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A Structural Economic Dynamic Approach to Technological Gaps

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Abstract

In this paper we intend to show that the structural economic dynamic approach can provide new insights to a synthesis to the debate between the Structuralist paradigm and the outward oriented view. It is argued that both views failed to recognise both the role of demand and the particular structural dynamics of underdeveloped economies in the diffusion and absorption of technological progress. From a Pasinettian approach, which considers technical change and the evolution of preferences, we develop an analysis that attempts to capture the main channels of the North-South interdependence.

Keywords: Structural Economic Dynamics, Uneven Development, North-South Trade, Technical Progress, Engel's Law.
JEL Classification Number: O19, F12

1. Introduction

Nowadays it is widely accepted that the main benefit to a country from participating in the international affairs is the access to international knowledge [Pasinetti (1981, 1993), Araujo and Teixeira (2003a), Grossman and Helpman (1991), Lucas (2000)]. Foreign trade is one of the channels for technological diffusion. However, as growth in the national income and in

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the volume of foreign trade are closely related for most of the nations, the latter is sometimes misconceived as the first source of gains from relations among countries[1].

Since Solow (1956) published his seminal work, technical progress is best described as the main engine of economic growth. It is then reasonable to ask why the superiority of international learning over foreign trade in generating economic growth was not recognised earlier[2]. A possible answer is given by Metcalfe (1987, p.167). According to him, "the economic analysis of technical change is not a straightforward matter. The familiar tools of equilibrium economics are best suited to discussing the long-run effects of new products and methods of production; they are not well suited to analysis of the disequilibrium processes by which new technologies are generated, improved and absorbed into the economic structure."

In fact, the suspicious that learning would the first source of benefits from international economic relations, being the disparities of comparative costs and endowments only a secondary one, has been around for some time. Pasinetti (see above) was one of the contemporary authors to stress this point. An important characteristic of his approach that lead him to this conclusion is its focus on the structural economic dynamics, which is performed in a multi-sector framework. His emphasis on demand composition brings out an important qualitative improvement in relation to the aggregated models, which cannot possibly take into account the composition of consumption demand since any increase in per capita income is transformed into a higher level of consumption of the same kind[3].

In this paper we deal with uneven development in the sense that there is a marked and persistent difference in the levels and rates of growth between different sectors of the economy as well as the increasing gap in the GNP per capita between rich nations (North) and the poor ones (South). We also add a number of features, including technological dependence, different compositions of demand, structures of production and employment.

[1] The celebrated 'principle of static comparative cost advantage' of David Ricardo (1821) is generally used to support this idea. Despite the fact that he recognised some of the limitations of foreign trade, his principle has been generally used as a defence of unrestricted free commerce, exaggerating its benefits and disregarding its dynamic effects over the structure of the economies.

[2] Schumpeter (1934) had already emphasised that the technological progress is the engine of economic growth. The neo-Schumpeterian School has been focusing on the determinants of creation and diffusion of technological progress. Bresnahan and Trajtenberg (1995, pp.83-84) claim that economists have known for a long time that technical change is the single most important force driving the secular process of growth. Yet, relatively little progress has been made in accounting for the Solow's residual of aggregated production functions, largely because economic theory tends to treat all forms of technical change in the same diffuse manner.

[3] It is implicit in these models a well-known and strict definition of balanced growth: growth of a non-inflationary, full-capacity utilisation with all sectors growing at the same rate. It is somewhat a Von Neumann type of steady growth.

Our aim is to show that the structural economic dynamic approach can provide new insights to a syntheses for the debate between the Structuralist paradigm and the outward-oriented view. It is argued that both views failed to recognise the role played by demand in the diffusion and absorption of technological progress in underdeveloped economies.

On one hand, the import substitution strategies (ISS), by adopting the argument of the infant industry protection, did not create an environment favourable to absorption of international learning [See Bruton (1998)]. In principle, absorption of technological knowledge could lead underdeveloped countries to catch up to the technological frontier. Besides, the Structuralist school failed to recognise that the evolving patterns of demand represent a constraint for changing the dynamic structures of underdeveloped economies.

On the other hand, the export-led growth (ELG) view did not succeed to appreciate that the diffusion and absorption of international knowledge requires conditions that are particular to the structure of each economy, which is also conditioned to the role of demand. This failure means that outward orientation as such also needs substantial qualification and redirection, as pointed out by Bruton (1998, p. 904) [4].

Here, following a structural economic dynamic approach we emphasise that gains from international diffusion of technical progress are conditioned to the inherent patterns of human needs and preferences since they give rise to entirely different compositions of consumer demand, and therefore different structures of production and employment in each country. That is, the diffusion and absorption of technical progress are subject to different economic structures particular to developed and underdeveloped economies[5].

Following these lines of investigation, we show that issues related to the diffusion and absorption of technological progress under alternative trade regimes can bring new insights to understand the phenomena of uneven development. The paper stresses the importance of the concepts of technological distance and the capability to assimilate knowledge spillovers in the development process, but always conditioned to the dynamic structure of the economies and

[4] For an interesting comparison between the import substitution paradigm and the export-oriented approach see Bruton (1998) and Edwards (1993). Ardeni and Wright's (1992) reappraisal of the Prebisch-Singer hypothesis of the deterioration in the terms of trade sheds light on earlier discussion on this matter. The justification for both strategies seemed to rest on the implicit assumption that through changes in the structure of the economy, induced by government policies or by market forces, international learning would occur automatically and resolve the difficulties. Learning, however, proved to be more difficult since the order of priority in the expansion of demand is a strict limitation to the diffusion and absorption of international technology [see Pasinetti (1981, 1993)]. Besides, the lack of qualification of the labour force in underdeveloped countries was revealed to be a serious constraint to the absorption and diffusion of technological progress.

to the evolving patterns of demand. Section 2 deals with the dynamics of technological gaps. Section 3 presents a number of issues related to the barriers of diffusion and absorption of technical progress in underdeveloped countries. In section 4 further aspects of structuralism and export-led analysis are considered. Section 5 concludes.

2. The Dynamics of Technological Gaps and The Exported Led Growth

One of the stylised facts about the relations among rich and poor countries is the widening gap between their per capita incomes. According to Dutt (2002, p. 369), "an examination of the recent literature on technology transfers suggests that convergence is not a foregone conclusion, and that it is much more likely that convergence is likely to take place within rich countries, with many of the poorer countries left out of the process."

In the neo-classical theory of growth there is no room for a widening gap since the exogenous growth rate of technical progress determines the overall growth rate. According to Fagerberg (1994, p.1147), in this theory "technology is assumed to be a public good and subsequent empirical research showed that a theory based on this premise explains very little of the observed differences in growth across countries."

Denying the importance of changes in the sectoral composition, this model focuses on issues that can be addressed within a limited scope of a one-sector framework and considers that the only barrier to diffusion of technology from advanced to underdeveloped countries is the cost of imitation and adaptation. Barro and Sala-i-Martin (1999, p.266) reported that "(...) follower countries tend to catch up to the leaders because imitation and implementations of discoveries are cheaper than innovation. This mechanism tend to generate convergence even if diminishing returns to capital or to R&D do not apply."[6]

Grossman and Helpman (1991, p. 238) have built models in which a higher degree of openness allows less developed countries (LDC's) to adopt technologies developed in the advanced nations at a faster rate and thus to grow, in equilibrium, more rapidly than with a lower degree of openness. According to them "countries that trade in world markets invariably learn a great deal about innovative products and about the novel methods that are being used to produce older goods." In the same vein Lucas (2000) relies on the mechanism

[5] Of course there is some reciprocity, that is, the technological absorption is determined by the structure of the economy but when technological change is effectively added to the productivity process it affects the structure of the economy as will be shown in the next sections.

[6] This reasoning can be considered a benchmark for the revival of the neo-classical theory of growth, known as the new growth theory. Since the evidence had shown that technology could not be treated as a public good, the

of international learning for convergence: poor countries are simply to assume to learn from the experience of rich countries and to catch up to them.

The central point of the studies above is that imitation and adaptation of technologies is cheaper than finance R&D. Being these analysis carried out with a small number of sectors, no attention is given to the particular structures of economies with different levels of per capita income[7]. The technical progress attained in advanced countries is easily transferred to underdeveloped ones since it is implicit assumed that the structure of the economies is the same everywhere. According to Aghion[8] (2002, p. 855), "Recent growth theories have been concerned mainly with the analysis of technical change and 'aggregate' growth in economies with identical agents. This precludes any analysis of the relationship between growth and inequality".

The advent of the 'New Economy', understood as the rapid advances of information and communication technology extending labour productivity, is a striking example of the particular nature of technological progress that is being generated in developed countries and which is hardly adopted by underdeveloped nations. Acemoglu (2002, p.63) points out that "(...) new technologies developed in the rich economies are typically 'too skill-biased' for LDC, the recent acceleration in skill bias could have negative implications for the LDCs". According to him the bias of the technical progress is mainly determined by the qualification of the available labour force. In this vein skilled biased technical progress was generated in advanced countries because there was a supply of skilled workers in those countries. Of course this is not the scenario observed in underdeveloped nations, where the labour force is characterised by low qualification[9].

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mainstream economics was challenged to justify the theoretical convergence of per capita income that is hardly seen in practice if we consider developed and underdeveloped nations.

[7] The ELG prescriptions to underdeveloped countries relies heavily on the above mentioned frameworks. Thirlwall (1997, p. 379) reported that "There is a rich literature on export-led growth models (including Hicks supermultiplier), incorporating the notion of circular and cumulative causation (Myrdal, 1957) working through induced investment, embodied technical progress, learning by doing, scale of economies, and so on, that will produce rapid productivity growth in countries where exports and output are growing fast."

[8] He is dealing with the dynamics of wage inequality in developed economies. However, his concern with the notion of major technological change with particular reference to the new General Purpose Technology in Communication and information (GPT) that, according to him, have diffused throughout the industrialised countries is an interesting starting point to reconsider issues related to the New Economy and its significant impact on the 'evolution' of the North-South inequality.

[9] One could figure out that skilled biased technical progress would produce a skilled labour force in the less developed countries (LDC's). But this is exactly the contrary path observed in advanced countries. Another important characteristic of technological diffusion raised by Acemoglu (2002) is that a new technology is adopted only if is more profitable than the available technologies.

In fact, a number of recent contributors have emphasised the role of skill resources. It is quite obvious that the process of technology absorption is affected by the skills of the labour force and this is a crucial constraint on the selection of the technological profile to be implemented by a developing economy. Parente (1994), studying technology adoption, learning by doing and economic growth, stresses that adoption costs may well take different forms, including institutional and legal constraints. He argues that barriers to technological progress, such as tariffs or import restrictions can explain some of the disparities of income levels across countries. As his approach is supply driven he does not mention that some barriers are imposed by balance of payments constraints.

Gonzalo (2002) focuses on the processes of adoption and maintenance of new technologies as well as their, shall we say, consequences to the growth and development strategies. His main objective is to explain differences in the use of investment goods due to the high costs of implementation of new technologies, given the same available technological menu. Naturally, maintenance costs affect the adoption process.

Adoption costs have been repeatedly invoked to explain technological sclerosis and higher age of capital in developing countries. Of course, an increase in the absorption costs of technological improvements generated abroad not only lower the short run growth rate in the less advanced countries but also decreases the speed of convergence towards the advanced ones. According to Bessen (2002, p.444), "(...) whole new technologies may incur large adoption costs because they involve learning new skills, implementing new forms of organization, and developing complementary investments". Surely, the technological gap increases with the size of the absorption costs.

One of the failures of the ELG view was not to acknowledge that the diffusion and absorption of international knowledge were conditioned to the particular structures of each economy, which is also conditioned to the role of demand. Actually, this strategy does not provide a reasonable explanation for most of the Third World's chronic condition of quasi-stagnation, without any marked tendency toward sustained growth. In the next section, based on extensions of the structural economic dynamic approach, the diffusion and absorption of technical progress are shown not to be as straightforward as reported by these theories. Indeed these processes are affected by the comparative advantage positions of developed and underdeveloped countries and by the pattern of human needs and preferences.

3. Engel's Law as a Constraint to the Diffusion of International Technical Progress

In this section we focus on the evolving patterns of demand and productivity growth as important elements determining the capability of absorption of foreign technical progress. The central idea is that different rates of growth in demand, governed by different income elasticities, and international evolution of tastes critically affect international learning and diffusion of technology[10].

In Pasinetti's (1981) multi-sector model the case of the same structure of economies everywhere corresponds to the assumption that advanced, *A*, and underdeveloped, *U*, nations produce the same set of commodities with different methods of production but the same structure of costs for each single good. This corresponds to the situation in which consumer preferences are homothetic in both environments, giving rise to the same structure for economies with different levels of national income. It is assumed that all commodities can be produced in *A* with 1/10th of the labour they require in *U*. In this case the new methods of production developed in the advanced countries are directly applicable for both countries. It follows that learning new techniques from abroad arises as a straightforward source of gains from international relations.

Although the hypothesis of the same structure of costs in both regions is useful for analytical purposes, the analysis may well be enriched when it is dropped. In this case the nature of human needs and preferences gives rise to entirely different compositions of demand and, therefore, different structures of production and employment, according to the particular levels of real per capita income. Such a phenomena lead us to issues concerning the pattern of specialisation and its effects on the absorption of technological change, which have to be taken into account in addition to the dynamics of technology transfer. In this vein it is possible to consider the effects of the Engel's law on the diffusion and absorption of technological diffusion in a North-South framework where uneven growth is the most probable outcome.

To accomplish this task consider that per capita demand of consumption goods is represented by a set of consumption coefficients: both a_{in} and $a_{i\hat{n}}$ stand for the demand coefficients of final commodity *i*. The former refers to domestic and the latter to foreign demand. In the same vein, $a_{ki,n}$ and $a_{ki,\hat{n}}$ stand for the investment coefficients of capital goods *ki*. The production coefficients of consumption and capital goods are respectively a_{ni} and

[10] We recognise that when technological change is effectively added to the productivity process it affects the structure of the economy as will be considered below.

a_{nki}. The family sector in country *A* is denoted by $\hat{n}$ and the size of population in both countries is related by the coefficient of proportionality ξ. The level of employment in country *U* can be measured by the following expression[11], which is referred as the employment level, *EL*:

$$EL(t) = \sum_{i=1}^{n-1}(a_{in} + \xi\ a_{i\hat{n}})a_{ni} + \sum_{i=1}^{n-1}(a_{ki,n} + \xi\ a_{ki,\hat{n}})a_{nki} \tag{1}$$

Taking the derivative of *EL* with respect to time allows us to evaluate if gains in terms of jobs accruing from exportation compensate losses from importation in the short run. This happens if:

$$\begin{aligned}&\sum_{i=1}^{n-1}\left\{\left[\frac{d}{dt}a_{in}(t) + \xi\frac{d}{dt}a_{i\hat{n}}(t)\right]a_{ni}(t) + [a_{in}(t) + \xi\ a_{i\hat{n}}(t)]\frac{d}{dt}a_{ni}(t)\right\} + \\ &+ \sum_{i=1}^{n-1}\left\{\left[\frac{d}{dt}a_{ki,n}(t) + \xi\frac{d}{dt}a_{ki,\hat{n}}(t)\right]a_{nki}(t) + [a_{k,in}(t) + \xi\ a_{ki\hat{n}}(t)]\frac{d}{dt}a_{nki}(t)\right\} \geq 0\end{aligned} \tag{2}$$

where the dynamical paths of the demand and technical coefficients are given below:

$$a_{in}(t) = a_{in}(0)e^{r_i t} \tag{3}$$

$$a_{i\hat{n}}(t) = a_{i\hat{n}}(0)e^{r_{\hat{i}} t} \tag{4}$$

$$a_{ki,n}(t) = (g + r_i)a_{in}(t) \tag{5}$$

$$a_{ki,\hat{n}}(t) = (g + r_{\hat{i}})a_{i\hat{n}}(t) \tag{6}$$[12]

$$a_{ni}(t) = a_{ni}(0)e^{-(\rho_i + \gamma_i \rho_{\hat{i}})t} \tag{7}$$

$$a_{nki}(t) = a_{nki}(0)e^{-(\rho_{ki} + \gamma_{ki}\rho_{\hat{ki}})t} \tag{8}$$

where r_i is the growth rate of internal demand for commodity *i* and $r_{\hat{i}}$ stands for the growth rate of foreign demand for good *i* In the same vein, ρ_i is the rate of technical change for sector *i* while ρ_{ki} has the same meaning in relation to sector *ki*. Besides, $\rho_{\hat{i}}$ and $\rho_{\hat{ki}}$ are the rate of change of productivity in the foreign sectors $\hat{i}$ and $\hat{k}_i$, respectively. The symbols γ_i and γ_{ki} stand for the fraction of foreign technological progress that is captured through international learning, $0 \leq \gamma_i \leq 1$ and $0 \leq \gamma_{ki} \leq 1$.

[11] $0 \leq EL(t) \leq 1$. If *EL*(*t*) =1 then we face full employment of the labour force.

[12] Expressions (5) and (6) represent capital accumulation conditions.

Increases in productivity, captured by the labour coefficients (7) and (8) and their variations through time, imply increases in per capita income, which does not expand proportionally for each commodity due to Engel's law. The demand coefficients expressed by (3) and (4) capture the particular dynamic paths due to the inherent patterns of human needs and preferences. They give rise to entirely different compositions of consumer demand, and therefore different structures of production and employment[13].

Technical change that an underdeveloped country can take advantage is partial since there is a definite order in which the production process can be enlarged according to the increases in demand as income expands. Actually, there is an almost fixed order in which the production process can be enlarged and methods of production can be learnt[14]. In this vein, Engel's Law, which gives rises to non-homothetic tastes and particular structures of consumption and production for each country or region, constitutes one of the mechanisms blocking prompt diffusion and absorption of international knowledge in less developed countries. From this perspective, the limitations of the mainstream models concerning the passive role of per capita consumption demand on the diffusion and absorption of technical progress are diminished. Here, the path of diffusion and absorption processes will reflect, on the input side, the order of priorities in which production of consumption goods is organised according to the consumers' preferences.

One of the possible outcomes from this analysis is that technology transfer to the less developed countries will not necessarily increase its growth rate, but may reduce the rate of labour absorption, having negative impacts on the employment level, given by expression (1). In fact, recent literature tends to admit that a large portion of technical progress is specific to capital goods. If it is true the capability of underdeveloped countries to absorb foreign technical progress is connected to the availability of capital goods to use new technologies. Balance of payment constraints may damage the capability of the South to adopt technology from abroad. In general, to use advanced technologies, underdeveloped countries must import that equipment that is directly or indirectly necessary for mastering the new technologies but

[13] See Pasinetti (1981) for the dynamical path of production coefficients subject to sectoral technical progress. According to his approach, technical change, although taking place at a different pace in the various sectors, is exogenously determined. Reati (1998) goes a step further and introduces long waves in this model assuming that productivity growth is fundamentally driven by technological revolution, giving rise to a complex dynamic involving a set of prices, physical quantities and employment.

[14] According to Pasinetti (1981, p.75) "although possibilities of substitution among commodities are of course relevant at any given level of real income, there exists a hierarchy of needs. More precisely, there exists a very definite order of priority in consumers' wants, and therefore among groups of goods and services, which manifests itself as real income increase".

that cannot be produced at home[15]. Importing such advanced machine may be prevented from an intertemporal balance-of-payments constraint. Araujo and Teixeira (2003a) have shown that this restriction may be expressed in formal terms as:

$$\sum_{t=0}^{\infty}\Big[\ \sum_{i=1}^{n-1}(\xi\ a_{i\hat{n}}-a_{\hat{i}n})a_{ni}+\sum_{i=1}^{n-1}(\xi\ a_{ki,\hat{n}}-a_{\hat{k}i,n})a_{nki}\ \Big]=0 \qquad (9)$$

For most of the underdeveloped countries, only exportation of primary products, with low foreign demand elasticities, is available. Hence the balance of payment constraint on growth that springs from the Engel's law has a negative effect upon the adoption of new technologies learnt from abroad[16].

Any analysis of the North-South linkages from which reliable policy conclusions are to be drawn should take into account not only technical progress but also the barriers to its diffusion and absorption due to the particular structure of economies with different levels of per capita income and labour skills. As a summary, the investment-specific nature of technological progress in the 'New Economy', added to the balance of payments constraints and to the deterioration in the terms of trade, make the diffusion and absorption of new technologies in the South a daunting task.

4. An Alternative Perspective to Structuralism

Historically trade between the industrialised North and the less developed South has entailed the exchange of capital-intensive and human-capital-intensive manufactures by the former region for the labour intensive manufactures and primary commodities of the latter. Southern economies are characterised for maintaining a rather traditional comparative advantage structure towards labour and resource intensive industries.

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[15] As pointed out by Oda (1999, p. 208) "learning new techniques without importing any capital goods is also meaningless unless all the capital goods that are directly or indirectly necessary for using the learnt techniques can be produced at home. The importation of advanced capital goods is not the origin of acquisition of new techniques, but the latter is almost inevitably accompanied by the former."

[16] Thirlwall (1994) argues that the effective constraint to long-term steady growth of underdeveloped countries, at a high rate, is the long-run rate of growth of exports, combined with the long run elasticity of demand for imports in relation to the national income (output). His balance of payments constrained growth model and the so-called Thirlwall's Law have typically been used to analyse the determinants of growth for industrialised nations. Moreno (1999), and McCombie and Thirlwall (1994) deal with developing countries. Lopes and Cruz (2000, p.478) pointed out that "All these studies have been carried out under the (implicit) assumption that the real terms of trade or real exchange rate remain constant in the long run". Dutt (2000) relates Thirlwall's approach to a model of North-South trade to show how it may explain uneven development. The Journal of Post Keynesian Economics, vol. 19, No.3, Spring 1997, provides a "Minisymposium on Thirlwall's Law and Economic Growth in an Open-Economy Context".

The main prescription of the 'Structuralist' School for underdeveloped economies was that the structure had to be changed in fundamental ways if they were to compete on equal terms in the world markets, and a market mechanism could not bring about this sort of structural change. Bhaduri and Nayyar (1996, p.14) summarised this view stating that "there is *no* historical case of successful late industrialisation, either in the nineteenth or in the twentieth century, which did not depend upon State support in the form of promotion of protection of domestic industry". This strategy led to the support of some protectionism measures[17].

In the 1950s and early 1960s, due to balance of payments constraints, the trade strategy pursued by France and Japan, for instance, were based on a vigorous protection of their home markets. Protectionism was considered as springboard to sustained growth. Both countries adopted a variety of tariff and non-tariff barriers to trade and their industrial policies were highly interventionist. A number of incentives, credit subsidies and prices controls were introduced, and the general approach to structural economic dynamics was closely related concepts normally associated to ISS. As reported by Eatwell (1987, p. 737), such rationale is clearly presented by Ojimi (1970), Vice-Minister of the Japanese Ministry of International Trade and Industry:

"After the war, Japan's first exports consisted of such things as toys or other miscellaneous merchandise and low-quality textile products. Should Japan have entrusted its future, according to the theory of comparative advantage, to these industries characterised by intensive use of labours? That would perhaps be rational advice for a country with a small population of 5 or 10 million. But Japan has a large population. If the Japanese economy had adopted the simple doctrine of free trade and had chosen to specialise in this kind of industry, it would almost permanently have been unable to break away from the Asian pattern of stagnation and poverty (...). The ministry of International Trade and Industry decided to establish in Japan industries which require intensive employment of capital and technology, industries that in consideration of comparative cost should be the most inappropriate for Japan (...)."[18]

[17] The outcome of this strategy depends on the precise form of protectionism and whether it is thought to be permanent or temporary. It was in this context that the essential ideas of ISS for Latin America appeared in the works of Prebisch and his group at ECLA (Economic Commission for Latin America). For some authors such as Bruton (1998), this strategy halted somewhat the speed of the structural adjustment in the direction of more technologically advanced industries and technologies since it imposed more difficulties to the processes of diffusion and absorption of international learning.

[18] This view is supported by McCombie (1997, pp. 368–369) who states that "However, it should be emphasized that Japan cannot be viewed as a good example of conventional 'export-led growth', at least through the working

Such approach is on line with the main ideas of the Structuralist School, which emphasised that underdeveloped countries need to change the structure of the economy through the application of ISS in order to grow and to become more independent of industrial nations. As it is well known such development policy met with considerable success in Latin America in the 1950s. Initially, output of domestically produced manufactured goods grew substantially, as did industrial employment. It seemed that peripheral capitalism had found a promising land – to be capable of developing the productive forces and thus to reduce both technological and income per capita gaps in relation to rich nations. Eatwell (1987, p.737) remind us that: "Later the policy fell into disrepute. It was argued that import substitution took place primarily in the 'soft' consumer goods industries, whereas investment goods continued to be imported". Hence, after a period of successful implementation of ISS, most of the countries in the region were unable to proceed towards the construction of a solid capital sector. Investment goods continued to be imported despite of a number of stimulus and controls.

It is interesting to notice that, based on the works of Feldman (1928) and Mahalanobis (1953), one of the prescription of the Structuralist paradigm was that countries must not only change their structures, but must do it by creating a domestic heavy capital goods sector. The allocation of capital within the boundaries laid down with respect to structural change was considered a central issue.

The Feldman-Mahalanobis model inverted the accelerator-type relation in a market economy, i.e. the increase in consumers' goods was linked/derived to an increase in capital goods investment. This violates the logic of market/export-led growth, where consumers' demand transmit to the rest of the economy, including capital goods. One of the shortcuts of this strategy, which is in fact related to other ISS, was that it has ignored to some extent the role of demand. As pointed out by Halevi (1996, p.170), "The Marx-Feldman-Mahalanobis two-sector model cannot possibly take into account the composition of consumption demand because it contains only one consumption good. Any increase in per capita income is transformed into a higher level of consumption of the same commodity."

In order to mitigate the limitations of Feldman's model in relation to the passive role of per capita consumption demand, Araujo and Teixeira (2003b) have shown that it can be treated as a particular case of Pasinetti's model of structural change (1983). From this

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solely of Harrod foreign-trade multiplier, if only because of the relatively low share of exports in GDP. In 1952, exports, in current prices, were less than 5 percent of Japan's GDP and, although export growth rapidly

standpoint, it is possible to carry out the analysis of investment allocation in a framework where demand and productivity change at particular rates. Considering that r^n and r^s represent the rates of change of demand of the Northern and Southern consumption goods, respectively, and assuming that the global growth rate of population is equal to g, it is possible to establish the growth rate of demand for the commodity of each region, which is equal to the growth rate of demand of the correspondent capital goods in every time period:

$$\frac{\dot{X}^n_{ki}}{X^n_{ki}} = \frac{\dot{X}^n_i}{X^n_i} = g + r^n_i \tag{10}$$

$$\frac{\dot{X}^s_{ki}}{X^s_{ki}} = \frac{\dot{X}^s_i}{X^s_i} = g + r^s_i \tag{11}$$

This is the growth rate that has to be observed in order to fulfil the demand requirements particular to each region in each point of time. But expressions (12) and (13) give the feasible growth rates of production:

$$\frac{\dot{X}^n_{ki}}{X^n_{ki}} = \lim_{t\to\infty} \frac{\dot{X}^n_i}{X^n_i} = \frac{\mu^n_i}{v^n_{ki}} \tag{12}$$

$$\frac{\dot{X}^s_{ki}}{X^s_{ki}} = \lim_{t\to\infty} \frac{\dot{X}^s_i}{X^s_i} = \frac{\mu^s_i}{v^s_{ki}} \tag{13}$$

Hence, by equalising (12) to (10) and (13) to (11) we obtain the values of μ^n and μ^s that give the warranted growth rate of investment compatible with the growth path of demand of each commodity in each of the countries:

$$\mu^n_i = (g + r^n_i)v^n_{ki} \tag{14}$$

$$\mu^s_i = (g + r^s)v^s_{ki} \tag{15}$$

Such expressions introduce a normative criterion for Feldman's model: capital goods have to be allocated according to (14) and (15) in each region to allow the fulfilment of the corresponding capital accumulation condition, given the hierarchical order in which the production of consumption goods ought to proceed. Of course, this approach requires a view on how poor nations have to reorganise their economic structure in order to promote development. Besides, empirical evidence shows that some LDC's, such as India and Brazil, have to some extent escaped capital dependence and created their own capital goods producing sectors, but they failed to enjoy persistently strong rates of growth.

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outstripped the growth of output, forty years later its share had only doubled to 10 percent."

5. Conclusion

In this paper we have focused on the two main strategic policies of economic development adopted by a number or countries with the aim of reducing the widening gap both in technology and income per capita among advanced and less advanced nations. It was pointed out that import substitution strategies (ISS) failed because in most of the historical circumstances they were applied, they created an environment that discouraged learning, which is the first source of gains from international relations. Besides, the Structuralist paradigm in Latin America have ignored that the structural changes and economic dynamics of their economies were conditioned firstly to the evolving patterns of actual and prospective demands (domestic and foreigner) for consumer and investment goods, and not to policy makers intentions.

Compared to the ISS, the Export-Led Growth (ELG), that is, outward oriented policies, allowed a better environment for learning and/or imitation in some countries. However, with few exceptions, such strategy also failed to reduce both income per capita and technological gaps between advanced and underdeveloped nations. Their strategists have ignored that the diffusion of international learning represents gains for less developed countries if the order of priority in the expansion of demand is considered. Needless to mention that the efficiency of any development strategy is not independent of current as well as prospective world economic performance as a whole. Obviously, all countries cannot achieve an increasing share of exported commodities in the worldwide market at once.

Bruton (1998, p.933) stresses an important issue: "To accept learning and knowledge accumulation both as the bottom line of growth and as having roots deep in the ethos and history of a society requires that explanation and policy prescription probe these precincts that are so alien to mainstream thinking. This is the great message of the histories of technical knowledge accumulation and of the stories of the failures of import substitution and outward orientation reported herein". Here it is stressed that the relative failure of both approaches to reduce the gap between the North and the South is due to the fact that they have ignored to some extent the role played by the structural economic dynamics according to the particular evolving patterns of demand and productivity growth in developed and underdeveloped economies[19].

[19] Needless to say that the two alternative approaches departure from the orthodox theory of free trade and free market. Both ISS and ELG imply strong reservation concerning static conceptions such as static allocative efficiency, static comparative advantage and related topics. The standard price and associated policies are not the

The basic lesson to learn is that economic policy has to rely heavily both on domestic (historical circumstances) and the worldwide economic outlook perspectives. Unfortunately, the dominant neoclassical literature on growth and trade of the early 1950s was inadequate to deal with economic development. The conventional theory of growth applicable to developed nations were based on economic background (or structure) where near full employment prevailed, as well as an adequate stock of capital and the balance of payments constraints were not too severe. In this case, trade liberalisation, instead of interventionism, seemed to be the desirable economic policy.

On the other hand the theory of development applied to backward countries needs to take into account a set of initial conditions such as high unemployment, subsistence wage level, shortage of capital etc. Needless to say that choosing among alternative trajectories of development depends upon the degree of backwardness when planning for growth is initially undertaken. To close both technology and income per capita gaps may well require a temporary protection by a number of tariff and non-tariff barriers to trade and industrial policy with a variety of incentives, credit subsidies and price controls.

The syntheses of the analysis presented here is that the structural economic dynamics of the systems should be considered as the stand point for the creation of a proper environment for international learning in underdeveloped countries. We acknowledge that more than one policy strategy follows from an understanding of the obstacles to diffusion and absorption of technical progress posed by Engel's law. A possible conclusion is that poor regions need to induce structural changes in their economies that encourage the expansion of export oriented manufacturing industries, producing commodities with higher elasticities of demand than those for primary products. This is not a novelty. However, our paper throw a new light upon the nature of the main problem actually found in ISS and ELG frameworks – they failed to recognise to some extent the role of demand both in the diffusion and absorption of technological progress.

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