334	392	5 449	507	4 942
8-11	1 964	137	1 949	122	1 985	157	1 827
12 or more	383	26	382	25	387	30	357
Total	*7 704*	*577*	*7 665*	*539*	*7 821*	*694*	*7 127*
Growth (%)[b]		8.1		7.6		9.7	
Total imports							
0-7	2 661	202	2 639	180	2 735	275	2 459
8-11	1 559	110	1 557	109	1 603	155	1 448
12 or more	369	25	369	25	379	35	344
Total	*4 589*	*338*	*4 566*	*314*	*4 717*	*465*	*4 252*
Growth (%)[b]		7.9		7.4		10.9	
Balance							
0-7	2 695	212	2 695	212	2 715	232	2 483
8-11	405	25	392	12	382	2	380
12 or more	14	1	13	0	8	-5	13
Total	*3 115*	*240*	*3 100*	*225*	*3 104*	*229*	*2 875*

Source: Prepared by the author on the basis of the hypothesis of Tourinho and Kume (2002).

[a] Difference with respect to the base years 1999-2001.

[b] Growth rate with respect to the base years 1999-2001.

338,000 for FTAA alone and 314,000 for the European Union agreement alone. In the case of the FTAA alternative and the simultaneous application of both agreements, imports making intensive use of less-skilled labour would be those which grow most (in terms of the net generation of employment compared with the base years), while in the case of the agreement between MERCOSUR and the European Union the greatest variation would be in the intermediate skills category.

Thus, there is net generation of labour in Brazil in all the alternatives considered: FTAA would give an increase of 240,000 jobs, the agreement between MERCOSUR and the European Union would give 225,000, and both together would give an increase of 229,000 jobs. The evolution of the individual categories is different, however. For less-skilled labour, the increase is similar in the cases of FTAA and the agreement between MERCOSUR and the European Union, and a little greater in the case of both agreements together. In the intermediate skills category, the increase is much greater

in the case of FTAA than in the European Union agreement. Finally, there is a positive variation in the most highly skilled jobs in the case of FTAA, but no variation in that of the agreement between MERCOSUR and the European Union.

It should be noted that in terms of the percentage of the total employed population of the country (1999 and 2001 data), the variations are not very representative. Thus, there is an increase of 0.4% in total employment, due entirely to the increase in the less-skilled category. In other words, even with quite substantial growth rates of trade of around 7%, the effects in terms of employment are not very significant and mainly affect only a single category of labour: the less-skilled workers.

These results are not uniform in all sectors or all skill categories. Appendix A shows the sectoral results.

For the sectors which benefit from the agreements in terms of total employment, the application of both agreements together is clearly not always the best

option. For some sectors –all with a low level of processing– the agreement with the European Union is the best option. This is so in the case of wood and furniture, mining, and iron and steel and metal products. For the sectors which obtain more jobs, FTAA is the best option only in the case of non-metallic minerals, whose contribution to total employment is only small, and the services included in the goods sold. The simultaneous application of both agreements is the best option, however, for the three sectors which gain most jobs: agriculture, food products, and footwear.

For all the sectors which already had a negative balance in terms of the labour incorporated in their trade in 1999-2001, the situation becomes even worse. In general, these sectors are those of the most highly-processed manufactures, where Brazil usually shows a deficit compared with the European Union and the United States. Thus, the negative balance becomes even greater in all three cases, but especially in the case of the simultaneous application of both agreements. The sectors in which the loss of jobs is most marked are those of machinery and tractors and electrical and electronic equipment.

These results illustrate the diversity of interests of the agents involved and the complexity of trade negotiations, as well as the fact that foreign policy decisions determine the gains and losses of the various agents affected.

IV

Conclusions

At present, Brazil is a net exporter of labour: the balance of labour incorporated in exports and imports corresponds to 4.8% of total employment in the Brazilian economy. According to our calculations, the labour content of exports corresponds to 11.9% of total employment, and to 7.1% in the case of imports. Among all labour categories, the most significant contribution to total employment balance is from the less-skilled workers (up to seven years' schooling). The contribution of the intermediate skill category is relatively small, while that of the most highly-skilled category is almost nil (the balances in terms of the labour incorporated in net exports amount to 2% and 0.2% of the total employment in each category, respectively).

These results refer to Brazil's total imports and exports, but the sectoral differences in the trade flows according to partner naturally lead to disparities in the amount and type of labour incorporated in bilateral trade flows. Trade with the European Union, for example, follows a typical North-South pattern, so that Brazil is a net exporter of less-skilled labour (due mainly to agriculture) and a net importer of more highly-skilled labour. In the case of the United States, although Brazil has a larger positive balance for the less-skilled categories, the disparities among categories are less evident, since the North-South trade pattern is not so pronounced. In the case of MERCOSUR, the results are quite different: Brazil is a net importer of labour (especially of low levels of skills), due largely to agricultural imports and its own exports of manufactured goods.

To estimate the impact of the free trade agreements on employment, one must take into account not only current trade patterns but also the possible outcomes of trade negotiations. To assess the possible outcomes for the FTAA and the MERCOSUR-European Union FTA, we used the growth rates for Brazilian trade flows simulated by the CGE model of Tourinho and Kume (2002). In all scenarios, the growth of Brazilian exports and imports was between 7.3% and 10.9%, even in the case of simultaneous entry in force of both agreements and the increase in imports was systematically higher than that of exports. Moreover, there are significant differences between sectors.

Our simulations suggest that the impact of the agreements on employment is extremely small: in all scenarios, trade agreements generate nearly 230,000 jobs, which represents an increase of only 0.4% in the country's total workforce. FTAA would create 15,000 more jobs than the agreement with the European Union and 11,000 more jobs than the simultaneous entry into effect of both agreements. We must stress that simultaneous accomplishment of both agreements does not lead to cumulative results in terms of trade and employment generated.

All the agreements generate more jobs for the least-skilled workers: the growth in employment in this category accounts for almost the whole of the overall

increase in employment. In the case of FTAA, jobs increase for all categories, with the major gains for the less-skilled workers, followed by highly-skilled workers. The net generation of skilled employment is quite insignificant, however: close on 1,000 jobs. In the other scenarios, there is a clear change in the employment pattern, depending on the skill level of the labour concerned. An agreement with the European Union would keep the number of skilled jobs exactly the same, while the simultaneous accomplishment of both agreements would lead to a reduction of almost 40% in highly skilled jobs. Briefly, all the agreements would mainly benefit the least-skilled workers.

The present exercise aims to contribute to a better understanding of the possible effects on employment in Brazil of the MERCOSUR-European Union agreement and of the FTAA. Our calculations used a methodology which, although simple and widely used, suffers from the limitations mentioned earlier. Nevertheless, even though the results not be interpreted in absolute terms, they give an idea of the direction of the changes and the differences in outcomes according to the trading partner involved.

This paper also illustrates the complexity of the negotiations for a trade agreement as it generates gains and losses for different sectors. As we have seen, workers in a given skill category, but employed in different sectors, may have different preferences regarding foreign policy priorities. The dilemma is obviously made even more complex by the existence of other factors of production and their owners, who have distinct interests.

Finally, the numbers reflect a well-known finding of international trade theory, according to which liberalization generates gains which differ depending on the agents involved, so that economic policy-makers must act as arbiters between the winners and losers, perhaps by creating transfer mechanisms to compensate for losses. As results on total employments are quite small, if this issue is taken into account in trade policy decisions, policy makers will have to decide which type of employment they want to promote or protect.

(Original: Portuguese)

APPENDIX

Brazil: Employment associated with the trade balance, by skill levels of the labour force and by sector, for three integration alternatives[a]
(Number of jobs)

	Years of schooling: 0-7				Years of schooling: 8-11				Years of schooling: 12 or more				TOTAL			
	FTAA	EU	FTAA +EU	1999-2001	FTAA	EU	FTAA +EU	1999-2001	FTAA	EU	FTAA +EU	1999-2001	FTAA	EU	FTAA +EU	1999-2001
Agriculture and stock-raising	2 106 466	2 131 242	2 148 173	1 925 048	175 988	178 058	179 472	160 831	23 529	23 805	23 995	21 502	2 305 982	2 333 105	2 351 639	2 107 381
Mining	126 481	127 664	125 661	122 721	23 556	23 777	23 403	22 856	5 582	5 634	5 545	5 416	155 619	157 074	154 609	150 993
Oil and gas extraction	(6 648)	(6 598)	(6 687)	(6 357)	(12 622)	(12 527)	(12 695)	(12 068)	(5 654)	(5 611)	(5 687)	(5 406)	(24 924)	(24 736)	(25 069)	(23 830)
Non-metallic minerals	12 083	10 262	10 712	10 084	5 337	4 533	4 731	4 454	728	619	646	608	18 148	15 413	16 089	15 146
Iron and steel and metal products	37 118	37 403	34 874	35 826	41 801	42 122	39 273	40 345	5 974	6 020	5 613	5 766	84 894	85 545	79 760	81 937
Machinery and tractors	(42 216)	(43 209)	(46 099)	(40 935)	(53 811)	(55 077)	(58 760)	(52 178)	(15 679)	(16 048)	(17 122)	(15 203)	(111 706)	(114 335)	(121 981)	(108 316)
Electrical and electronic equipment	(28 748)	(28 343)	(29 146)	(27 297)	(75 638)	(74 573)	(76 685)	(71 820)	(24 560)	(24 215)	(24 900)	(23 320)	(128 946)	(127 131)	(130 732)	(122 437)
Transport equipment	6 218	6 702	5 490	5 457	12 591	13 570	11 116	11 050	3 082	3 321	2 721	2 705	21 891	23 593	19 327	19 211
Wood and furniture	142 012	145 579	140 126	142 894	62 776	64 352	61 941	63 165	6 413	6 574	6 327	6 452	211 200	216 504	208 394	212 512
Paper and printing	11 547	11 880	11 188	13 159	23 241	23 909	22 517	26 485	6 121	6 298	5 931	6 976	40 909	42 086	39 637	46 621
Rubber industry	115	45	(176)	527	147	57	(224)	669	21	8	(32)	96	283	109	(432)	1 292
Chemical industry	(14 072)	(13 806)	(14 811)	(14 111)	(13 028)	(12 781)	(13 713)	(13 064)	(5 157)	(5 059)	(5 427)	(5 171)	(32 257)	(31 646)	(33 951)	(32 345)
Oil refining	(2 457)	(2 429)	(2 503)	(2 333)	(4 633)	(4 580)	(4 720)	(4 399)	(3 096)	(3 060)	(3 154)	(2 940)	(10 186)	(10 069)	(10 376)	(9 672)
Pharmaceuticals and perfumery	(9 675)	(9 720)	(10 019)	(8 910)	(21 807)	(21 906)	(22 580)	(20 081)	(10 795)	(10 844)	(11 178)	(9 941)	(42 277)	(42 470)	(43 776)	(38 932)
Plastic products	(5 876)	(5 477)	(6 174)	(5 215)	(9 118)	(8 499)	(9 581)	(8 092)	(1 144)	(1 067)	(1 203)	(1 016)	(16 138)	(15 043)	(16 957)	(14 323)
Textile industry	(1 785)	(3 807)	(3 290)	(1 625)	(1 469)	(3 133)	(2 707)	(1 338)	(189)	402	(347)	(172)	(3 443)	(7 342)	(6 344)	(3 135)
Clothing	(10 478)	(12 131)	(11 117)	(8 711)	(6 990)	(8 092)	(7 416)	(5 811)	(593)	687	(629)	(493)	(18 061)	(20 910)	(19 162)	(15 015)
Footwear	155 955	136 369	158 099	143 002	95 145	83 196	96 453	87 243	8 449	7 388	8 565	7 747	259 549	226 953	263 117	237 992
Food products	184 194	178 793	186 711	163 859	137 121	133 100	138 995	121 982	18 869	18 316	19 127	16 786	340 184	330 209	344 833	302 627
Miscellaneous manufactures	(26 284)	(24 635)	(30 060)	(19 983)	(30 007)	(28 125)	(34 319)	(22 814)	(4 189)	(3 926)	(4 790)	(3 185)	(60 480)	(56 687)	(69 169)	(45 981)
Services	61 478	59 061	53 204	55 655	56 711	54 524	47 292	51 776	6 388	6 096	3 707	6 159	124 577	119 681	104 204	113 590
Total	*2 695 429*	*2 694 844*	*2 714 155*	*2 482 757*	*405 290*	*391 903*	*381 796*	*379 193*	*14 100*	*13 159*	*7 707*	*13 367*	*3 114 819*	*3 099 905*	*3 103 658*	*2 875 317*

Source: Prepared by the author.

[a] Figures in brackets denote negative values.

FTAA = Free Trade Area of the Americas.

EU = European Union.

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Central bank independence and its relationship
to inflation

Helder Ferreira de Mendonça

T his paper builds on earlier studies of central bank independence

(CBI), making a comparison of the rankings of central banks for 15 countries

through three different indices. The analysis reveals that there is no shared

concept of CBI and that the indices are a measure of the inflation bias. The

Brazilian case is used as an example, with the objective of examining the

impact on inflation of an increase in independence over time, as measured

by Cukierman's index. The findings indicate that CBI is a consequence of

the conduct of monetary policy and that it is not an adequate framework

for developing credibility.

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I

Introduction

Nowadays, central bank independence (CBI) is considered one of the main conditions for assuring low and stable inflation. This view is largely a consequence of the dissemination of the well-known empirical evidence that there is a negative correlation between inflation and CBI. Although the majority of empirical studies support this conclusion, the reliability and usefulness of CBI indices and the robustness of the previous studies have been questioned, especially since 1995.[1]

In the same vein as the current literature on CBI, this paper analyses two major points. First, it discusses the quality of independence indices by comparing the three most popular independence measures in the literature, constructed by Alesina and Summers (1993), Cukierman, Webb and Neyapti (1992), and Grilli, Masciandaro and Tabellini (1991). Forder's suggestion (Forder, 1999) that one can hardly view the advocates of different concepts as supporting the same legislative policy proposals would confirm that there is no shared concept of what constitutes statutory independence.[2] Second, this paper points to a potential problem of endogeneity in the CBI indices. Both CBI and inflation may be related to a third factor, such as a society's aversion to inflation. Without controlling for the third factor, the relationship between CBI and inflation may be spurious (Posen, 1993). The present paper reiterates this criticism, arguing that CBI indices measure the degree of inflation bias in the economy and are therefore, by definition, negatively correlated with inflation. Further, it is observed that if CBI includes the issue of whether or not price stability is the main objective of the central bank, this may, in principle, lead to reverse causality, especially if the analysis is put in a time series perspective.

The analysis of a particular country is important for the literature concerning CBI because the majority of the empirical literature is a result of cross-sectional comparisons of economic outcomes. Thus, there is a difficulty in evaluating the effects of institutional changes within a given country (Hutchison and Walsh, 1998). One way to determine whether the effort and the success of an economy in the quest for price stability is related to an increased degree of CBI is the selection of a country that has had success in reducing inflation. In this sense, a study of countries such as Australia, Canada, Finland, New Zealand, Sweden and the United Kingdom could be profitable. It takes less effort, however, to stabilize inflation in these economies than in developing countries. Furthermore, the literature concerning CBI indicates that in industrial countries, independence is systematically and inversely correlated to inflation. Thus, it is very probable that the selection of one of these industrialized countries will indicate a relationship between price stability and an increase in the degree of independence. In order to attempt to eliminate the possible tendency of bias in the analysis, the selection of a developing country is recommended. With this objective, Brazil was chosen for a case study.

In summary, this paper builds on earlier analyses of CBI, making a comparison of the rankings of central banks for 15 countries through three different indices. This study reveals that there is no shared concept of CBI, and that the indices are a measure of the inflation bias. Furthermore, with the objective of verifying the impact on inflation of an increase in independence over time, measured by Cukierman's index, the Brazilian case is used as an example.

This paper is organized as follows. Section II assesses previous empirical results reported in the literature. The third section analyses the quality of independence indices by comparing three measures. Section IV discusses the endogeneity of the CBI indices. Section V analyses the impact of CBI, the turnover of central bank governors and the interest rate on inflation in the Brazilian case. The final section offers some concluding comments.

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[1] Berger, de Haan and Eijffinger (2001) list 35 papers (after 1995) that record a change in the empirical evidence on the consequences of CBI.

[2] The analysis, relative to the first point in this paper, is an upgrade in relation to the intuitive analysis offered by Forder (1999).

II

The origin of CBI measures: a brief review

The empirical analysis that supports the thesis of CBI is based on a negative correlation among several proxies for independent central banks and inflation.[3] Several studies show a strong correlation between a higher degree of legal independence and a lower inflation rate for industrialized countries.

The main relationships found in the literature between CBI and the performance of the economy can be summarized in the following ways: (i) in industrial economies, legal independence and inflation have a strong negative correlation; (ii) in developing countries, there is no evident relationship between legal central bank independence and inflation; (iii) there is a positive correlation between political vulnerability of the central bank and the rate (or variation) of inflation; (iv) countries where the monetary authorities have announced their goals have been presenting lower inflation rates; (v) the legal CBI does not have a correlation with the real growth average;[4] and (vi) central banks with a higher degree of autonomy do not finance deficits.[5]

One of the main problems in the analysis of the CBI proposal refers to the difficulty in evaluating the possible effects on the economy of an increased independence. In the search for a solution to this problem, two types of independence indices are used in the analysis: (i) legal independence indices, which denote the relationship between monetary policy and the laws that establish and define the power of the central banks; and (ii) the independence indices achieved by questionnaires (real independence indices) that are based on judgements concerning the behaviour of the central bank.

The literature on independence recognizes that legal independence is a basic prerequisite to isolating the central bank from the influence of the political authorities. Thus, at first, the existence of legal independence is necessary in order to create an appropriate institutional environment capable of creating conditions so that a higher independence is attained by real independence indices.

The empirical analysis concerning the independence proposition was put in the spotlight between the second half of the 1980s and the beginning of the 1990s. The first authors who developed an index based on legal attributes for central banks were Bade and Parkin (1985) and Alesina (1989). These indices mainly take into account: (i) which authority controls the monetary policy; (ii) the presence or absence of government employees on the board of the central bank; and (iii) whether the government appoints the majority of the board members of the central bank.

In the 1990s, Grilli, Masciandaro and Tabellini (1991) elaborated a two-part index that was applied to the majority of the industrialized countries. The first part dealt with the independence of bank policies (existence of a procedure for appointing the board of the bank, and also the duration of their mandate and the presence of guidelines that incorporate the goal of monetary stability. The second referred to economic independence (existence of a maximum level, established by law, that the central bank may lend to the government, and whether the central bank is responsible for the supervision of the bank system).[6]

Following the same model developed by their predecessors, Eijffinger and Schalling (1993) built an index that encompasses: "(i) formal responsibility of CBs with regard to monetary policy; (ii) the relationship between the CB and government/parliament in the formulation of monetary policy; (iii) the procedures for the appointment of the board of a central bank" (Eijffinger and van Keulen, 1995, p. 51) The main difference in comparison to the previous cases is the

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[3] Several papers discuss this result, see Cukierman (1992); Cukierman, Webb and Neyapti (1992); Alesina and Summers (1993); Eijffinger and Schalling (1993); Posen (1993); Eijffinger and van Keulen (1995).

[4] Although the empirical evidence in the literature does not support the idea that CBI improves economic growth, there are two points that do not eliminate this possibility: (i) the behaviour of an CBI is more predictable because it is less vulnerable to political pressure, and thus it helps to improve economic stability and the planning capacity of private agents; and (ii) an CBI decreases the costs for society because it reduces inflation volatility and therefore uncertainty about inflationary behaviour.

[5] This point is associated with the observation that an CBI does not use the inflation tax, and thus it is independent from the fiscal authority.

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[6] CB supervision of the bank system is associated with the effort to guarantee price stability.

extent of the central bank's responsibility for monetary policy. In this last index, enhanced importance is attached to the laws that give the central bank exclusive control over monetary policy.

Cukierman, Webb and Neyapti (1992) elaborated one of the best-known methodologies for the measurement of CBI.[7] This index was built on 16 basic legal features of central banks, divided into the following four groups (Cukierman, 1996): (i) the appointment, dismissal, and legal duration of the mandate of the main executive (usually the president); (ii) the institutional location of the final responsibility for monetary policy and the procedures for the resolution of conflicts between the government and the central bank; (iii) the importance of the stability of prices in comparison to other objectives (such as high levels of employment or financial stability); and (iv) the constraints on the government with regard to taking loans from the central bank (market or subsidized rate) or on the central bank with regard to lending to a third party.

After the above-mentioned studies, several papers were developed with the objective of disaggregating indicators into their various components, in order to determine which aspects of independence affect the inflation performance.[8]

III

Is there any convergence among CBI indices?

One relevant point is to verify that the independence indices treat the same object in the CBI empirical literature, since the indices were created for the measurement of independence. If the concept of independence differs from index to index, this means that there is no homogeneous concept of independence. Under the hypothesis that the indices are based on different concepts of independence, the analysis of the linkages between the degree of independence and several elements in the economy (interest rate, output, inflation, etc.) may reveal different effects on the same object and may therefore lead to inconclusive results for the empirical analysis. This observation is mentioned as one of the main weaknesses of the empirical analysis concerning independence.

Forder (1999, pp. 35-36) notes the following: *"The failure to agree on a measure of independence makes impossible any test of the effects of independence. It is important to recognize exactly what the point is. It is not the foolish one that different authors use different approaches to measure independence and so cannot be said to be talking about the same thing. The problem is not the different approaches to measurement, but rather the different resultant measures. (...)The claim of these studies* [measurement of independence] *is that they show a general tendency for lower inflation to be associated with greater independence. And indeed this claim could even be correct, but what the literature has not succeeded in doing is offering an empirical concept of independence that allows the claim to be tested."*

In order to determine whether the indices reveal a homogeneous concept of independence, a correlation analysis with different independence measurements was made. For this purpose, three indices that are frequently used in the empirical studies of CBI (Alesina-Summers (AS), Cukierman-Webb-Neyapti (CWN) and Grilli-Masciandaro-Tabellini (GMT)) were chosen. The study focused on 15 industrialized countries and was divided into two parts.[9] The first analysed the independence indices, while the second analysed the independence ranking of the countries according to these indices. This division matters because the divergence between the three resulting rankings reveals inconsistencies in the measurement of independence (table 1, columns B).

Table 1 lists each country's values for CBI and its ranking for each above-mentioned index. Furthermore, sample summary statistics for each of the three scales

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[7] That research resulted in an index of legal independence for all the industrialized countries and for 50 developing countries (period 1950-1989).

[8] See, Fuhrer (1997); Forder (1999); de Haan and Kooi (2000); Brumm (2000); Berger, de Haan and Eijffinger (2001) and Farvaque (2002). For the purposes of this paper, it is not necessary to use the "new indices" of CBI.

[9] The justification for the use of industrialized countries in the analysis is that there is no evidence that central bank independence is associated with low inflation in emerging economies. Evidence that supports this affirmation is present in Cukierman, Webb and Neyapti (1992).

TABLE 1

Industrialized countries (15 countries): indices and rankings of CBI

Countries	Alesina and Summers (AS)		Cukierman, Webb and Neyapti (CWN)		Grilli, Masciandaro and Tabellini (GMT)	
	Index (A)	Ranking (B)	Index (A)	Ranking (B)	Index (A)	Ranking (B)
Germany	4	1	0.69	1	13	1
Australia	2	4	0.36	6	9	4
Belgium	2	4	0.17	13	7	6
Canada	2.5	3	0.45	5	11	3
Denmark	2.5	3	0.5	3	8	5
Spain	1.5	6	0.23	11	5	8
France	2	4	0.24	10	7	6
Italy	1.75	5	0.25	9	5	8
Japan	2.5	3	0.18	12	6	7
Norway	2	4	0.17	13	-	-
New Zealand	1	7	0.24	10	3	9
United Kingdom	2	4	0.27	8	6	7
Sweden	2	4	0.29	7	-	-
United States	3.5	2	0.48	4	12	2
Switzerland	4	1	0.64	2	12	2
Mean	2.35	-	0.34	-	8	-
Std. Dev.	0.84	-	0.16	-	3.04	-
Minimum	1	-	0.17	-	3	-
Maximum	4	-	0.69	-	13	-

Source: Author's estimates, on the basis of Alesina and Summers (1993); Cukierman, Webb, and Neyapti (1992); and Grilli, Masciandaro and Tabellini (1991).

are listed. This analytical framework is justified by the fact that an analysis based only on the first part does not allow for a qualitative assessment. An indication that this perspective deserves attention is the finding presented in table 2 that the CBI rankings obtained by each methodology differ considerably among themselves. This observation is valid especially for the countries where the measure of independence is not high.

The data presented in table 1 allowed for the elaboration of figures 1, 2 and 3. The first section of each graph exhibits the relationship between indices, while the second section shows the relationship between rankings from indices (denoted by "R"). In other words, figure 1 presents the relationship between the AS and CWN indices, and between the ASR and CWNR rankings; figure 2 shows the relationship between the AS and GMT indicators and between the ASR and GMTR rankings; and figure 3 presents the relationship between the CWN and GMT indices and between the CWNR and GMTR rankings. The use of the ranking of the countries is justified by the fact that the correlation tests among the independence indices are not capable of capturing the essence of the analysis proposed. The correlation tests

among indices only relate the values of the coefficients, without qualifying the relations among the points.

Based on the finding that there is almost a total coincidence between the first and second places resulting from each index for countries with higher independence, and the observation made by Forder (1999, p. 33) that "[c]learly, the apparent similarity of measures of independence depends on agreement that the central banks of Germany and Switzerland are highly independent", the analysis of each relationship follows three steps. The first column of graphs uses all countries in the sample; the second column excludes Germany and Switzerland (case denoted by "A" –countries that were classified as having a higher independence) from the sample; and the third column excludes also the United States of America (case denoted by "B" –occupying the second place in the ranking– see table 1).[10]

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[10] The United States Federal Reserve System, the Deutsche Bundesbank and the Swiss National Bank are excluded from the sample because they are usually highlighted in the literature as an independence paradigm.

FIGURE 1
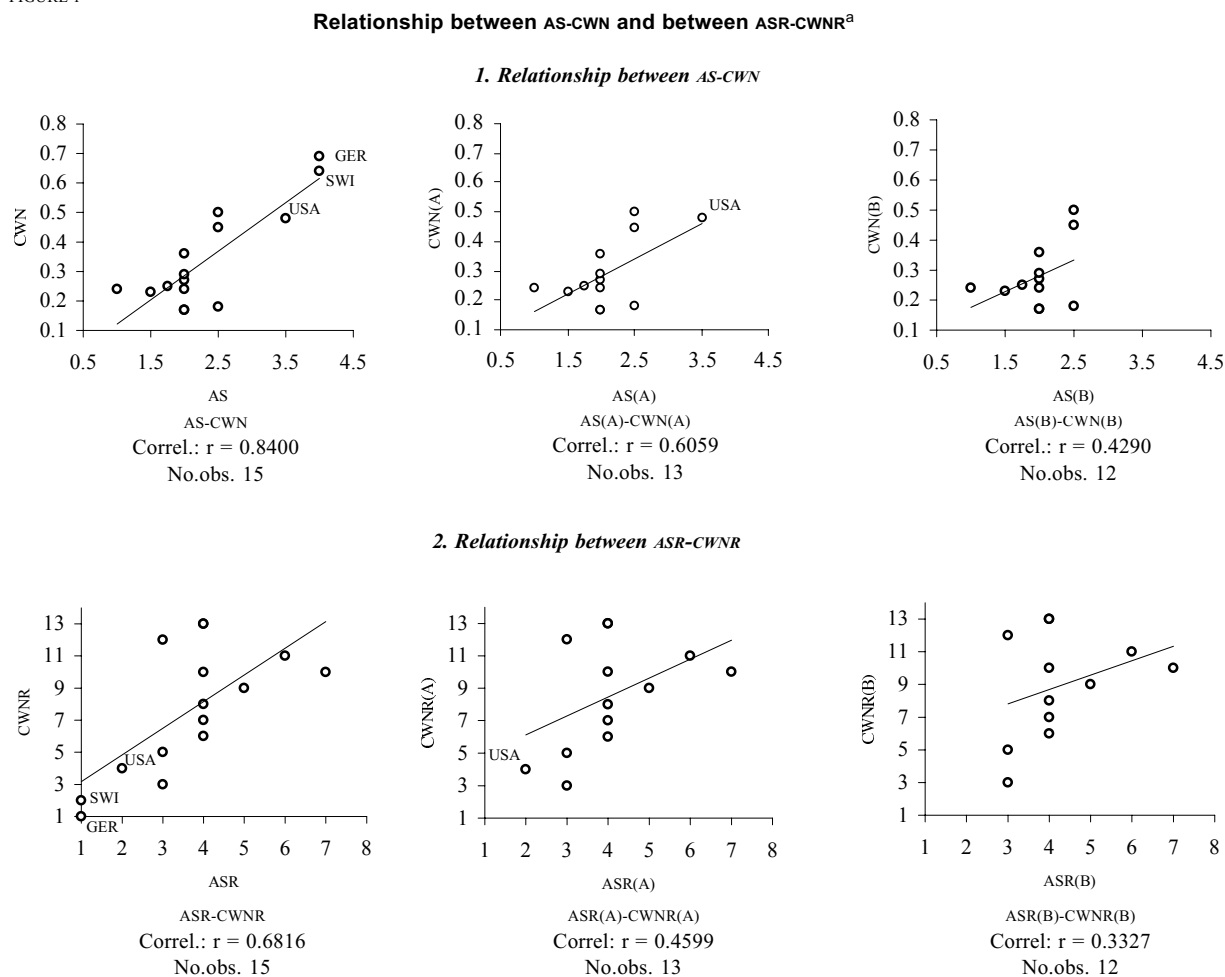
Relationship between AS-CWN and between ASR-CWNR[a]

1. Relationship between AS-CWN

AS-CWN
Correl.: r = 0.8400
No.obs. 15

AS(A)-CWN(A)
Correl.: r = 0.6059
No.obs. 13

AS(B)-CWN(B)
Correl.: r = 0.4290
No.obs. 12

2. Relationship between ASR-CWNR

ASR-CWNR
Correl.: r = 0.6816
No.obs. 15

ASR(A)-CWNR(A)
Correl: r = 0.4599
No.obs. 13

ASR(B)-CWNR(B)
Correl: r = 0.3327
No.obs. 12

Source: Prepared by the author on the basis of table 1.

[a] See explanation of abbreviations in table 1 and in the two paragraphs preceding figure 1.

The graphs in figures 1, 2 and 3 show that the correlation among rankings is lower than the correlation among indices. Moreover, the exclusion of Germany, Switzerland, and the United States from the sample contributes to the reduction of the correlation between measures of independence. Thus, there is an indication that the divergence of rankings and the exclusion of the aforementioned three countries from the sample can weaken the relationship among independence measurements. Nonetheless, the figures generally illustrate the existence of a significant and positive correlation among the three indices (excluding the relationship between AS-CWN and ASR-CWNR).

To ascertain if the results of the correlations are consistent, the following equation was regressed (OLS

method) to analyse the relationship among the independence indices:

$$\text{CBI index} = \alpha_0 + \alpha_1 \text{ CBI index*} \qquad (1)$$

where α_0 is a constant and CBI index* denotes a different independence index than that used on the left side of the equation.

Following the same framework as that used in the correlation analysis, table 2 summarizes the regression results. Table 2 is divided into six boxes. The first box shows the estimates for the relationship between CWN and AS indices (first row), CWN(A) and AS(A) (excluding Germany and Switzerland - second row), and CWN(B) and AS(B) (excluding Germany, Switzerland, and the United States - third row). The second box shows the

FIGURE 2

Relationship between AS-GMT and between ASR-GTMR[a]
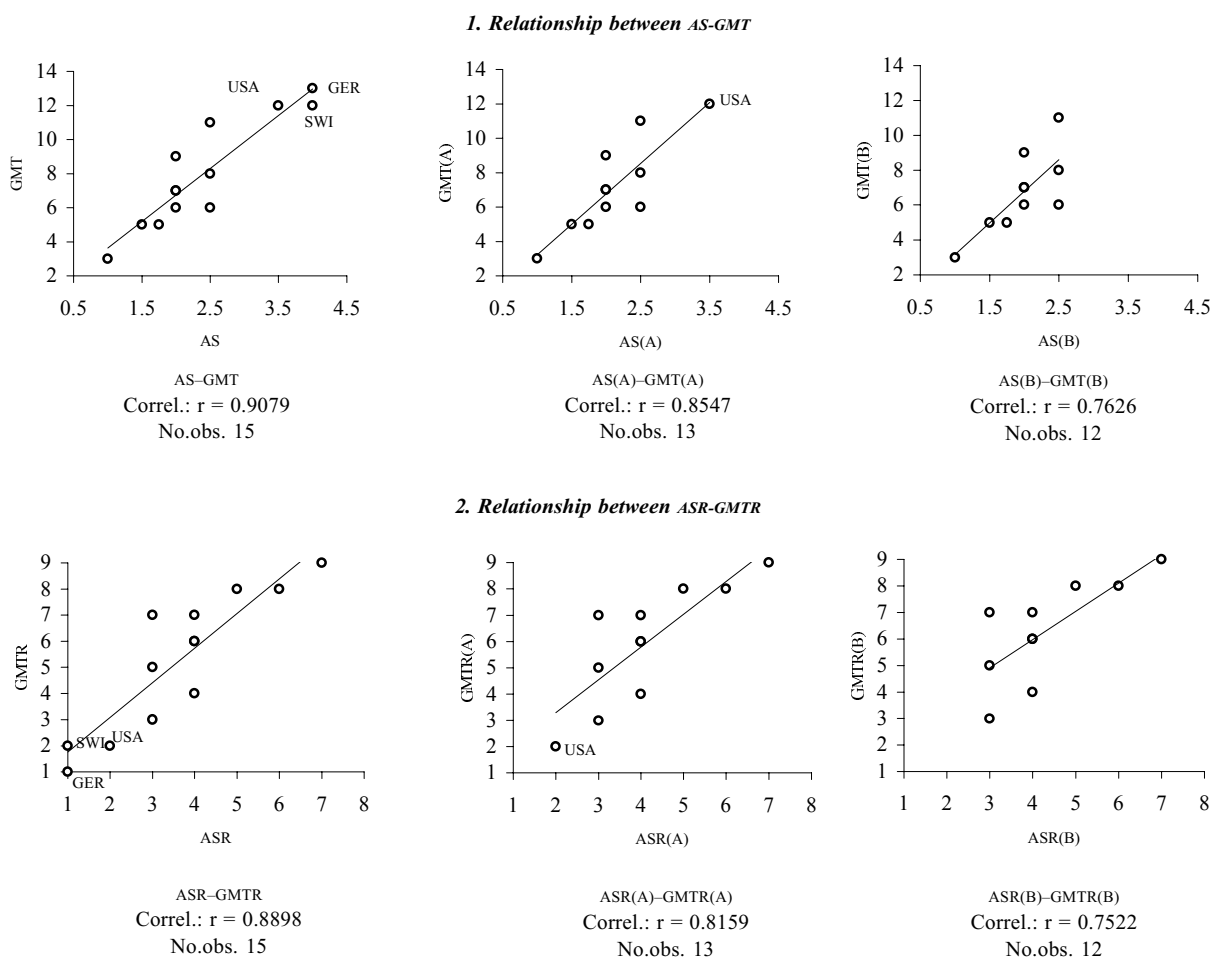
1. Relationship between AS-GMT

AS–GMT Correl.: r = 0.9079 No.obs. 15	AS(A)–GMT(A) Correl.: r = 0.8547 No.obs. 13	AS(B)–GMT(B) Correl.: r = 0.7626 No.obs. 12

2. Relationship between ASR-GMTR

ASR–GMTR Correl.: r = 0.8898 No.obs. 15	ASR(A)–GMTR(A) Correl.: r = 0.8159 No.obs. 13	ASR(B)–GMTR(B) Correl.: r = 0.7522 No.obs. 12

Source: Prepared by the author on the basis of table 1.

[a] See explanation of abbreviations in table 1 and in the two paragraphs preceding figure 1.

estimates for the relationship between the rankings from CWN and AS (respectively CWNR and ASR) and follows the same framework as in the first box. The idea of the first box is repeated in the third to sixth boxes.

On the basis of these estimates, the idea is to verify if the constant (α_0) is significant and thus denotes a strong disagreement between indices; or if, on the contrary, the relationship between each pair of indices is strong (captured by parameter α_1 in equation 1), confirming the homogeneity of the indices. The first row in the first, third and fifth boxes (table 2) indicates that the t-values of the indices are significantly different from zero at a 99% confidence level and the average R^2 (adjusted) is 0.736. Therefore, these results (strong

statistical association among indices) confirm the expectation, in theory, that the indices reflect a homogeneous concept of independence. The same idea can be applied for the first row in the second, fourth and sixth boxes (analysis of rankings), although the average R^2 is less than in the previous case (0.616).

Despite these results, when Germany and Switzerland are removed from the sample, the situation changes considerably. The empirical results presented in table 2 for the relationship among indices (second row of first, third and fifth boxes) and for the relationship among rankings from indices (second row of second, fourth and sixth boxes) reveal that the t-statistic values remain significant. Except for CWN(A)-

FIGURE 3

Relationship between CWN-GMT and between CWNR-GMTR[a]
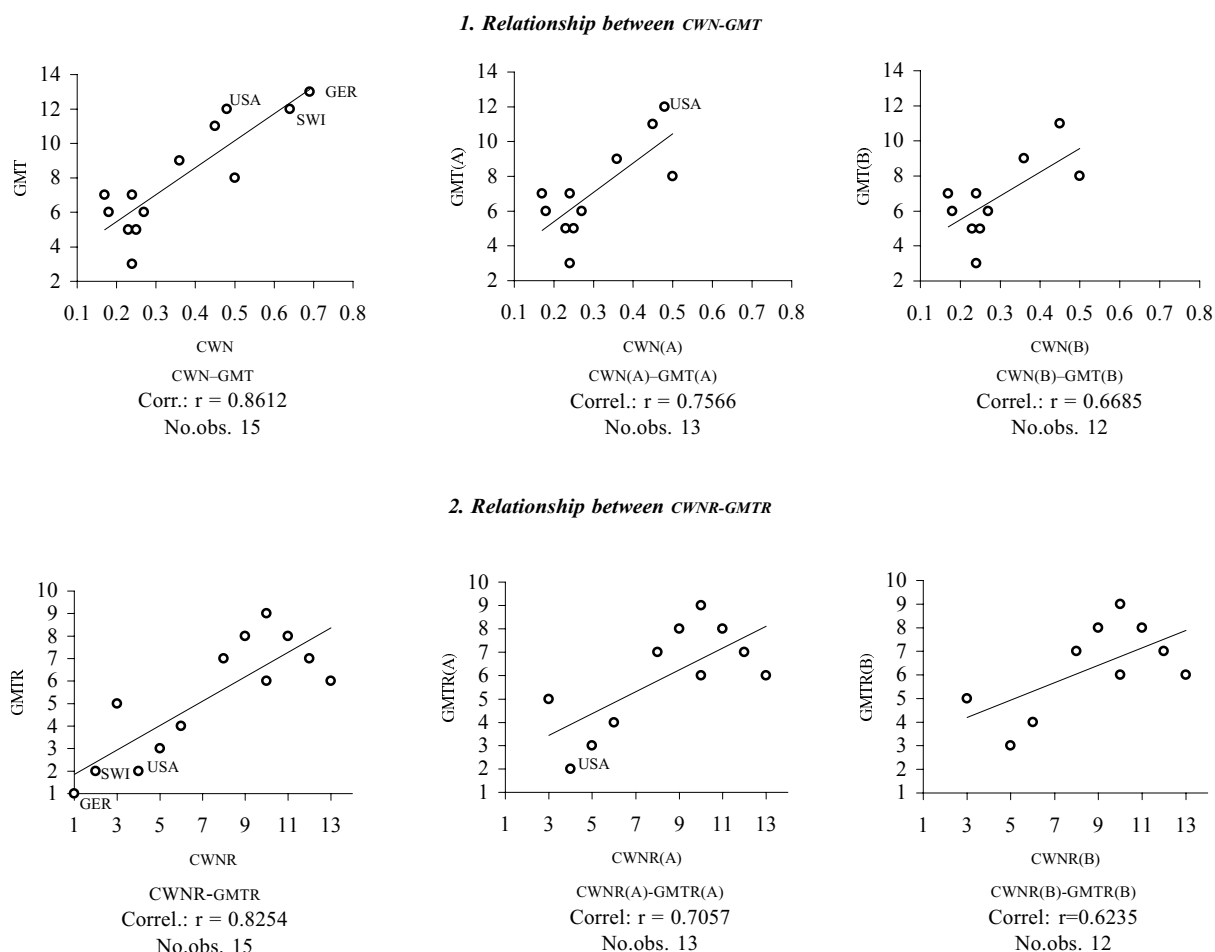
1. Relationship between CWN-GMT

CWN–GMT
Corr.: r = 0.8612
No.obs. 15

CWN(A)–GMT(A)
Correl.: r = 0.7566
No.obs. 13

CWN(B)–GMT(B)
Correl.: r = 0.6685
No.obs. 12

2. Relationship between CWNR-GMTR

CWNR-GMTR
Correl.: r = 0.8254
No.obs. 15

CWNR(A)-GMTR(A)
Correl: r = 0.7057
No.obs. 13

CWNR(B)-GMTR(B)
Correl: r=0.6235
No.obs. 12

Source: Prepared by the author on the basis of table 1.

[a] See explanation of abbreviations in table 1 and in the two paragraphs preceding figure 1.

AS(A) and CWNR(A)-ASR(A), all values are significant at the 1% level, although R^2 decreases substantially. For the first case (analysis of indices), the average R^2 corresponds to 0.512, while for the second case (analysis of rankings), the average R^2 is 0.404. These results suggest that the exclusion of the above-mentioned countries from the sample weakens the statistic association among independence indices.

The exclusion of the United States together with Germany and Switzerland from the sample confirms the tendency noted above. The third row in each box in table 2 reveals that the significance of the t-values of

the indices reduces the confidence level (except for GMT(B)-AS(B) and GMTR(B)-ASR(B)) and the t-values of the constant become significant in half of the cases. The most relevant result is the analysis of the R^2, whose average value for indices is 0.336, and for ranking 0.282. Therefore, the result shows that the analysis, when focused on all countries in the sample, is misleading. When Germany, Switzerland and the United States (countries that represent the example of independence) are omitted from the analysis, the result appears to negate the existence of a relationship among the measurements of independence.

TABLE 2

OLS estimates of CBI indices and ranking

Dependent variable: CWN					
Constant	t-stat.	AS	t-stat.	Adjus. R^2	No. obs.
-0.042	-0.575	0.164	5.582[a]	0.683	15
Dependent variable: CWN(A)					
Constant	t-stat.	AS(A)	t-stat.	Adjus. R^2	No. obs.
0.045	0.440	0.119	2.526[b]	0.310	13
Dependent variable: CWN(B)					
Constant	t-stat.	AS(B)	t-stat.	Adjus. R^2	No. obs.
0.070	0.493	0.106	1.502[c]	0.102	12
Dependent variable: CWNR					
Constant	t-stat.	ASR	t-stat.	Adjus. R^2	No. obs.
1.511	0.765	1.661	3.359 [a]	0.423	15
Dependent variable: CWNR(A)					
Constant	t-stat.	ASR(A)	t-stat.	Adjus. R^2	No. obs.
3.772	1.298	1.169	1.718 [c]	0.140	13
Dependent variable: CWNR(B)					
Constant	t-stat.	ASR(B)	t-stat.	Adjus. R^2	No. obs.
5.190	1.498[c]	0.877	1.116	0.022	12
Dependent variable: GMT					
Constant	t-stat.	AS	t-stat.	Adjus. R^2	No. obs.
0.512	0.461	3.115	7.181[c]	0.808	15
Dependent variable: GMT(A)					
Constant	t-stat.	AS(A)	t-stat.	Adjus. R^2	No. obs.
-0.305	-0.193	3.542	4.939 [a]	0.701	13
Dependent variable: GMT(B)					
Constant	t-stat.	AS(B)	t-stat.	Adjus. R^2	No. obs.
-0.432	-0.197	3.611	3.335 [a]	0.529	12
Dependent variable: GMTR					
Constant	t-stat.	ASR	t-stat.	Adjus. R^2	No. obs.
0.438	0.535	1.326	6.466 [a]	0.773	15
Dependent variable: GMTR(A)					
Constant	t-stat.	ASR(A)	t-stat.	Adjus. R^2	No. obs.
0.804	0.632	1.248	4.233 [a]	0.629	13
Dependent variable: GMTR(B)					
Constant	t-stat.	ASR(B)	t-stat.	Adjus. R^2	No. obs.
1.733	1.175	1.062	3.229 [a]	0.512	12
Dependent variable: GMT					
Constant	t-stat.	CWN	t-stat.	Adjus. R^2	No. obs.
2.345	2.115[b]	15.642	5.620 [a]	0.718	15
Dependent variable: GMT(A)					
Constant	t-stat.	CWN(A)	t-stat.	Adjus. R^2	No. obs.
2.027	1.278	16.826	3.471 [a]	0.525	13
Dependent variable: GMT(B)					
Constant	t-stat.	CWN(B)	t-stat.	Adjus. R^2	No. obs.
2.775	1.688[c]	13.582	2.543 [b]	0.378	12
Dependent variable: GMTR					
Constant	t-stat.	CWNR	t-stat.	Adjus. R^2	No. obs.
1.306	1.426	0.543	4.850 [a]	0.652	15
Dependent variable: GMTR(A)					
Constant	t-stat.	CWNR(A)	t-stat.	Adjus. R^2	No. obs.
2.054	1.486	0.466	2.988 [a]	0.442	13
Dependent variable: GMTR(B)					
Constant	t-stat.	CWNR(B)	t-stat.	Adjus. R^2	No. obs.
3.098	2.060[b]	0.368	2.255 [b]	0.312	12

Source: Prepared by the author on the basis of estimates made from data contained in table 1.

[a] Significant at the 1 percent level.   [b] Significant at the 5 percent level.   [c] Significant at the 10 percent level.

IV

The "endogenous character" of the indices

Since measures of CBI pay special attention to the inflationary bias, these indices are indissolubly linked to inflation. In other words, if a central bank is strongly (or weakly) contrary to the inflationary bias, it is seen to have a high (or low) independence, and thus a negative correlation between CBI and inflation is found. To put it another way, *"... measures of independence are only acceptable if one already agrees with the theoretical principles on which the thesis of correlation between independence and price stability is based. Of course, if one defends the assignment of highest priority to price stability as a measure of independence and then correlates this measure of independence with price stability, one should not be surprised to find some correlation"* (Carvalho, 1995/96, p. 169-170).

Therefore, with the objective of showing the inherent tendency of a high negative correlation between central bank independence and inflation in questionnaires devised to measure the degree of CBI, table 3 lists the most frequently asked questions. The main objective is to identify, in each question, some common characteristics that could reveal a prior intention to confirm the negative correlation.

The questions in table 3 can be divided into three groups: (i) questions 1, 2, 3 (present in all the indices under consideration) and 7 have the objective of identifying the possible influence of government over operational decisions of the central bank; (ii) questions 4 and 5 try to reveal the capacity of the central bank to neutralize the pressures from the government; and (iii)

question 6 verifies if the central bank is committed to the quest for price stability or is concerned with other objectives (for example, employment level).

Despite the above-mentioned differences, the main point is the existence of one feature that is common to all the questions: they were created with the objective of evaluating the possible inflationary bias associated with the conduct of monetary policy. Herein lies the main element for an external critique. Since the questions were created to evaluate the effect of the largest degree of independence on inflation, there is an implicit bias present. Consequently, the degree of independence obtained by these indices has a tendency to reveal a negative correlation between higher independence and inflation.

The corollary of the above observation is that these indices are not useful as an instrument capable of demonstrating the effects of an increase in independence on inflation. Since a low degree of independence denotes, to a great extent, the presence of an inflationary bias in the conduct of monetary policy, and since the evaluation of this bias depends on the observation of the inflation, the measure of independence is ultimately a consequence of the observed inflation. Furthermore, an internal critique can be made on the basis of the observation that an increase in independence today does not mean an immediate fall in the inflation rate, because the central bank's credibility in reducing the inflation is not automatic. In other words, the degree of independence in one period

TABLE 3

Most frequently asked questions for the measurement of CBI

	BP	A	GMT	ES	CWN
1. Does the central bank have the final responsibility for monetary policy?	X	X	X	X	X
2. Are there any government appointed representatives on the board of the central bank?	X	X	X	X	X
3. Are any appointments to the board outside government control?	X	X	X	X	X
4. Is there a limit on government loans from the central bank?		X	X		X
5. Are there legal provisions that strengthen the bank's position in cases of conflict with the government?			X		X
6. What is the importance of price stability in relation to other objectives?			X		X
7. What is the duration of the legal mandate of the president of the central bank?			X		X

Source: Compiled by the author on the basis of: BP = Bade and Parkin (1985); A = Alesina (1989); GMT = Grilli, Masciandaro and Tabellini (1991). ES = Eijffinger and Schalling (1993); CWN = Cukierman, Webb and Neyapti (1992).

cannot be held responsible for the average inflation in that period.

An endogenous feature is therefore observed in the indices. When the economy presents a low inflation level, there is a tendency for indices to reveal a high level of independence, while if the inflation rate is high, the same indices exhibit a low degree of independence. Hence, it is the level of inflation of an economy that determines the degree of independence and not the opposite. Based on an econometric analysis, Posen

(1993) offered evidence that supports this result. He verified that in countries where the public interest has anti-inflation motivations, institutions are being built to sustain this aversion. On the other hand, in countries where there is an acceptance of inflation, such institutions are not developed. Besides, Posen showed the existence of a clear causal relationship between anti-inflationary interests and independence, and did not find a relationship between high independence and a low inflation rate.

V

Turnover rate, CBI index, inflation and interest rate in Brazil

In order to illustrate the analysis made in the previous section, a study of the Brazilian economy was carried out. Brazil was selected because of its success in attaining price stability since the middle of the 1990s. Between 1986 and 1993, Brazil adopted several economic plans in an attempt to stabilize inflation (Cruzado, Bresser, Verão, Collor I and Collor II), all of which failed. Success in the control of inflation came only after the introduction of the Real Plan, a stabilization programme divided into three steps: (i) budgetary equilibrium; (ii) introduction of a new stable unit of account to align the most important relative prices in the economy; and (iii) the conversion of this unit (URV – unit of real value) to the new currency of this country (the real) with the parity semi-fixed with the dollar. With the introduction of the Real Plan, the new monetary unit (the real) was guaranteed to have a level of international reserves equal to the volume in circulation. In addition, currency issues were limited by law, in accordance with the government's intention to indicate to the agents that such issues were not necessary.

With the recovery of political stability after the impeachment of President Fernando Collor de Mello, an economic stabilization programme, adopted in the second half of 1993 under the direction of the then Minister Fernando Henrique Cardoso, was introduced. During that period a national consensus was built around the idea that budgetary equilibrium was a prerequisite to economic stabilization. In addition, the exchange market was liberalized and the external debt

with the Paris Club was renegotiated. The main idea was to gain the public's confidence in the stabilization programme in order to increase its chances of success.

Under the presidency of Fernando Henrique Cardoso, the third phase of the Real Plan was concluded in July 1994. The result was a substantial decrease in inflation. In spite of the success in the control of inflation, the cost of a tight monetary policy was not negligible. In an attempt to control the pressure on consumption due to the fall in inflation tax, the Central Bank of Brazil (CBB) adopted a high interest rate strategy. As a result, after the positive initial impact of this fall in inflation on the real sector, three basic problems appeared in mid-1995: (i) fiscal – the high interest rate increased the debt/GDP ratio; (ii) economic growth and unemployment –the high interest rate strategy attracted speculative capital and reduced the interest in productive activities, and thus increased the unemployment rate; and (iii) external account– high interest rates contributed to an appreciation in the exchange rate and led to a persistent deficit in current transactions.

The above-mentioned strategy remained in place until June 1999. At that time, owing to a change in the exchange rate, the National Monetary Council decided on inflation targeting as the new monetary policy for Brazil. Before this, two different targeting frameworks had been used during the Real Plan: exchange rates and monetary aggregates. The main motivation for introducing inflation targeting was the expectation that the use of this strategy could eliminate the inflation

that resulted from supply shocks. It was expected that the use of this monetary regime would neutralize the pressure on prices stemming from the sharp currency devaluation in January 1999, and would restore inflation control.

In an attempt to demonstrate the endogenous character of the independence index in relation to the conduct of monetary policy, and thus the spurious effect of CBI on inflation, Cukierman's methodology (1992) was used. In this framework, it was expected that CBI would help to reduce/stabilize inflation. The justification was that in Brazil, since 1994, the main objective of monetary policy has been price stability, and therefore the degree of CBI must have increased considerably after that year.

It must be remembered that the analysis of the independence of the monetary authority cannot be seen only from the legal side. Based on the above-mentioned methodology, an estimate was made of the degree of independence of the Central Bank of Brazil (CBB) for the period 1980-2002 (table 4). As expected, the outcome shows that 1994 was the year that presented the highest increase in CBB independence (about 48%) between 1980 and 2002. Therefore, it can be affirmed that the increase in CBB independence was accentuated after the introduction of the Real Plan.

The main arguments for the increase in CBB independence after the introduction of the Real Plan can be divided into five points:

(i) Use of a crawling peg for the exchange rate, a strategy that was considered the main instrument for maintaining price stability after the introduction of the Real Plan. This framework was seen as useful in impeding the acceleration of inflation by constraining the prices of tradable domestic goods; attenuating the inertial inflation that fed wages and prices of non-tradable goods; and contributing to the convergence of inflationary expectations, based on the inflation of the anchor country. In addition, this mechanism created an automatic adjustment of the money supply, reducing the problem of dynamic inconsistency in monetary policy.

(ii) Reduction of seignorage, an important indicator of the level of independence because it reveals the financing of the budget deficit through the money issued (denotes the presence of fiscal dominance).[11] Thus, a higher seignorage would be associated with a lower degree of independence; while lower seignorage would mean constraints in financing the government, and thus would indicate higher independence. Seignorage reached its highest level in 1990 (5% of GDP) and after 1995 the level remained under 0.01%.

(iii) Use of intermediate policy targets, that is, quarterly quantitative targets for a monetary base. In accordance with Act No. 9,069 of June 1995, the targets for monetary growth ceased to be determined by law, and CBB became responsible for these targets.[12] As can be observed in table 5, there was a growth in the fulfilment of the CBB monetary targets (from the last quarter of 1995 the outcomes are found within the expected range). As the rule followed by CBB was not violated, the inflationary bias was reduced, giving more credibility to the institution as a guarantor of monetary discipline and thereby impeding an increase in inflation. Despite this observation, CBB recognized that monetary policy execution required strict compliance with monetary programming in order to guarantee that the fundamental goals of the Real Plan, namely economic growth with declining inflation, would be attained.

(iv) Use of inflation targeting, which increases the level of transparency and puts limits on inflation, and thus binds the inflation variability. The consequence of this framework is the reduction of inflationary bias, and thus an increase in CBI. With the flexible exchange rate introduced in January of 1999, the adoption of inflation targeting in June of the same year represented an arrangement that assured the influence of the central bank on the control of inflation.

TABLE 4

Estimates of CBB independence

Period	1980/85	1986/89	1990/93	1994/96	1997/99	2000/02
Degree of independence[a]	0.25	0.35	0.46	0.68	0.71	0.76

Source: Estimates on the basis of the methodology of Cukierman, Webb and Neyapti (1992).

[a] Degree of independence ranges from 0 to 1.

[11] According to Fry (1998), the size of the deficit and the way in which it is financed determine the level of independence of central banks in the developing countries.

[12] Empirical evidence suggests that over periods of five or more years the growth in money is a major determinant of inflation (see, for example Leeper and Roush, 2003).

TABLE 5

Brazil: Monetary program - 1995/1999
(R$ billion)

Quarter	Restricted base		M1		Expanded base		M4	
	Estimated	Confirmed	Estimated	Confirmed	Estimated	Confirmed	Estimated	Confirmed
1st/95	17.7 - 18.1	15.7	20.4 - 21.4	18.1	81.0 - 90.0	80.3	176.0 - 188.0	188.2
2nd/95	14.9 - 17.4	14.7	17.7 - 20.7	17.7	84.1 - 85.5	83.8	200.4 - 203.6	199.7
3rd/95	15.1 - 18.3	15.0	18.2 - 21.8	19.2	87.9 - 94.0	106.6	207.5 - 222.1	229.9
4th/95	18.6 - 23.1	20.7	22.4 - 27.8	26.6	111.0 - 122.7	122.3	233.4 - 258.6	251.2
1st/96	17.0 - 19.9	18.0	21.2 - 24.8	23.4	122.0 - 143.2	137.7	234.8 - 275.7	265.3
2nd/96	16.8 - 19.7	17.4	19.7 - 26.6	24.0	134.4 - 157.8	157.4	252.3 - 296.1	280.2
3rd/96	16.6 - 19.5	17.2	23.2 - 27.2	24.3	154.2 - 181.1	165.1	276.1 - 324.1	297.6
4th/96	20.6 - 24.2	20.1	28.6 - 33.6	29.0	159.4 - 187.1	184.1	289.0 - 339.2	322.1
1st/97	23.3 - 27.3	24.7	33.2 - 39.0	36.9	191.5 - 224.8	193.7	323.9 - 380.2	336.4
2nd/97	24.0 - 28.1	24.7	35.1 - 41.2	36.8	220.3 - 258.7	203.2	337.5 - 396.2	351.3
3rd/97	22.7 - 26.7	26.2	33.8 - 39.7	38.8	225.8 - 265.1	224.0	340.4 - 399.6	373.8
4th/97	31.7 - 37.2	32.3	48.6 - 57.1	45.6	257.7 - 302.5	280.1	371.4 - 436.0	392.8
1st/98	25.1 - 29.4	30.9	36.1 - 42.4	41.5	313.9 - 368.5	310.7	406.6 - 477.3	416.9
2nd/98	30.2 - 35.5	33.1	37.9 - 44.5	42.4	320.4 - 376.1	340.0	405.8 - 476.3	431.1
3rd/98	31.0 - 36.4	34.6	39.4 - 46.3	43.4	346.6 - 406.9	322.2	415.8 - 488.1	423.5
4th/98	34.6 - 40.7	39.9	45.0 - 52.8	49.0	347.7 - 408.2	352.3	435.1 - 510.7	453.4
1st/99	35.4 - 41.6	37.6	46.0 - 54.0	46.6	353.0 - 414.4	388.0	436.7 - 512.6	477.4

Source: Central Bank of Brazil.

(v) Reduction in the turnover of CB governors (table 6). Cukierman, Webb and Neyapti (1992) highlighted that in developing countries the frequency of turnover of the chief executive officer of the CB is a good proxy for CBI because it is strongly and positively associated with inflation. The idea behind this indicator is that a more rapid turnover presumably creates more dependence on the part of the CB, probably as a result of political pressures.

Table 6 shows the turnover of CBB governors for the period between March 1979 and December 2002. It can be seen that the turnover has been decreasing since 1985. The lowest turnover ratio was during the tenure of President Fernando Henrique Cardoso, when there was a decrease of 56% compared with the previous period.

1. Empirical Results

After identifying the main reasons for the increase in the degree of independence of CBB after the introduction of the Real Plan, it is important to analyse whether the increase in independence was responsible for the control of inflation. With this objective, a vector autoregression analysis (VAR) was applied, using the following annual data for the period 1980-2002: the transformed inflation rate (INFD is the inflation variable transformed in order to reduce heteroskedasticity of the

TABLE 6

Brazil: turnover of central bank governors

Presidents of Brazil	Period	Turnover ratio[a]
João Batista Figueiredo	15/03/1979 - 15/03/1985	0.67
José Sarney	15/03/1985 - 15/03/1990	1.20
Fernando Collor	15/03/1990 - 29/12/1992	1.07
Itamar Franco	29/12/1992 - 01/01/1995	1.00
Fernando Henrique Cardoso	01/01/1995 - 01/01/1999	0.75
Fernando Henrique Cardoso	01/01/1999 - 01/12/2002	0.33

Source: Estimates ono the basis of the methodology of Cukierman, Webb and Neyapti (1992).

[a] Turnover ratio is the frequency of turnover of the chief executive officer of the CB during the President's tenure.

error);[13] the turnover of the CBB governors (TOR); the CBB independence (CBBI);[14] and the modified Selic interest rate (INTD).[15] The last variable was included in the VAR because it is now widely accepted that the Brazilian monetary policy operates through setting a

[13] Inflation is measured by the extended national consumer price index (IPCA); it covers a sample of families with personal income between 1 and 40 minimum wages and has a broad geographical basis. INFD is the year's inflation rate divided by one plus the inflation rate.

[14] CBI index is the actual degree of independence weighted, based on Cukierman's methodology (1992).

[15] Interest rate for overnight interbank loans collateralized by government bonds registered with and traded on the Special System of Clearance and Custody (Selic). INTD is the Selic divided by one plus the Selic.

key interest rate. The VAR is used because the theoretical analyses concerning CBI are not developed enough (in particular for developing countries) to provide a dynamic specification that identifies all relationships among the variables in analysis.

It is first necessary to verify if the above-mentioned series have a unit root. The unit root tests (Augmented Dickey-Fuller (ADF) and Phillips-Perrron (PP)) denote the acceptance of the null hypothesis (nonstationary series) for the original values of these series. On the other hand, for the case of first difference, the null hypothesis is rejected at the 1% significance level, and thus the series are stationary (table 7).

Before applying the cointegration test to the series in analysis, the lag orders were determined by means of Akaike (AIC), Schwarz (SIC) and Hannan-Quinn information criteria (HQ). Owing to the presence of an outlier in the inflation rate which occurred after the introduction of the Real Plan, it was decided to place a dummy variable to capture the outlier effect. It is important to emphasize that the critical values of the cointegration tests are no longer completely valid when the model has deterministic variables other than the intercept and trend. It is observed that both models (with or without constant) and the outcome of the criteria used denote 1 lag for the VAR (table 8).

The cointegration test proposed by Johansen (1991, LR test statistic), based on the significance of the estimated eigenvalues, indicates that the trace statistic rejects the no-cointegration hypothesis at the 1% significance level (table 9), but not the hypothesis that there is more than one cointegration relation.[16]

The cointegration test indicates, therefore, that there is a long-run equilibrium among variables considered in VAR. The cointegrating vectors (β), normalized for the variable INFD, as well as the adjustment coefficients (α) are reproduced in table 10. All components of the cointegrating vector are significant at the 1% level, except for TOR, which is significant at the 10% level. Furthermore, all variables presented the expected indication: increases in the CBI and interest rate lead to a reduction in inflation, while an increase in turnover of CB governors exerts the opposite effect.

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[16] The specification selected has only the intercept within the cointegration vector.

TABLE 7

Brazil: Unit root tests (Augmented Dickey-Fuller (ADF) and Phillips-Perrron (PP))[a]

Series	Lag	ADF test	Lag	PP test
CBBI	0	-2.9531	8	-2.8512
ΔCBBI	0	-5.3460[b]	9	-6.0578 [b]
INFD	0	-2.9753	1	-2.9422
ΔINFD	0	-6.6553 [b]	1	-6.6935 [b]
INTD	0	-2.0287	4	-2.0168
ΔINTD	0	-3.5621 [b]	4	-3.5010 [b]
TOR	0	-0.6510	1	-0.6571
ΔTOR	0	-3.9390 [b]	0	-3.9390 [b]

Source: Prepared by the author.

[a] ADF test: number of lags based on Schwarz criterion; PP test: lag based on Newey-West criterion using Bartlett kernel. For CBBI, INFD and INTD constant and linear trends were applied. For ΔCBBI constant was applied. For other series, no-constant specification or time trend was used.
[b] Denotes rejection of the null of a unit root at the 1% significance level.

TABLE 8

Brazil: VAR lag order selection criteria

Lag	With constant			Without constant		
	AIC	SIC	HQ	AIC	SIC	HQ
0	-10.35247	-10.10378	-10.29850			
1	-15.76519[a]	-14.27302[a]	-15.44135[a]	-14.85520[a]	-13.61172[a]	-14.58533[a]
2	-15.59074	-12.85509	-14.99703	-14.38647	-11.89952	-13.84674

Source: Author's estimates on the basis of Akaike (AIC), Schwarz (SIC) and Hannan-Quinn information criteria (HQ).

[a] Denotes rejection of the hypothesis at the 1% level.

TABLE 9

Brazil: Johansen's cointegration test

Hypothesized no. of CE(s)	Eigenvalue	Trace statistic	5% critical value	1% critical value
R = 0[a]	0.867686	78.41756	68.52	76.07
R ≤ 1	0.568159	33.92080	47.21	54.46
R ≤ 2	0.352939	15.44743	29.68	35.65

Source: Estimates calculated by the author using the Johansen cointegration test.

[a] Denotes rejection of the hypothesis at the 1% level. Trace test indicates 1 cointegrating equation at 1% level.

TABLE 10

Brazil: Cointegrating vectors and adjustment parameters

Series	β	α
INFD	1.000000	-0.055467
CBBI	-1.294171	-0.016736
INTD	-16.33198	0.026754
TOR	0.269904	0.426996
Constant	15.50979	

Source: Author's estimates.

TABLE 11

Brazil: weak exogeneity test[a]

Series	χ^2	P-Value
CBI	1.638928	0.2005
DINT	1.493454	0.2217
ROT	0.214067	0.6436

Source: Author's estimates.

[a] Dependent variable: INFD.

Table 11 shows the χ^2 (Wald) statistics for the joint significance of each of the other lagged endogenous variables in equation INFD in the VAR model. The weak exogeneity test performed for the variables denotes that the variables under consideration can be treated as exogenous. Thus, it is correct to estimate a model for INFD. It is worth stressing that the values of the coefficients of the cointegrating vector should not be interpreted directly as a measure of the impact of the innovations of each variable isolated from the rest because these coefficients do not take into account the relationships between the variables expressed in the VAR model (Lütkepohl, 1991).

Figure 4 shows the impacts on the INFD due to the increase in the standard deviation in the innovations of the other variables.

The variables were ordered in different ways for the analysis of the impulse response function, but the results did not change significantly. It is shown that a positive shock in the CBBI and in the interest rate reduces inflation permanently. On the other hand, a positive shock in the turnover of CBB governors contributes to an increase in the inflation rate. In other words, the results suggest that a mix of an increase in CBI and in the interest rate with a decrease in turnover of CB governors should be a good framework for reducing inflation.

The results above need to be clarified. Albeit the empirical data denote that an increase in CBBI and TOR contributes to reducing inflation, in fact both variables depend on the macroeconomic environment. As pointed out in section IV, Cukierman's index is a consequence of the success of monetary policy in the control of

FIGURE 4

Brazil: impulse response functions
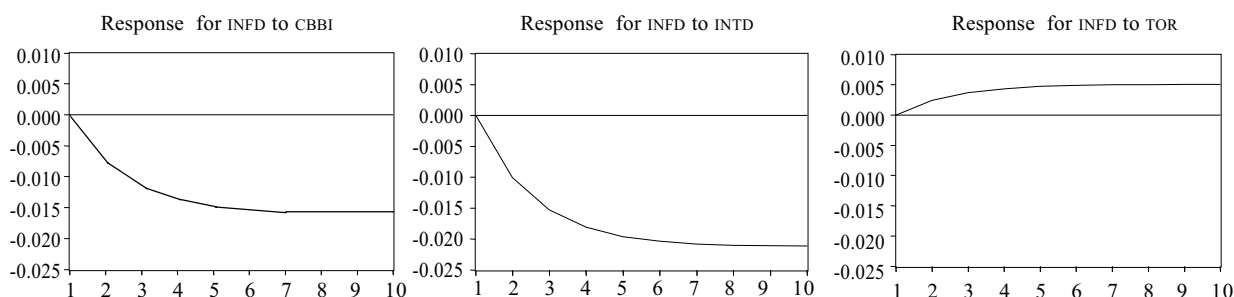
Source: Prepared by the author.

inflation. In this sense, the results found from a CBI index with an economy whose main monetary policy objective is the quest for price stability are not surprising.

One important lesson extracted from the analysis in this section is that it does not matter which country (developing or industrialized) is considered in CBI studies. The endogenous character of the indices reflects a conservative monetary policy (aversion to inflation) and, as a consequence, results in an increase in CBI. Therefore, if a country changes the conduct of its monetary policy against inflation, the effect is an increase in CBI, thereby offering fallacious evidence that the independence helps to control inflation.

VI

Conclusion

The empirical evidence suggests that when countries that have been historically successful in fighting inflation are eliminated from the sample, it becomes difficult to define a reasonable independence ranking for central banks. Thus, an analysis that considers a set of countries, but omits Germany, Switzerland and the United States, may produce results that are quite the opposite of those which CBI enthusiasts might hope for. Further, the disagreement among the rankings by indices reveals the subjective nature of the measurement of independence.

The empirical results for the Brazilian economy are in accordance with the standard literature concerning CBI. The main point behind these outcomes is the credibility of the conduct of monetary policy. Blinder (2000) showed that, in the opinion of central bankers and economists, CBI is the most important criterion for establishing or maintaining credibility, provided there is a history of honesty. In fact, CBI is now understood as an operational independence, that is, entailing the freedom of the CB in the conduct of monetary policy in the quest for price stability. In spite of the importance of Blinder's observation, it needs to be treated with caution because it is based on simple opinions.

Brazil does not have a legally independent CB. Its success in controlling inflation is due to the fact that the CBB follows a set of criteria that represent a rule of thumb for monetary policy (such as using interest rates as a tool, increasing transparency and focusing monetary policy on inflation). After the implementation of the Real Plan, the priority of monetary policy was the control of inflation. Due to this objective, CBB adopted a conservative monetary policy and used two different monetary regimes (crawling peg for the exchange rate in the period between July 1994 and January 1999, and, since June 1999, inflation targeting). It is worth stressing that the CBBI is based on judgments concerning the behaviour of the CBB. Consequently, this indicator depends on the strategy adopted for the conduct of monetary policy.

A low and stable inflation depends on credibility, which is, in turn, endogenous to the public's perception concerning the accountability and the potential success of the CB in the conduct of monetary policy. Developing countries like Brazil that need to develop credibility must look for other frameworks, instead of accepting the presupposition that there is a vicious circle which includes inflation and a lack of CBI. The main point is that it is necessary to use a monetary strategy to achieve a historical success against inflation, and thereby develop credibility. Furthermore, since the main objective of governments is to maximize social welfare, and since the impact of monetary policy on the economy is not negligible, it becomes necessary for the monetary strategy adopted to take into account as well the possible effects of a tight monetary policy on fiscal equilibrium, economic growth and unemployment.

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Latin America and the Caribbean in the World Economy, 2004. Trends 2005 (LC/G.2283-P/I), Santiago, Chile, November 2005. United Nations publication, Sales No. E.05.II.G.117.

In 2004-2005 the international economy has been influenced by two phenomena that have been taking shape for a number of years now. The first is a new geography of international trade and financial flows, one of whose most salient features is China's greater presence in the world economy and financial system. The second has been the United States economy's strong reactivation in 2004, which has made the global economy's growth pattern more dependent on this country. These two factors, which go a long way towards accounting for the robust expansion of the international economy and trade flows in 2004 and 2005, have both direct and indirect effects on the Latin American and Caribbean economies, given how important the United States and China are to the region as trading partners. The nature of these effects is largely determined by these two economies' particular modalities of growth, as well as the structure of their trade and financial ties. The impact is also shaped, however, by the specific ways in which the region is linked to these two economies and by the profile of its trade and financial relations with the global economy.

The outlook for Latin American and Caribbean trade activity is encouraging, thanks to the dynamic growth of the world economy, and particularly the emergence of China, India and other developing Asian countries as new global players in the production sector, trade and financial movements. Although there are still factors that provide grounds for a certain degree of pessimism (including the United States' hefty twin deficits, high petroleum prices, the possibility of interest-rate hikes, an increase in antidumping complaints and in the use of safeguards), on balance, the situation in 2005 remains promising. In the first half of the year, the region's merchandise exports rose by 17%, with the South American countries outpacing Mexico, Central America and the Caribbean in this regard. A similar pattern was seen in imports. If commodity prices continue to climb, the region will see another strong increase in its trade flows, as occurred in 2004.

The world economy's momentum drove up the growth of merchandise trade in 2004 to a 25-year peak and promises to keep it high in 2005. Within this framework, the trade activity of developing countries has risen sharply. This is mainly attributable to the expansion of intraregional trade flows that is occurring among the Asian countries as their production linkages with China multiply, thereby spurring on the Asian region's already ample intra-industry trade flows.

Also on the horizon, however, is a marked upswing in the use of protectionist measures such as antidumping actions, safeguards and export quotas. The industrialized countries, especially the United States and the European Union, have increasingly been taking recourse to such measures to shield themselves from developing country imports, particularly from Asian nations, and protectionism is thus beginning to pose a serious risk to world trade. These potential threats raise a number of concerns about the Doha Round negotiations and have prompted developing countries to consolidate or broaden their access to industrialized-country markets through the conclusion of bilateral free trade agreements. Recent disputes regarding agricultural products that have been brought before WTO have also called some the developed countries' policies in this regard into question.

Other publications

Elementos conceptuales para la prevención y reducción de daños originados por amenazas socionaturales. Cuatro experiencias en América Latina y el Caribe, Cuadernos de la CEPAL series, No. 91 (LC/G.2272-P), Santiago, Chile, November 2004. United Nations publication, Sales No.S.05.II.G.146.

This work was construed as a guide for the authorities in Latin American municipalities hit by natural disasters, with the aim of helping them to put in place effective local risk management and thus reduce loss of life and material damages.

Thus, the intention is to cooperate in the training of society's stakeholders, with a view to helping them adopt a preventive, rather than reactive, approach to natural disasters, reduce vulnerability (the main determinant of how much damage a natural disaster can cause), and strengthen sustainable development strategies.

This work forms part of the project on the prevention and reduction of threats posed by natural disasters, which was conducted by ECLAC in 2002-2004, with financial assistance of the German Agency for Technical Cooperation (GTZ).

Fostering Economic Policy Coordination in Latin America. The REDIMA Approach to Escaping the Prisoner's Dilemma, Libros de la CEPAL series, No. 82 (LC/G.2277-P/I), Santiago, Chile, September 2005. United Nations publication, Sales No. E.05.II.G.42.

This work attempts to assemble and synthesize some of the results of the first phase (2000-2003) of the REDIMA project implemented in Latin America by ECLAC in cooperation with the European Commission, which provided technical support as well as co-financing for the project. REDIMA is the acronym of the Spanish and Portuguese title of the Macroeconomic Dialogue Network (Red de Diálogo Macroeconómico), which ECLAC conceived and implemented in the three main subregions of Latin America between the end of 2000 and end of 2003.

This volume is intended mainly for Latin American experts who are involved in the formulation of macroeconomic policy in their respective countries, but should also be of interest to a broader public concerned with regional integration options and strategies. It aims to provide some useful elements for addressing specific issues related to economic policy coordination among sovereign nations in a world engaged in a process of globalization and subject to increasing uncertainty. It is, therefore, not constructed as an analytical treatise.

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