

# PAL REVIEW



UNITED NATIONS

# CEPAL

## Review

*Executive Secretary*  
Norberto González

*Deputy Executive Secretary for  
Economic and Social Development*  
Gert Rosenthal

*Deputy Executive Secretary for  
Co-operation and Support Services*  
Robert T. Brown

*Director of the Review*  
Raúl Prebisch

*Technical Secretary*  
Adolfo Gurrieri

*Deputy Secretary*  
Rosa Nielsen



UNITED NATIONS  
ECONOMIC COMMISSION FOR LATIN AMERICA AND THE CARIBBEAN

SANTIAGO, CHILE, APRIL 1986

# C E P A L

Review

Santiago, Chile

Number 28

## CONTENTS

Address delivered by the Executive Secretary of ECLAC, Mr. Norberto González, when opening the Meeting on Growth, Adjustment and the Debt in Latin America.	7
Central America: Bases for a reactivation and development policy. <i>ECLAC Mexico Subregional Headquarters</i>	11
Thoughts on industrialization, linkage and growth. <i>Joint ECLAC/UNIDO Industrial Development Division</i>	49
Inflation and stabilization policies. <i>Daniel Heymann</i>	67
Transnational corporations in Argentina, 1976-1983. <i>Daniel Aspiazu, Eduardo Basualdo and Bernardo Kosacoff</i>	99
Social security and development in Latin America. <i>Carmelo Mesa-Lago</i>	135
Changes of social relevance in the transplantation of theories: the examples of economics and agronomics. <i>Ivo Dubiel</i>	151
The preparation of natural and cultural heritage inventories and accounts. <i>Nicolo Gligo</i>	171
Co-operativism and popular participation: new considerations regarding an old subject. <i>Roberto P. Guimarães</i>	187
Notes on trade from the standpoint of the periphery. <i>Raúl Prebisch</i>	203
Recent ECLAC Publications	215

# Changes of social relevance in the transplantation of theories: The examples of economics and agronomics

*Ivo Dubiel\**

The penetration of scientific and technical knowledge from the developed into the underdeveloped countries has often led to the latter's acceptance of theories and techniques which are totally remote from their realities and interests, and are of no use to them as tools of interpretation or transformation.

According to the main thesis of the present essay, the dominant theories in various disciplines reflect the conditions prevailing in the countries where they originated; changes in them are generally hastened when conditions in their countries of origin alter. This mechanism ensures the social relevance of the dominant theories at different times in the countries that blaze the trail of scientific progress, even though that may not have been the scientists' intention. In the underdeveloped countries, on the contrary, scientists draw their nourishment from the science of the developed countries which generate the theories, and changes in these occur irrespective of their social relevance for the recipient country. If in the theory-importing country there is no such phenomenon as gave rise in the creator country to the dominant theory, science, a potent factor of development in the latter, may become, in dependent countries, a potent factor of underdevelopment, if this is interpreted as a process taking place in a direction that is undesirable from the standpoint of the welfare of the majority.

The author maintains that this thesis can be abundantly corroborated, and in the present article he deals with the establishment and modification of certain theories of special importance in economics and agronomics.

\*Professor, Universidad Nacional Autónoma de México, and formerly Consultant to the United Nations Development Programme.

## The epistemological thesis

This essay is based on the theory of scientific dynamics expounded by Kuhn (1962) and later formalized by Sneed (1971) and Stegmüller (1973, 1974, 1975). For several reasons, and particularly because the world theory has so many acceptations, Kuhn prefers to speak of development and change in "paradigms". The reference is to what Schumpeter (1954, p. 41) calls the preanalytic vision that of necessity precedes theoretical work. As this "vision" is at once the focal point of theoretical work and the guiding principle of research undertaken in the framework of a theory, I shall continue to use the term "theory" instead of "paradigm"; according to this conception, what is often called "theory" is equivalent to interpretations or hypotheses within the framework of a theory.

### 1. *The progress of a theory*

A theory, in this sense, is a structure which allows of manifold interpretations, and requires one to relate it to concrete reality. In its general form it says nothing in concrete terms and, accordingly, can be neither corroborated nor refuted by experiment. In the structure of a theory, however, there is no room for interpretations of other structures. The first successful interpretations of a theory often account for phenomena that had previously met with no satisfactory explanation. These paradigmatic interpretations encourage researchers to look for further valid interpretations of reality within the framework of the theory in question.

By virtue of this effort, theory develops and becomes a potent instrument of explanation. In their endeavours to deal with new phenomena, researchers gradually discover the limitations of this frame of reference. When these become increasingly numerous and occur in relation to important problems, a few researchers to begin with, and afterwards the majority, abandon the dominant theory and look for another that can offer a better explanation of phenomena which

have not been satisfactorily interpreted by that dominant theory and which are of importance for a society, a social class or a scientific community.

Given that this, in synthesis, were the evolution of science, it would be impossible to demonstrate that in the course of scientific progress one good theory is replaced by another even better, and that we are gradually approaching the "truth"; there is no atheoretical criterion whereby the degrees of truth in different theories can be impartially compared.

## *2. The transfer of a theory to a different historical and social context*

If the change from one theory to another is not an ahistorical and universal process, but something directly related with the historical and social situation of a group of researchers, the effect of exporting theories from one historical and social context to another of a different nature must give food for serious thought. Kuhn stresses that research work isolates the scientist from his social environment: his disappointment in a theory is occasioned when it does not—in spite of his efforts—provide satisfactory explanations for important problems in his own field of work. A case in point is afforded by Newton's attempt to find an interpretation in Newtonian theory for the phenomena of light. If a theory is exported to a different historical and social environment, some researchers in that environment will probably try to apply the theory to phenomena which in its original context were non-existent or of no importance. If, after years of work, the new theory does not meet the hopes pinned on it, researchers in the new environment may be disillusioned and begin to look for another theory to grapple with their old problem.

As historico-social conditions influence changes of theory, the export of theories to cope with other conditions constitutes a source of frustration for the scientist. A similar case occurs when conditions in a society change so radically that a theory up till then quite fruitful no longer provides valid interpretations.

In this limited sense, historico-social conditions influence the abandonment of a theory. Social influence in respect of what theory

ought to take the place of the one discarded is much more direct. Normally, several options present themselves, each one with its paradigmatic interpretations exemplifying how that particular theory suggests that problems be resolved. For instance, after the decline of classical economic theory, the historical school vied, fairly successfully at first, with the incipient neoclassical theory. As these two represented radically different approaches to economic phenomena, there was no possibility of making a logical comparison of one theory with the other to decide which was the more promising. Apparently neoclassical theory gained the day over the historical school because it was more academic and less concerned with the social question.

A theory like that of Clark (1981, p. 313) which holds that "what a social class gets is, under natural law, what it contributes to the general output of industry" will be more kindly received by the power structures, in times of labour unrest, than the classical theory which takes into account the class struggle; according to Ricardo, for example, in marginal land, that is, when rent is not paid, profits are the leavings of wages. When the dominant theory was this, which of course incited labour conflicts, it was not as yet the working class but the landowners that put the development of British industry at risk. Once the landowners had joined forces with industry and the threat to international competition and the profitability of British industry stemmed mainly from the demands of the working class, an atmosphere favourable to a change of theory was created.

I should like to make it clear that such a decision in favour of one theory or another, because of this or that historical condition, is not an explicit option. Social and class conditions determine the priorities of researchers as regards their field of work and only in relation to that field could one theory seem more interesting than another.

The dynamics of science, rather than representing an everlasting process of approximation to a final state—"truth"—, much more closely resembles a Darwinian process of evolution, in which a new theory proves to have an explanatory capacity better adapted to a specific natural or social ecosystem.

## II

## The sociological thesis

Normally it is not society in general, or a representative sample of it, but well-defined social groups that engage in the pursuit of science. That is why the determination of the problems that will be tackled by researchers and the methods that they will use are subordinated to the interest and social situation of this group, not to the general interest. The medieval monks satisfactorily resolved their own problems of horticulture and of fermentation of milk, wheat and grapes to make cheeses, beer and champagne. To the solution of the problem of the peasants who worked with the Egyptian plough, so unsuited to the heavy soils north of the Alps, they contributed nothing; the peasants solved it by inventing the mouldboard, and for want of the support of systematic knowledge, they did so very slowly.

1. *Classical economic theory*

Classical economic theory was concerned with the wealth and the development of nations; those who put forward this theory constitute a representative sample of all urban classes (O'Brien, 1975, p. 8) —excluding, of course, the workers. As each of their interpretations related to a different period of history or a different nation, the social class which this theory identifies as the enemy of future development varies according to the interpretation.

An ahistorical comparison of the assertions of the physiocrats, of Adam Smith, of Ricardo and of Marx would show how contradictory are their declarations with respect to the coincidence between the interest of one social class and the social interest; unfortunately an ahistorical position is the rule among scientists, not the exception. For the physiocrats the bourgeoisie was a "sterile class" and its work unproductive because it manufactured and marketed mainly "non-basic products" (Sraffa, 1926) for the French nobility. Adam Smith (1937, pp. 248 to 250), in contrast, identified the social interest of landowners with the general social interest,

since in his day what was needed was to break down the monopolies and privileges built up by traders and entrepreneurs during the period of mercantilism. Ricardo (1951, I, p. 77 and IV, p. 21), on the other hand, asserts that landowners grow rich at the expense of the other social classes because —with the ban on imports of cereals in force— the high price of grain raises the nominal wages of workers and reduces the rate of profit and the competitive capacity of industrialists. Marx accurately describes the antagonism between capital and labour in a world where the rate of profit is low because of keen inter-capital competition, and where a worker aristocracy exists which has closer ties with the national capital that ensures it privileges than with the poorer workers within and outside its own country.

The different interpretations of classical theory have been capable of describing the most widely varying systems of exploitation of one class by another that have occurred in the development of capitalism. If the researchers who continue using classical theory as a working tool today have failed to offer a satisfactory interpretation of existing systems of exploitation, it is because of their tendency to take their stand on interpretations of classical theory which deal with other historical situations, instead of reinterpreting the old theoretical framework in innovative fashion with reference to the conditions in force.

2. *Neoclassical economic theory*

Neoclassical economic theory, in contrast, contributed nothing in its earliest decades to the discussion of economic policy (Stigler, 1972, pp. 571 to 578), and taught that all classes get what they deserve. That this theory has nothing to say on the major themes of the classical economists is not a matter of chance but the result of its own structure. Those who sponsored it were almost all university professors and the theory clearly reflects this social group's

aesthetic values, remote from political debate. Just as the political recommendations of the classical thinkers are ascientific positions for the neoclassicists, because they imply an impossible comparison of subjective benefits, so the impossibility of making recommendations of this type within the framework of neoclassical theory is for the economists of the classical school "very conducive to the euthanasia of our science" (Hicks, 1939, p- 697). Harrod (1938, p. 396) remarks in this connection: "If the incomparability of utility to different individuals is strictly pressed ... the economist as an adviser is completely stultified, and unless his speculations be regarded as of paramount aesthetic value, he had better be suppressed completely".

### 3. *A Herodianized science*

With respect to the social classes that concerned themselves with science in Latin America —the future middle classes—J.B. Alberdi (1836, iv, p. 62) expresses the opinion that "the Argentinian gaucho, the owner of an hacienda, the businessman, are better fitted for practical politics than our students of Quinet and Michelet, masters whose knowledge embraces everything but South America". On the relationship between this class and its own country Alberdi comments (1886, iii, p. 80): "Civilized Latin America could be defined by saying that it is Europe established in America", and (1916, p. 134): "Every sizable South American city aspires to be a *petit Paris*". Even if the cultural and intellectual bond between this Latin American class and Europe and the United States were less strong in the countries north of the Southern Cone, it would seem, nevertheless, that in the rest of Latin America too the intellectual link with the centre was decisive enough. On the mood of scientists in the time of Porfirio Díaz, L. Zea says (1968, p. 317): "What is essentially Mexican is important, perhaps its realization would be desirable; but this would be a misguided course, and might imply its destruction. The predominant, the powerful influence is that of the Saxon spirit; Mexico, if it wants to survive, will have to adapt itself to that spirit, Saxonize itself, there is no other road open, and even if there were, the decision has

already been taken and the impulse given; now there is nothing to be done but follow the chosen path and await the outcome."

The phenomena to which the quotations allude reflect a well-known process. The first description of it comes from Toynbee, when he refers to the Jewish groups in Herod's Palestine, to whom, as to Herod himself, events in Rome were of more interest and better-known than those in their own country. With regard to the Herodianized classes in Latin America Vekemans writes: "As Herod lived physically in Jerusalem but mentally in Rome, so the Latin American upper classes live physically in Latin America, but mentally in Europe or the United States" (quoted in Steger, 1971, p. 30).

Now, if these are the classes that engage in the pursuit of science, it is not very likely that the importing of theories which could be less socially pertinent in the new environment will lead to frustration and in time to the repudiation of the theory. As these classes belong to the intellectual world of the countries whence the theory comes, and as the places where they study and carry out research seem to be cultural enclaves compared with the rest of the country, processes of adjustment of an unsuitable theory take place more slowly or not at all. It is to be hoped that these classes will choose, out of the supply afforded by the countries to which they look for intellectual guidance, the theory that is most appropriate to their country, but there is little likelihood that they will risk a rupture and a change of theory that involves making themselves independent of their spiritual homeland.

An evaluation of their intellectual and scientific contribution would necessarily lead to the same conclusion reached by Medina Echavarría (1955, p. 65) on what they bring to economics: "Considered as a whole, it is improbable that the Latin American middle class, with its current structure, will be able to react in the best possible way and to the extent required by the economic development targets."

### 4. *The progress of Herodianized science*

A reminder must be given of what was said above on scientific progress and on the comparative irrelevance of Herodianized science

must be given a more precise shade of meaning. The dynamics of scientific development comprise two types of progress: normal scientific progress within the framework of a given theory and scientific progress via changes of theory. The sociological thesis on the Latin American scientists relates only to progress through changes of theory. It does not preclude the possibility that these scientists may so radically interpret a dominant and structurally unsuitable theory that at the pragmatic level it has more or less the same degree of social pertinents as another apparently more suitable, but as yet somewhat amorphous. A case in point is afforded by the interpretation that Prebisch and ECLAC placed on neoclassical theory (Dubiel, 1984).

But it was not the demonstration effect alone that encouraged inappropriate imports of theories. In the course of industrialization through import substitution, the institutions of higher education in Latin America performed

the function of producing national technical experts who knew how to manufacture the products hitherto imported. That implied the importing of machine-tools and textbooks in order to form the necessary physical and human capital. This type of industrialization and the role of the universities in the process also account for its outward-directed slant.

Industrialization and the expansion of State and entrepreneurial bureaucracy were favourable to the middle classes. Without possessing either land or military or financial power, these classes were able to justify their participation in power through the value of their knowledge, which was continually rejuvenated with new imports. Imported knowledge long warranted the political importance of their own class and their high income levels in the eyes of other social classes. From the standpoint of their contribution to national development, however, the social value of this imported knowledge was often insignificant (Dubiel, 1981; 1982).

### III

## The example of economic theory

In order to obtain an overall idea of a theory and of its predecessors, it is sometimes of little use to have recourse to the opinion of the adherents of that theory because "though many scientists talk easily and well about the particular individual hypotheses that underlie a concrete piece of current research, they are little better than laymen at characterizing the established bases of their field, its legitimate problems and methods" (Kuhn, 1971, p. 86). The ahistorical outlook observable in all developed scientific disciplines is attributable to the fact that "partly by selection and partly by distortion, the scientists of earlier ages are implicitly presented as having worked upon the same set of fixed problems and in accordance with the same set of fixed canons that the most recent revolution in scientific theory and method has made seem scientific" (Kuhn, 1971, p. 215).

#### 1. *Classical theory is not protoneoclassical*

By way of these processes, the name neoclassical theory has now come to be applied to the theory born in 1870, which has nothing to do with the earlier classical theory. As the neoclassical economists found in volume IV of the *Wealth of Nations* (1776) a proposition compatible with their own theory, it was in vain that Adam Smith expounded in the Plan of the work and in the early volumes a line of thinking quite different from and incompatible with that of the neoclassical school. For them, the aphorism that individual interest guarantees economic progress as if it were guided by an invisible hand (Smith, 1937, p. 423), became the pith and marrow of their own theory (Blaug, 1964, p. 57).



Very few economists are aware of the deep chasm between classical and neoclassical theory. Almost the only one who does not cherish an illusion that neoclassical theory is the complement or the consummation of classical theory is Schumpeter as a young man. In his vigorous defence of neoclassical theory he admits (1908, pp. 182 and 1983): "Statics and dynamics are completely different areas: not only do they deal with different problems, but they use different methods and materials. ... With respect to development phenomena and the "major problems" of economic progress we are completely at a loss." Accordingly, in 1911 he published his *Theory of Economic Development* in which he described the imbalances in that process. To explain the difference between this book and the equilibrium systems presented in his 1908 text, Schumpeter (1961, p. xi) asks: "But is it really untrue of life or artificial to keep separate the phenomena incidental to running a firm and the phenomena incidental to creating a new one?"

Robbins and Hicks too appreciated this difference. Robbins (1974, p. 35) noted that neoclassical theory gave rise to a tendency on the part of economists to concentrate their attention on the distribution of the means of production rather than on development. Hicks (1975, p. 325) compares Schumpeter's observations (1954) on, the classical economists with his comments on Jevons, Walras and Menger, and with reference to the former says: "Why does he write them down? Because they belong to the other party!"

Without embarking on discussion of the neoclassical tergiversations of classical theory, which present the classical economists as if they were protoneoclassical, suffice it to recall a few of the many elements that distinguish the two parties. "Capital" in the classical sense comprises the heterogenous inputs of production including variable capital: wages; "neoclassical capital" excludes wages and assumes that physical installations are malleable, i.e., for the neoclassical theorists capital is a homogeneous mass, something that can be remodelled like plasticine. "Interest", "rent" and "wages" constitute for the classical school the income of the three most important social classes of their day, while for the

neoclassical economists they are the remunerations of the universal factors of production: capital, land and labour. According to classical theory, market competition forces prices down as technology makes progress, an element incompatible with neoclassical theory; for the neoclassical school, competition ensures that the factors of production receive their "marginal product", an element incompatible with classical theory. The classical theorists determine distribution among the social classes before fixing the prices of goods, since these latter vary with distribution; neoclassical economists do the opposite, determining distribution as the result of supply and demand in respect of "factors of production", while demand is the result of demand for goods and of their prices. These examples may suffice to show that the classical and neoclassical theorists, although they may use the same words, are referring to different theoretical concepts.

## 2. *The structure of classical theory*

If economic theory began as a science with the classical school, the reason is that only from that time onwards did its explanations cease to be disconnected. This systemic approach is attributable to Madame Pompadour's physician, François Quesnay, who became famous when, using a hydraulic model, he refuted the thesis that bleeding had to be applied at the point farthest from the inflammation. In later years he applied this concept of circling flows to the movements of goods and money in order to analyse the French economy and the obstacles in the way of its development.

The first principle laid down in this model is that what has been consumed in the course of a production cycle must be replaced at the end of it. The second is that only if a surplus over the quantity of goods consumed in the production process is ensured can there be economic development. Thus the subsequent analysis focuses upon the factors that exert a positive or negative influence on this surplus: technological progress stimulated by the large and increasing size of the market; productive or unproductive consumption as the way in which the surplus is used; distribution of the social product among the different classes, as a determinant of the

percentage of unproductive work. Price-fixing—the major concern of the neoclassical theorists—is a secondary question for the classical economists compared with aspects relating to economic development.

The general model of classical theory has met with several interpretations. The first is the *tableau économique* of Quesnay and the physiocrats; the second the corn-corn model that Ricardo expounded in a lost text and that Sraffa was able to reconstruct. The third is the interpretation which Ricardo uses in his *Principles* (1817), and which is more appropriate for an economy that is based on the hiring of labour. But in the first sentence of the *Wealth of Nations* too—"The annual labour of every nation is the fund which originally supplies it with all the necessaries and conveniences of life which it annually consumes"—Adam Smith refers to the recirculating fund of the classical model and not as the neoclassical economists take it, to factors of production. The most recent interpretation of classical theory is the input-output analysis of Leontief, who introduces his study with the words (1966, p. 9): "The statistical study presented in the following pages may be defined as an attempt to construct... a *tableau économique* of the United States for 1919 and 1929." Leontief himself calls attention to certain differences between his input-output matrix and his studies in the tradition of neoclassical theory, but not to the deep-seated antagonism between the two that Schwartz points out (1961, pp. 196-197). Apart from the direct relation with Quesnay's work, the intellectual sources drawn on by Leontief—a Russian student in the 1920s—must be sought in the "material balances" of Soviet planning and in the reproduction schemes of Marx, both descendants of the *tableau économique*.

### 3. *The classical structure and the problems of underdevelopment*

As interpretations have been found for classical theory whereby to analyse the development process in different countries and at different times—the theory guided England's economic policy for decades—, likewise for the problems

of the underdeveloped countries today it will presumably be able to offer interpretations of great explanatory power.

Thus it was that W. Arthur Lewis (1954) said: "This essay is written in the classical tradition, making the classical assumptions, and asking the classical questions. ... The student of such (underdeveloped) economies has therefore to work right back to the classical economists before he finds an analytical framework into which he can relevantly fit his problems." W. Arthur Lewis, a professor at Manchester who came from Jamaica, belongs intellectually to a group of English economists concerned for the lot of the former colonies, who, followers as they were of A. Marshall, felt themselves more strongly committed to the classical school (Dubiel, 1984, pp. 79 to 96).

In Latin America Raúl Prebisch developed a model similar to that of Lewis but with much wider repercussions, since he was at the head first of ECLAC and then of UNCTAD. In contrast with Lewis, Prebisch says practically nothing in favour of classical or against neoclassical theory. He seems convinced that the classical economists are really protoneoclassical (Prebisch 1979, pp. 171 to 172) as they are presented in neoclassical interpretations. Nevertheless, an analysis of the elements that Prebisch uses in his explanations of the cause of Latin American underdevelopment reveals that he handles the same concepts and the same themes as classical theory. This was achieved—partly perhaps in unawareness of the relation with classical theory—by means of *ad hoc* hypotheses and ancillary assumptions. The result was sufficiently different from the standard interpretations of neoclassical theory for many United States economists (Viner, Haberler, Bronfenbrenner, Powelson, Flanders, etc.) to consider that "CEPAL's theoretical writings were not up to the professional standards of academic economists" (Pollock 1978, p. 78; see Prebisch 1963, p. xi).

Prebisch's is a macroeconomic theory like that of the classical school, and antithetical to neoclassical theory of which the core is microeconomic. Like the classical economists, Prebisch refers to a development problem clearly defined by historical circumstances, and does not present a universal and timeless theory

like the neoclassical economists. For Prebisch, as for the classical school, capital is something heterogeneous; the disastrous implications of this assumption for neoclassical theory are familiar enough. On the basis of his postulate that different generations of technology exist side by side, Prebisch constructs a concept of "surplus" which serves the same purpose as the concept of "profit" in classical theory. Like the classical economists, Prebisch is concerned about the effects of non-productive consumption on development. His discussion of the terms of trade, the subject which economists in the industrialized countries found most exasperating, can only be understood in the framework of classical theory which distinguishes between the increasing yields of manufacturing industry (the dominant sector in the central countries) and the diminishing yields of raw materials production (the dominant sector in the peripheral countries). Until "CEPAL doctrine had... achieved quite widespread academic respectability in the United States", some lively criticism continued, "mainly centering around CEPAL's earlier terms-of-trade presentation" (Pollock, 1978, p. 78).

#### 4. *Prebisch's thesis*

Economic competition, which according to neoclassical theory ensures that each "factor of production" receives fair payment, i.e., its "marginal product", according to classical theory is necessary in order that the prices of reproducible goods may vary with production costs. In the processing sector, production costs fall more quickly than in the primary sectors because of the greater possibility of division of labour and technification (Adam Smith, 1937, p. 6). In industry, therefore, an increase in market size is conducive to reorganization of production, whereas in agriculture and in mining costs do not decrease or may even increase because of the need to make use of marginal land and mineral deposits in order to step up output.

In this process, the beneficiaries of the technological progress deriving from an increase in market size are the national and international consumers of a now cheaper product. The

deterioration of the terms of trade for industrial products is necessary to compensate consumers in non-industrialized countries for the advantage enjoyed by industry in respect of the technological progress induced by a larger market. In practice, the world market operated in accordance with classical theory until 1815 and to a lesser degree up to 1882 (Imlah, 1950, p. 183). As from that date a reversal of the process began. Technological progress in agriculture resulted in low prices for domestic and international consumers, while the fruits of technological progress in industry were distributed mainly among domestic producers: one part increased the profits of firms and their technological research and development capacity, while another part made it possible to improve the workers' daily wages. Despite the fact that these wage increases are costs for an enterprise, from an economic standpoint they would have to be entered on the books as profit or rent on behalf of workers, because they originate in the greater facility with which industrial workers—as compared with agricultural labourers, peasantry and other sectors—can form an effective trade union and exert pressure (Adam Smith, 1937, p. 126). It should be pointed out that the deterioration of the terms of trade has been a decisive factor not only in international relations, but also in national social relations (for England, see A. Smith, 1937, p. 126; for the United States, see Krieg, 1984, pp. 61 and 64; for Maoist China, see Aubert, 1981, p. 100).

In this discussion on a misunderstood thesis of Prebisch, many "refutations" assume that statistics can explain or refute something without being interpreted by a theory. This empiricism is a feature common to several social sciences in the United States, where recourse is had to the computer, but not so much to theory. For this reason, the statistical data presented to refute Prebisch—"there is no evidence of a systematic deterioration of the terms of trade for raw materials"—in reality corroborated Prebisch's thesis, namely, the infringement of world market rules to the benefit of the industrialized countries, inasmuch as the terms of trade had not varied as they should have done if all the participants in the system had enjoyed the same opportunities.

### 5. *The conflict between representatives of different theories*

This controversy between Prebisch and the neoclassical economists may usefully be considered in the general framework of the discussions among scientists holding different theories. The reasons why these discussions tend to be conflictive have been set forth by Kuhn (1971). However, not only in debates between physicists of the Aristotelian, Newtonian or Quantum Theory schools, but also in discussions among mercantilists, classical economists, neoclassical economists or institutionalists, the arguments show a tendency to go round in circles; each party seeks to demonstrate that its theory satisfies the scientific norms which that theory itself prescribes and which another violates. The neoclassical economists can hardly grasp an argument of Prebisch which assumes the existence of increasing yields, when their own theory is incompatible with this assumption (Sraffa, 1926; Kicks, 1957, pp. 83 to 85).

Since Prebisch's positions can only be understood in the framework of classical theory, it is not surprising that this anti-Prebisch controversy shows a close correlation between ignorance of the content of classical theory and a militancy of attack which sometimes actually violates academic rules (see Bronfenbrenner, 1976). In this sense, the polemic in question is another illustration of Stigler's ideas (1969, p. 222) on the lessons to be learned from some of the early controversies on economic theory: "The inevitable lesson is that after studying previous controversies one cannot become so engaged in the current controversies. ... The more subtle lesson is that it does not pay to learn the first lesson: the temperate, restrained, utterly fair-minded treatment of one's own theories does a disservice to these theories as well as to one's professional status and salary."

The chief opponents of Prebisch were Haberier, Viner and Bronfenbrenner. Haberler (1957, pp. 335 and 336; 1964, p. 126) is so far from understanding what he criticizes that he contrasts Prebisch's thesis with the thesis of the classical economists. Viner (1953, p. 44) writes: "All that I find in Prebisch's study ... is dogmatic identification of agriculture with poverty." For

Viner (1953, p. 12) classical theory has a static character, when even one reading of Samuelson could have shown him the contrary. Bronfenbrenner (1976, p. 825) reports on "UNCTAD's progress from international joke to international menace. ... It was all more important, and quicker by a generation, than the Mafia's expansion from the Two Sicilies to New York and Chicago!"; the resolutions adopted by UNCTAD I and II were largely the result of Prebisch's personal action (Nye, 1972). Furthermore, Bronfenbrenner (1971, p. 142) imputes to Adam Smith a position of *laissez-faire* and harmony among social classes, as if he had never read anything in the *Wealth of Nations* on the antagonism between those who produce raw materials in the countryside and those who produce manufactures in the town (Smith, 1937, pp. 124 to 127), or the conflict, according to Smith (1937, p. 248), between society and traders.

This list of correlations between militancy and ignorance could be made longer, but it is more important to stress that these are not isolated deficiencies on the part of certain scientists. The experience of Prebisch is the same as that of Keynes with the Harvard economists. Keynes wrote in 1938: "It may be worth while to defend what one has said, if one still sticks to it. But a controversy arising from somebody attributing to one what one has not said and does not hold can scarcely be fruitful. A number of articles have been published in Harvard ... which do not seem to run counter to anything I have said, but, on the contrary, exemplify it. Yet the authors seem to suppose that they are controverting something I have said, imagining, apparently, that what I thought were quite straightforward statements mean something different from their face value!... At any rate, I beg for an occasional re-reading of what I did say!" (quoted by Gilboy, 1939, p. 634).

These experiences, and others even worse which fall outside the academic frame of reference, have, nevertheless, a long history in economic theory. From Adam Smith's time to the present day mercantilist theories —this derogatory epithet was invented by Adam Smith— have been and still are being refuted that no prominent mercantilist has ever upheld (Ingram, 1888, p. 37; Cannan, 1903, p. 3). With

import control and export promotion measures the mercantilists endeavour to create an increase in profits which by means of multipliers and accelerators would promote national industrial development; the industrialized countries were able to exploit these promotion measures in the last century thanks to the evolution of the terms of trade in their favour, without having to resort to government measures. A dispassionate appraisal of these policies could have pointed out that Adam Smith's argument (1937, p. 415) to the effect that the external market makes it possible to lower production costs when the domestic market is small constitutes a perfect justification of mercantilist policies, as in fact was noted by J.S. Mill (1909, p. 579). Most economists, in contrast, preferred to admit no modifications in the defence of "economic rationality" and, in the case of some participants in this controversy, of the bases for a free society; in the heat of these debates the omission of quotations and acknowledgments of sources is forgivable.

Within this tradition Haberler (1957, p. 335) refutes the hypothesis of the secular deterioration of the terms of trade. As "Prebisch's thesis" to this effect is "well-known" (Haberler, 1957, p. 331), Haberler and others see no need to indicate where Prebisch maintained it. Others criticized Prebisch's use of such-and-such an index instead of another, when Prebisch used none at all because what he had done was to republish some League-of-Nations statistics published by the United Nations in 1949. Apart from this, Powelson (1977, p. 19) asserts that "the terminal years for the Prebisch study (!) were during the world depression", when the statistical series quoted by Prebisch ends in 1946-1947. A member of the OECD expert committee for the evaluation of methods of determining the aid requirements of the underdeveloped countries criticizes "the bases of the calculation presented by Prebisch with respect to the increasing balance-of-payments deficit of the underdeveloped countries" (Duerr, 1977, p. 207), without stating where Prebisch presented the said calculation; whereas Prebisch (1962, p. 17) affirms that these financial needs of the underdeveloped countries could not be even approximately quantified. The writers referred to could be confident that their

periodicals would publish their "refutations" but never Prebisch's "pamphlets" (Haberler, 1964, p. 136). Given such a state of affairs, it seems normal that James Conant should have had to threaten to resign from his post as President of Harvard before the Board of Governors of that University would approve the appointment to a professional chair of so eminent, albeit non-traditional, an economist as Galbraith; Haberler submitted a protest in writing against his admission (Kemton, 1981, p. 24).

Most of these neoclassical authors were well aware that their "refutations" of the "Prebisch thesis" had been warmly welcomed by the politicians of their countries (Haberler, 1957, p. 325; Powelson, 1977, p. 17). The most outstanding essay of this kind was undoubtedly that of Bronfenbrenner (1976) who ended his comments on Prebisch and UNCTAD with the remark: "Such is the conspiracy (or lunacy, if you will) to be resisted. One can of course hope it will collapse on its own; this seems unlikely in the immediate future."

#### *6. Changes in economic theory in the centre*

The first attacks against classical theory were launched by Bailey and Cotteril in the 1820s; as neoclassical theory maintained 50 years later, they argued that value is not an objective entity, but is determined by the subjective judgement of each consumer. Their thesis that capital is as productive as labour suited a bourgeoisie which felt itself menaced by the socialists: the Ricardians first, and later the followers of Marx. With J.S. Mill classical theory gave ground before this pressure and lost the logical coherence which it had in Ricardo's interpretation. But only when at the end of the nineteenth century the English bourgeoisie considered the country definitely developed was it prepared to discard a theory which focused on development problems. Cairnes remarked in 1870: "I seem to observe in the literature and social discussion of the day, signs of belief that political economy has ceased to be a fruitful speculation;... It is not denied that the science has done some good; only it is thought that its task is pretty well fulfilled" (Ingram, 1978, p. 6). It was

not until this conviction that development had been achieved struck root in the politically most important segment of the population that neoclassical theory proved more attractive, because it asserted that all participants in the economic process were in the best possible situation when the development process took place in competitive conditions.

Hobsbawm (1969, p. 220) characterizes this intellectual *volte-face* in relation to the situation in the preceding decade when he says that "establishing an industrial economy is not the same thing as operating one already in existence" (with these words Schumpeter (1961, p. xi) distinguishes the content of his neoclassical book of 1870 from his 1911 text). On the *Zeitgeist* (spirit of the age) Hobsbawm (1969, p. 126) remarks: "The British middle-class citizen who surveyed the scene in the early 1870s might well have thought that all was for the best in the best of all possible worlds. Nothing very serious was likely to go wrong with the British economy." Keynes (1971, II, pp. 5 to 7) agrees: "In this economic El Dorado, in this economic Utopia, as the earlier economists would have deemed it, most of us were brought up. ... But most important of all, he (the Londoner) regarded this state of affairs as normal, certain, and permanent, except in the direction of further improvement, and any deviation from it as aberrant, scandalous, and avoidable." In such a situation to preserve a theoretical system which aimed at shedding light on how to emerge from underdevelopment would have been absurd and futile. Classical gave way to neoclassical theory.

As the structure of classical theory focuses attention on the dynamics of development and its simplest interpretation is Ricardo's corn-corn model, so the structure of neoclassical theory highlights the homostatic problems of equilibrium and its simplest interpretation is an auction sale. In it all the merchandise to be auctioned and all the purchasers are brought together. Every purchaser has a fixed sum of money and specific preferences. The problem is how to distribute the goods assembled in such a way that no other distribution pattern could be of greater benefit to all those present as a whole. This shift of the question from "how to produce more in each cycle" to "how to distribute what is

already produced in the best possible way" reflects the evolution of a developing society to one which feels itself to be developed.

### 7. *Changes in economic theory in the periphery*

Both in classical and neoclassical theory a relation can be established between the structure of the theory and the society that adopts it. This relation is not obvious in underdeveloped countries. Confronted with development problems, it should be classical theory that is of interest to them, but since intellectual and academic ties with the industrialized centres largely determine the researcher's social prestige, he sacrifices the country's development on the altar of his own advancement. These decisions on theories are seldom consciously taken.

Goodwin (1972, p. 561) maintains that "Marginal utility theory ... is a luxury good which will be produced only at an advanced stage of economic development. So long as the marginal utilities of all goods are very high,... as they must be on the frontier or in underdeveloped countries, it is unreasonable to expect economists to spend their time analysing the phenomena of declining utility". In this sense, the importing of neoclassical theory is yet another instance of the importing of luxury goods for the well-to-do classes, detrimentally to the interests of the majority.

If in view of the low marginal utility of neoclassical theory in conditions of underdevelopment not only Prebisch but also Allyn Young, Arthur Lewis and Nurske resorted to classical theory as the frame of reference for discussing development problems, it might well be assumed that Latin American economists had availed themselves of this recourse. It is not by chance that Prebisch shares Adam Smith's definition (1937, p. 397) of the task of political economy as being "To provide a plentiful revenue or subsistence for the people, or more properly to enable them to provide such a revenue or subsistence for themselves and ... to supply the State or commonwealth with a revenue sufficient for the public service". But to take a favourable reception for granted would be

to overlook the intellectual orientation of most social scientists in Latin America. Instead of being appreciated and outdone, Prebisch was attacked not only by economists in the industrialized countries, but also by those of Latin America, both on the right and on the left; it is ironical that it should have been a sociologist (Cardoso, 1977) and not an economist who best grasped Prebisch's theoretical originality. The right wing preferred neoclassical theory, dominant in the industrialized countries and incapable of dealing with development problems (Schumpeter, 1908, pp. 182 and 183). The left, as from the 1960s, chose to explain the underdevelopment of two-thirds of the world by means of the labour theory of value in the Marxist sense, which focuses upon the exploitation of one social class by another and which, in that context, encompasses the possibility of exploitation of countries of one type (of the capitalists and workers of these nations) by those of another. If the spirit of Marx were respected rather than his texts, this last aspect might appear more important. Marxist theory, however, even in its commonest form, almost always confined to a few concepts from the first volume of *Capital*, is an interpretation of classical theory and therefore is structurally more capable of explaining phenomena in

underdeveloped countries than is neoclassical theory.

The argument put forward in the present chapter has been that the developed countries of today generated and changed economic theory in face of the modification of their problems. Economists in the underdeveloped countries of today swung from one theory to another when the economists of the developed countries did so. These changes of theory in relation to the problems of one type of country, and irrespective of the country's own situation in a different type, are doubtless explained by the differences in economic and scientific development between one group and the other. The behaviour of economists in the underdeveloped countries is explicable because they live intellectually outside their own country. To this has contributed their theory of modernization—taking as a model country the country that is most advanced, whether capitalist or socialist—which has imbued them with the idea that conditions in developing countries can only be transient, and has invited them to follow the path signposted by that model. For want of a model, in contrast, the more advanced countries had to map out their own courses, in relation to their own problems and historical conditions, in order to continue making progress in science.

## IV

### The example of agronomics

It was explained above that scientific progress is related to the changing needs of the countries of origin of new theories, because inevitably the interest or indifference of scientists reflects—almost always unconsciously—the constellation of problems of their area of work and of their country. According to Weizsacker (1974, pp. 10 to 18), "the biotope of a scientific idea is made up of the ideas that exist alongside it. The survival of a species reveals, so to speak, the existence of an ecological niche. The survival of a paradigm

reveals a structure of reality". As in other processes of Darwinian evolution, scientific progress, rather than a series of cumulative steps towards "truth", is a process of changes in no teleological order, a series of revolutions which break with the older theory instead of surpassing it in the Hegelian sense.

The foregoing chapter shows this dynamics at work in economic theory. The same holds good for agronomics. Although agronomists feel themselves more nearly related to the natural sciences, the methodology of their science more

closely resembles that of the social sciences, since in both cases the phenomena depend upon countless interacting factors, and theories and experiments that focus upon only isolated factors are of very little explanatory value. Keynes (1971, X, p. 186) stresses this point when he relates and comments on the observations of Max Planck with respect to these methodological differences: "Professor Planck of Berlin, the famous originator of Quantum Theory, once remarked to me that in early life he had thought of studying economics, but had found it too difficult. Professor Planck could easily master the whole corpus of mathematical economics in a few days ... but the amalgam of logic and intuition, and the wide knowledge of facts, most of which are not precise, which is required for economic interpretation in its highest form, is, quite truly, overwhelmingly difficult for those whose gift mainly consists in the power to imagine and pursue to their furthest points the implications and prior conditions of comparatively simple facts...". The tendency to mathematicize economics and the reductionist approach in agronomics, irrespective of the problem that has to be resolved, are a major source of both the progress and the social unproductiveness of the two sciences.

### 1. *Evolution of agronomics*

The evolution of agronomics is similar in many respects to that of economic theory. Up to the mid-nineteenth century the guiding principle of agronomic research was the theory of humus or vegetable mould: the earth was regarded as the stomach of plants; the biological life in the soil converted organic material into food for the crops and the formation of vegetable mould kept these nutrients at the disposal of the plants by preventing leaching. Agricultural technology fostered these natural processes, inasmuch as it consisted in preserving and increasing the vegetable mould in the soil.

The theory of humus, linked with the names of Dombasle, Hasenfratz, de Saussure, Sennebier and Thaer, was discarded when first Sprengel and later Justus von Liebig maintained that the minerals to be found in ash —with the

methods of analysis of the time— and those that escape in the form of gases are all that plants need. Experiments which showed that plants apparently grow well in mineral solutions, devoid of organic matter, corroborated the new minerals theory. A change of theory is generally characterized by a change of slogan: instead of "feed the soil with organic matter", "feed the plants with salts".

The knowledge of chemistry developed in the eighteenth century led to the installation of the chemical industry, especially in Germany. Von Liebig placed this knowledge and this productive capacity at the service of agriculture; his new theory of agronomics was a response to a new situation in the industrialized countries and, without this new situation, it could hardly have been a success. The findings of research under the old theory on the effects of organic matter and the formation of the topsoil were forgotten, and their place was taken by research on levels of application of mineral fertilizers. The new theory had so resounding a success that few agronomists know that Justus von Liebig, the "father of modern agronomics", was also its first critic, since he had observed that the new way of feeding plants detracted from their vitality and increased the incidence of pests (von Liebig, 1979, pp- 95 to 98). His contemporary disciples still think that this disadvantage of feeding plants with chemical substances can be counteracted by greater use of chemical products in the form of pesticides.

Although the theoretical and ideological bases of modern agriculture date from the last century, only since its mass application as from the end of the 1930s in the United States and ten years later in Europe has it been possible to determine the potential viability of this agriculture over the long term. In Europe, where in order to compensate for a per capita land endowment equivalent to barely half that of the United States it is customary to apply twice as much energy in the form of inputs per hectare (*Global 2000*, pp. 261 to 280), there are increasing numbers who doubt whether this type of agriculture will be viable for another 20 to 50 years. Just as a "return to the classical school" is observable among economists, opinion is swerving back to many of the technologies of the former organic agriculture.



## 2. *The drawbacks of imported agricultural technologies*

An attempt will next be made to show the drawbacks of the minerals theory as well as of the humus theory, in underdeveloped countries, since both theories, different though they are, reflect the social and ecological conditions of their countries of origin. The argument will begin with a criticism of the economic repercussions of modern agriculture and will go on to its ecological sequels. This second part of the argument is incomplete, since it singles out only the difference between temperate zones and the humid tropics, whereas the majority of the underdeveloped countries are located in the tropics, but not exactly in the humid tropical zone. The discussion is confined to this sector for methodological reasons, inasmuch as it is easier to emphasize the special relation of modern agriculture with the temperate zones by contrasting it with the performance of vegetation in the humid tropics. The dry or semi-dry tropics, at least as regards soils, are not so very different from the temperate zones, and the dry season fulfils some of the ecological functions of winter. Analysis of modern agriculture in the dry tropics should include the subject of salinization of soils and the difficulty of applying artificial fertilizers when the amount of rainfall may vary greatly from one year to the next.

### a) *The economic disadvantages*

Clement *et al.* (1973, p. 23) begin their book with the assertion that agriculture is an artificialization of the environment and its progress is always in the direction of a triumph over natural conditions. This orientation contrasts with the former view of progress in agronomics as an ever-improving imitation and intensification of the processes of nature. Technologies conceived in the light of the new principle call for more and more capital and for cheap energy, their ideal being an automatic lettuce factory that has become independent of weather conditions. In *Global 2000* it is stated that increases in productivity in the past generally depended upon a marked increase in

input of fuels. In the United States, inputs to produce 1 000 calories of maize rose between 1945 and 1977 by 33% according to Pimental *et alii* (1973, p. 444) and according to Hampicke (1977, p. 53), using the same data but different conversion coefficients, by 78%. In West Germany consumption of energy in agriculture doubled between 1950 and 1975 (Weber, 1979). To produce one unit of energy in vegetables by traditional methods costs 0.05 to 0.1 units of energy, while production in greenhouses in Northern Europe costs 572 units (Luenzer, 1982, p. 53). Agriculture of this type is from every point of view less appropriate in countries where capital is in very short supply. Consequently, for many of the poorer countries the achievements of modern agriculture are virtually meaningless.

### b) *Drawbacks of the use of chemical fertilizers in the humid tropics*

In soil development as related to climatic factors, the rate at which weathering takes place depends upon the temperature and humidity of the environment. Because of their high temperatures and heavy rainfall, in the humid tropics the pace of weathering is a hundred times faster than in temperate zones (Weischet, 1981, p. 20). The soils typical of the humid tropics are therefore much more developed than temperate-zone soils, except in flood areas and highlands, where weathering is slower, and in the case of young soils, the product of recent volcanic activity or of landslides that have swept them down from high altitudes. In the weathering process the parent rock disintegrates and ultimately forms a new element, clay, which is a laminar crystal. In temperate zones, stones which indicate the original material are usually found, almost always only a little below the surface; tropical soils are generally much deeper, with no traces of the parent rock. Weathering likewise alters the state of the clay. At first, clay soils are formed mainly in three layers (ilutes, vermiculites, montmorillonites), but the high temperatures and rates of precipitation desilicate them and lead to the formation of clay soils with two layers (kaolinites). As a result of these processes, in temperate zones as a rule

chiefly three-layer clay soils are found, whereas in soils in the humid tropics those of two layers predominate.

The difference in the quantity of traces of the original parent rock in mineralization processes, plus the difference in precipitation, plus the difference in types of clay, explain why the minerals theory gives better results in temperate-zone soils than in tropical soils. The weathering of the traces of the parent rock in temperate zones affords mineral nutrients which in tropical soils are no longer present. The mineral nutrients existing in the soil and those added by man will be retained in a larger proportion and washed out to a lesser extent in temperate soils, because the lower temperatures have less mineralizing effect and because the material mineralized is washed out less by the lower precipitations. Clay soils can absorb in their negative-load fibres the positive mineral ions and prevent them from sinking to the subsoil, out of reach of the plants. This retention capacity —quantified as capacity for cation exchange— is normally from three to ten times greater in three-layer clays than in those with two layers. Because of the difference in precipitation and in clays, application of chemical fertilizers has to be on a bigger scale in humid tropical areas, and may even prove useless, because for want of cation exchange capacity most of the chemical product is leached with the next fall of tropical rain. It is not only research on chemical fertilizers that is of little significance in a large part of the tropics, but also research leading to the production of improved seeds, which make a positive response to copious doses of chemical fertilizers. The most notable agricultural research effort, known as the green revolution, has doubled the harvests in industrialized countries, and they continue to increase. In tropical countries, on the other hand, the increases obtained when these seeds were used in the areas most appropriate in respect of humidity and cultivation subsequently came almost to a standstill, despite the continuous increases in inputs such as chemical fertilizers and machinery (Weischet, 1981, pp. 11 to 13). The seeds which were at first called "high-yield varieties" and then, more modestly, "improved seeds" ought to be designated —if researchers were disposed to replace their ideological labels

by others of a more technical character— "high-response seeds" (Mooney, 1981, p. 54): highly responsive, that is, to optimum conditions of humidity, soil management and application of chemicals (fertilizer and biocides). The list of optimum conditions for these seeds is a description of the conditions prevailing on the experimental farms of agronomists in temperate zones. Where these conditions are not present, the response of the improved seeds, the product of very costly research, is not nearly so good as that of the local peasants' seeds (Muñoz *et alii*, 1976). When the rainy season is short and precipitation uncertain, when soils are rather shallow and the ground is sloping, it would be irrational for the peasant farmer to use improved seed even if he had the economic capacity to buy the commercial inputs which they require.

Justus von Liebig has already noted that modern crops are less pest-resistant than those fertilized by the traditional methods. Few agronomists are aware of this phenomenon, because of the difficulty of observing it on the relatively small experimental stations where agronomists play at the exact sciences. This general problem becomes more acute in the humid tropics where there is no winter or dry season to keep down pests. In temperate zones insecticides now have to complement the effect of low temperatures, since the natural equilibrium attained in past centuries by the greater heterogeneity of crops, grown in smaller fields, encircled by bushes and hedges, has been destroyed by industrial agriculture. In the humid tropics, to combat the pests attacking the less resistant modern crops, only pesticides would be available; expense apart, experience with respect to the increasing resistance of insects to pesticides of every type suggests that to attempt their use would be to fight a losing battle.

In the humid tropics nature defends itself with the greater heterogeneity of the vegetation and the distance between one plant and another of the same species. On the long journey from one plant to another an insect runs much more risk of falling a prey to its natural enemies. The machinery pertaining to modern agricultural technology, specialized in the expeditious harvesting of large single-crop areas, has not yet an incorporated intelligence —as much modern

industrial machinery has— to enable it to work with heterogeneous crops and thus adapt itself to the requirements of tropical agriculture. The lesser heterogeneity of natural vegetation in temperate zones would seem to suggest that modern single-crop agriculture is more viable there than in the humid tropics. Because of this linkage of modern agriculture with temperate zones, a region that produces forests with a biomass 2.5 times greater than the woods of the temperate zones is regarded by agronomists as so infertile that it can be left at the disposal of stock-farmers and their cows. The characteristics of a specific technology are confused with the characteristics of a zone. Today nobody would say, as the Romans said, that the areas north of the Alps were, generally speaking, infertile because they could not be tilled with the techniques of the Egyptian plough, which in the deforested Mediterranean basin had given good results. But in the humid tropics infertility is still identified with the ecological characteristics of this zone instead of with a technology that is inappropriate for it.

c) *Drawbacks of organic technologies in the humid tropics*

Because of the similarities between the situation of the underdeveloped countries today and that of the industrialized countries prior to the second industrial revolution, the humus theory with its appended technologies seems to present several positive aspects. It offers a whole gamut of technologies, ranging from the capital-intensive to the labour-intensive, and utilizes mainly local materials, which reduces the vulnerability of a region. For a variety of reasons, crops grown under a system of organic agriculture are generally somewhat more dependable, which suits a rural population that has no guarantee of survival and therefore does not aim at maximum average output over the years, with good harvests in the fat years and poor ones in the lean years, but tries to reduce the risk of bad harvests on the basis of small-scale but stable production.

Adequate applications of organic material increase the fauna in the soil, and this degrades the organic material and leads to formation of the humus-clay complex, in which the organic

and the inorganic are closely intermingled. These soils, of a spongy texture, with 50% of additives and 50% of open spaces, a third of which fill up with water, afford optimum conditions for the growth of plants. The high cation exchange capacity of the humus could make up for the low exchange capacity of the tropical clays. This solution has its limitations, however, due to the rapid degradation of humus in conditions of high temperature and humidity. If from 10° to 20°C decomposition advances slowly, as from 20°C it increases exponentially, and at 30°C proceeds at a rate four times higher than at 20°C. To keep the humus at the same level it would be necessary to apply ten times the amount of organic material required in temperate zones (Weischet, 1977, pp. 14 to 96). Notwithstanding the more abundant production of biomass in the humid tropics, in many cases the application of technologies suggested by the humus theory will at least be more costly than in temperate zones.

Despite their disadvantages in the humid tropics, organic technologies seem of much more interest in underdeveloped countries than chemical technologies. In this connection the incipient switch-over in some industrialized countries towards research on and practice of organic technologies might be useful for tropical agriculture, but it is not a solution. The principal source from which to learn how to create an efficient and durable method of agriculture in tropical conditions would be an analysis in depth of traditional techniques, especially in regions that have been densely populated for centuries. These techniques have demonstrated their long-term viability, and agronomists, after obtaining a grasp of the details, should attempt to do the same thing, but with the full support of a technology which incorporates the latest scientific knowledge. The description of the drawbacks of agricultural theories imported from regions with different ecological and social conditions has mainly served to point out that the scant social utility of the dominating economic theory is not an isolated case: the same thing happens in agronomics and perhaps in many other sciences. Comparison between the economic and agronomic arguments shows that although the metatheoretical structure in both sciences betrays the same deficiencies, the

technical argument in each case is entirely different. Anyone wishing to make the same sort of demonstration in respect of other disciplines,

should abandon general discussion and penetrate into the technical arguments specific to each field.

## V

### Conclusions

The attempt to explain the establishment of the latest dominant theories in economics and agronomics signifies a rigorous examination of the metatheory propounded, i.e., that the dominant theories in various disciplines reflect the conditions prevailing in the countries where they originated. Nevertheless, it is unlikely to find acceptance, not because it would imply a radical change in ways of thinking, as regards both the specific theories or disciplines and the objective of science in general, but mainly because in science there is none of the instantaneous rationality which withdraws from positions when it sees them to be justly criticized. Lakatos (1974, p. 74) is referring to this when he asserts: "One must understand that even an adversary who appears to be defeated may return to a strong position." Max Planck (1948, p. 22) had already noted that "new scientific truths ... gain acceptance when their opponents are dead".

In some cases the differences between the industrialized countries themselves and between the creators of theories give rise to different theories and classifications and other countries have at least the opportunity to make an

intelligent selection between two or more options, even though none may completely meet their national needs. In disciplines in which not only a theory has been imported, but also the definition of the problem to be resolved and the means of resolving it the phenomenon of underdeveloped but developing science does not—apparently—arise, because the whole corpus has been imported and that in itself is internally coherent; a case in point might be civil engineering. But when an increase in the price of some input makes it necessary to resort to local materials not envisaged in traditional technologies, or when a rise in fuel costs prevents the correction of flows in the architectonic conception by artificial cooling or heating, the prescientific relation between types of knowledge and types of climate, landscape and environment is re-established. Or rather, this specificity of knowledge would be established, always providing that scientists in the country concerned had the intellectual capacity to perceive their country's specificity and the creative capacity to make an effective response with knowledge and technologies.

### *Bibliography*

- Alberdi, J.B. (1886), *Obras completas de J.B. Alberdi* (8 volumes), Buenos Aires, La Tribuna Nacional.
- (1916), *Estudios económicos. Interpretación económica de la historia política de Argentina y de Sud-América*, Buenos Aires, La Cultura Argentina.
- Aubert, C. (1981), Agriculture: "La voie chinoise reste a trouver", in *Bulletin d'information du Département d'Economie et Sociologie Rurale* (INRA), No. 7, Paris, December, pp. 79 to 120.
- Blaug, M. (1964), *Economic theory in retrospect*, London, Macmillan.
- Bronfenbrenner, M. (1971), "The structure of revolutions in economic thought", in *History of political economy*, **III**, 1, Second quarter, pp. 136 to 151.
- (1976), "Predatory poverty on the offensive: The UNCTAD record", in *Economic Development and Cultural Change*, **XXIV**, 4, July, pp. 825 to 831.

- Cannan, E. (1903), *A history of the theories of production and distribution in English political economy from 1776-1848*, London, Percival Se Son.
- Cardoso, F.H. (1977), "The originality of a copy: CEPAL and the idea of development", in *CI-PrfL Review*, No. 4, Second semester, pp. 7 to 40.
- Clark, J.B. (1891), "Distribution as determined by the law of rent", in *Quarterly journal of economics*, April, pp. 229 to 318.
- Clement, J.M. and J. Lamich (1973), *La agricultura del futuro*, Barcelona, Gea.
- Dubiei, I. (1981), "'El capital humano' después de la teoría neoclásica: los profesionales en los países subdesarrollados", in *Revista latinoamericana de estudios educativos*, XI, 4, pp. 35 to 52.
- (1982), "Educación superior y campesinos: Los Licenciados e Ingenieros", in *Revista latinoamericana de estudios educativos*, XII, Third semester, pp. 97 to 122.
- (1984), *Der klassische kern der lateinamerikanischen entwicklungs theorie* (The classical essence of Latin American development theory), Munich, Fink-Verlag.
- Duerr, E. (1967), "Methodische und politische probleme der berechnung des entwicklungshilfebedarfs", in *ORDO, fahrhuch fuer die ordnung von wirtschaft und gessesellschaft*, XVIII, pp. 207 to 250.
- Gilboy, E.W. (1939), "A reply (to A.J. Duncan, "The propensity to consume: a comment on a previous paper")", in *Quarterly Journal of Economics*, LUI, August, pp. 633 to 638.
- Global 2000 (1980), *Global 2000 Report to the President*, compiled by the Council on Environmental Quality and the United States Department of State, Washington, D.C.
- Goodwin, G.D.W. (1972), "Marginalism moves to the New World", in *History of Political Economy*, IV, 2, Third quarter, pp. 550 to 570.
- Haberler, G. (1957), "Los términos de intercambio y el desarrollo económico", in H.S. Ellis (comp.), *El desarrollo y América Latina*, Mexico, Fondo de Cultura Económica, pp. 325 to 351. ("Terms of trade and economic development", paper presented at Roundtable of the International Economic Association, Rio de Janeiro, August 1957. Republished in English in 1961.)
- (1964), "An assessment of the current relevance of the theory of comparative advantage to agricultural production and trades", in *International Journal of Agrarian Affairs*, IV, 3, May, pp. 130 to 149.
- Hampicke, U. (1977), *Landwirtschaft und umwelt* [Agriculture and environment!], Urbs et Regio series, Kassel, Gesamthochschule.
- Harrod, R.F. (1938), "Scope and method of economics", Presidential address before section F of the British Association for the Advancement of Science, in *Economic Journal*, September, pp. 383 to 412.
- Hicks, J.R. (1939), "The foundations of welfare economics", in *Economic Journal*, IL, December, pp. 696 to 712.
- (1957), *Value and capital, an inquiry into some fundamental principles of economic theory*, Oxford, Clarendon Press.
- (1975), "The scope and status of welfare economics", in *Oxford economic papers*, XXVII, 3, November, pp. 307 to 326.
- Hobsbawm, E.J. (1969), *Industry and empire, an economic history of Britain since 1750*, Harmondsworth, Middlesex: Penguin Books.
- Imlah, A.H. (1950), "The terms of trade of the United Kingdom, 1798-1913", in *Journal of Economic History*, X, pp. 170 to 194.
- Ingram, J.K. (1878), *"The present position and prospects of political economy", being the introductory address delivered in the Section of Economic Science and Statistics of the British Association for the Advancement of Science at its meeting in Dublin in 1878*, London, Longmans & Co.
- Kempton, M. (1981), "The message of the insider", in *The New York Review of Books*, XXVIII, 14, September, pp. 24 to 28.
- Keynes, J.M. (1971), *The collected writings of John Maynard Keynes*, London/Basingstoke, Macmillan and St. Martin's Press, 14 volumes.
- Krieg, P. (1984), *Der Mensch stirbt nicht am brot allein (Man does not die by bread alone)*, Wuppertal, Hammer.
- Kuczynski, J. (1974), *Wissenschaft und gesellschaft — studien und essays u'ber sechs jahrtausende* [Science and society. Studies and essays on six thousand years], Cologne, Paht-Rugenstein.
- Kuhn, T.S. (1971), *La estructura de las revoluciones científicas*, México, D.F., Fondo de Cultura Económica [First published in English in 1962].
- (1978), *Die entstehung des neuen [The genesis of new matter]*, Frankfurt, Suhrkamp.
- Lakatos, I. (1974), "Die geschichte der wissenschaft und ihre rationalen rekonstruktionen", in Diederich, W. (comp.), *Theorien der wissenschaftsgeschichte*, Frankfurt, Suhrkamp, pp. 55 to 119.
- Leontief, W. (1966), *The structure of the American economy. 1919-1939*, New York, Oxford University Press.
- Lewis, W.A. (1954), "Economic development with unlimited supplies of labour", *Manchester School of Economic and Social Studies*, XXII, 2, May, pp. 139 to 191.
- Liebig, J. von (1973), *Es ist dies ja die spitze meines lebens* [This is the peak of my life], Langenburg, Verlag Boden und Gesundheit.
- Luenzer, I. (1982), *Koventioneller und okologischer landbau* [Conventional and ecological agriculture!], in W. Krauth and I. Luenzer (comps.) *Okobau und welthunger* [Ecological agriculture and hunger in the world], Hamburg, Rowohlt, pp. 31 to 60.
- Medina Echavarría, J. (1955), "Three sociological aspects of economic development", in *Economic Review of Latin America*, special issue, Bogota, August, pp. 56 to 65.
- Mill, J.S. (1909), *Principles of political economy*, London, etc., Longmans Green.
- Mooney, R.R. (1981), *Saatmuttis und welthunger* [English title: Seeds of the earth], Hamburg, Rowohlt.
- Muñoz, O. A., et alii (1976), "Mejoramiento del maíz en el CIAMÍIC-II, aplicación de la base germo-plásmica y su aprovechamiento considerando caracteres agronómicos y rendimiento", *Memoria del sexto congreso nacional de fitogenética*, Monterrey, Sociedad Mexicana de Filogenética.
- Nye, J.S. (1972), "La UNCTAD bajo Prebisch: La estructura de influencia", in *Foro Internacional*, XLVII, January-February, pp. 308 to 339.
- O'Brien, D.P. (1975), *The classical economists*, Oxford, Clarendon Press.
- Pimentel, D., et alii (1973), "Food production and energy crisis", in *Science*, Vol. 182.
- Planck, M. (1948), *Wissenschaftliche selbstbiographie*, Leipzig, Barch [republished in 1978 on the basis of an English translation by CONACYT, under the title "Ensayos científicos", México, D.F.].
- Pollock, D.H. (1978), "Some changes in United States attitudes towards CEPAL over the past 30 years", in *CUPAL Review*, Second semester, pp. 57 to 80.
- Powelson, J.P. (1977), "The strange persistence of the "terms of trade" argument", in *Inter-American Economic Affairs*, XXX, 4, Second quarter, pp. 17 to 27.
- Prebisch, R. (1962), "The economic development of Latin America and its principal problems", in *Economic Bulletin for Latin America*, VII, 1, February. [Reprint of an essay presented to ECLAC in 1948. Also published in *Revista brasileira de*

- economía*, III, 1949 and in *HI trimestre económico*, XVI, 1949, and as a United Nations publication, Sales No.: 1950.II.C-2.)
- (1963), *Hacia una dinámica del desarrollo latinoamericano*, Mexico, Fondo de Cultura Económica, English version: *Towards a dynamic development policy for Latin America*, United Nations publication, Sales No.: 64.II.G.4.
- (1979), "The neoclassical theories of economic liberalism", in *CEPAL Review*, No. 7, April, pp. 167-188.
- Ricardo, D. (1951), *The works and correspondence of David Ricardo*, compiled by Piero Sraffa with the collaboration of M. Dobb, 10 vols., Cambridge, Cambridge University Press.
- Robbins, L. (1974), *Teoría del desarrollo económico en la historia del pensamiento económico*, Barcelona, Gustavo Gil.
- Schumpeter, J. (1908), *Das wesen und der hauptinhalt der theoretischen nationalökonomie*, Leipzig, Dunker & Humblot.
- (1911), *Théorie der wirtschaftlichen entwicklung: eine untersuchung ueber unternehmergeinn, kapital, kredit, zins and konjunkturzyklus*, Berlin.
- (1954), *The history of economic analysis*. New York/Oxford, Oxford University Press.
- (1961), *The theory of economic development*. New York/Oxford, Oxford University Press (English edition of the 1911 text).
- Schwartz, J.T. (1961), *Lectures on the mathematical method in analytical economics*. New York, Gordon & Breach.
- Smith, A. (1937), *The Wealth of Nations*, New York, Modern Library.
- Sneed, J.D. (1971), *The logical structure of mathematical physics*, Dordrecht, Reidel.
- Sraffa, P. (1926), "The laws of return under competitive conditions", in *economic Journal*, XXXVI, December.
- Steger, H.A. (1971), *Soziologie in und über-Lateinamerika*, in H.A. Steger (comp.), *Die aktuelle situation Lateinamerikas*, Frankfurt, Athenäum.
- Stegmüller, W. (1973), *Problème und resultate der wissenschaftstheorie*, 2. *Theoriestruktur und theoriendynamik*, Berlin/Heidelberg/New York, Springer.
- (1974), "Theoriendynamik und logisches verstandnis", in W. Diederich (comp.), *Theorien der wissenschaftsgeschichte-beiträge zur diachronen teissenschaftstheorie*, Frankfurt, Suhrkamp.
- (1975), "Die evolution des wissens: Nichtkumulativer wissensfortschritt und theoriendynamik - zur théorie von Thomas Kuhn", in W. Stegmüller (comp.), *Hauptströmungen der gegenwartsphtosophie*, vol. 2, Stuttgart, Kroner.
- Stigler, G.J. (1969), "Has economics a useful past?" in *History of political economy*, I, 2, Autumn, pp. 217 to 230.
- (1972), "Adoption of the marginal utility theory", in *History of Political Economy*, VI, 2, Third quarter, pp. 571 to 586.
- Weischedel, W. (1977), *Die ökologische benachteiligung der tropen [The ecological disadvantages of the tropics]*, Stuttgart, Teubner.
- (1981), *Die grüne revolution [The green revolution]*, Paderborn, Schöningh and Munich, Blutenburg-Verlag.
- Weizsäcker, C.F. von (1974), *Wissenschaftsgeschichte als wissenschaftstheorie [History of science as a theory of science]*. *Stiftungsverband für die Deutsche wissenschaft*, Special supplement, September, pp. 5 to 11.
- Zea, L. (1968), *El positivismo en México —nacimiento, apogeo y decadencia*, Mexico, D.F., Fondo de Cultura Económica.