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Trade and Industrialization in Developing Agricultural Economies [1]

Prepared by Sergei Dodzin and Athanasios Vamvakidis

Authorized for distribution by Leif Hansen and Peter Wickham

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Abstract

This paper examines the impact of international trade on industrialization in developing agricultural economies. The findings show that developing agricultural economies that increased their openness during 1970-95 experienced an increase in their share of industrial production at the expense of agricultural production. This is in contrast to what many policymakers in these economies have often argued when trying to promote industrialization by restricting trade. The paper presents an infant industry model with learning effects from imports of manufacturing products that is consistent with the supporting empirical results.

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I. INTRODUCTION

According to a well known principle of international trade theory, in a free trade world each country exports the products in which it has a comparative advantage. This implies that if some sectors of production are characterized by faster growth than others, the "lucky" countries with a comparative advantage in these sectors will grow faster than the other countries. This argument is a cornerstone of most theories supporting trade protection in developing economies. Many of these economies have high trade barriers in order to develop the industrial sector, a fast growing sector, and to discourage specialization in producing and exporting primary commodities, a slow growing sector. These protectionist policies have been justified by the belief that free trade may discourage industrialization.

The infant industry argument is based on the above view of the world. According to one of the most widely known versions of this argument (see Bardhan (1970)), only the industrial sector has the potential to grow through learning-by-doing effects, while the primary commodities sector is likely to stagnate. The hypothesis maintains that unprotected infant industries of a developing economy will not survive world competition, causing the country to specialize in the primary commodities' sector, therefore growing at a slower pace than the industrial countries. In contrast, protection of the industrial sector in the form of a production subsidy or an import tariff will result in faster growth of this sector and the economy.

If this reasoning is correct, free trade should lead to income divergence. However, empirical evidence has shown exactly the opposite. According to Ben-David (1993) and Sachs and Warner (1995), only open economies experience convergence. In addition, the so-called "newly industrialized countries" (NICs) represent examples of poor countries that industrialized by opening their markets. Finally, recent theoretical literature on the impact of trade on growth has shown that free trade can lead to the industrialization of developing economies. The above evidence does not imply that the principle of comparative advantage is wrong, but that developing countries have a comparative advantage in labor-intensive industrial products, in addition to primary commodities.

Both developing and developed countries often express concern that free trade may discourage industrialization. On the one hand, developed countries worry that industries will move to developing countries to benefit from cheap labor (there is a large body of literature on this issue, but no final answer yet: see Slaughter and Swagel, 1997). On the other hand, developing countries worry that their industrial sector cannot compete in a free trade world. However, if these concerns are right, free trade will lead to reallocation of industries worldwide, and to more efficient production. For example, the developing countries will stop producing in industries that cannot compete internationally, and switch to industries that can benefit from the relative abundance of cheap labor and other comparative advantages they have.

Even though many empirical studies show that openness leads to faster growth (for references, see Vamvakidis, 1997, 1998 and 1999), the previous literature has not examined the impact of trade liberalization on different sectors of production in developing economies. Do developing agricultural economies become more agricultural after opening to international trade, as the early literature predicts? Openness may lead to faster growth on average, but does it tend to discourage industrialization in developing economies?

This paper addresses the above issues by examining the impact of an increase in the openness to international trade on the share of agricultural and industrial production in developing agricultural economies. First, we present an example of how the standard infant industry argument, which is one of the main arguments in support of protection in developing countries, can be expanded to include learning effects from imports of manufactures. The model then shows that free trade may lead to an increase in the industrialization. The assumption that imports result in knowledge spillovers is standard in the more recent trade and growth literature, but was neglected by the earlier literature. Inclusion of this assumption in an infant industry model changes considerably the original results.

Empirical evidence in this paper suggests that developing agricultural economies that increased their openness to international trade during the period 1970-95 experienced an increase in the share of industrial production at the expense of agricultural production. This result holds when we consider both the nominal and the real shares of production in each of these two sectors, for different groups of developing agricultural economies, and different definitions of openness. This empirical result is in contrast to what many policymakers in developing agricultural economies have often argued, when trying to promote industrialization by restricting trade. The concern that free trade may hurt the infant industries and industrialization in such economies is not justified by the evidence.

This paper proceeds with a brief description in section II of some early arguments in support of government intervention in international trade, and a comparison of these arguments with the recent trade and growth literature. Section III combines the two approaches in an infant industry model that adds "learning by trading" effects, and shows that under certain reasonable conditions liberalization can lead to industrialization. Section IV presents empirical evidence showing that protection is higher in developing agricultural economies and that openness promotes industrialization in these economies. Changes in the empirical specification and the variables in the model test the sensitivity of the empirical results, and confirm their robustness. Section V concludes and is followed by two appendices, the first illustrating the proof of the main propositions in the theoretical model and the second presenting the country list in each of the three group of countries in the empirical sample.

II. THE EARLY ARGUMENTS ON PROTECTION AND INDUSTRIALIZATION VERSUS THE NEW TRADE AND GROWTH LITERATURE

This section briefly describes some early arguments in support of government intervention in international trade and compares them with the recent trade and growth literature.

A. Protection and Industrialization (Learning by Doing)

Many arguments in support of industrialization through protection and import substitution appeared in the decades following the Great Depression. The external shocks that many developing economies experienced during the Great Depression prepared the ground for more active government intervention in the economy. For example, the terms of trade of Latin America collapsed by 48 percent on average in the period 1928-32, while the current value of exports during the Great Depression fell by 78 percent in Chile, 72 percent in Mexico, 67 percent in Colombia and by 63 percent in Brazil.[1] Since one of the main driving forces of this deterioration was an increase in protection in the industrial world, it resulted in mistrust toward free markets in the developing world. During the 1930s, and more so during World War II, there was not much to be gained from international trade, since the world economy was closed and there were significant external shocks. Protection and the inward orientation of production were seen as the appropriate reaction by many developing countries.[2]

One of the most widely known arguments in support of the protectionist policy was Raul Prebisch's thesis proposed in a study on the economic development of Latin America in 1949. Prebisch argued that the gap between the developed and the developing world would increase in the future, because the terms of trade of the latter were deteriorating. The significant decline in the terms of trade in developing countries in the decade after the Great Depression, and the increase in protection in developed countries in the same period were the two main reasons for the popularity of Prebisch's thesis when it first appeared.

A further argument in support of protection is the infant industry argument, according to which government should protect young local industries until they grow and are able to compete internationally. Even though the infant industry argument has been recognized as one of the exceptions to free trade, for many decades it was not incorporated in traditional trade theory, because of its dynamic nature. Only in 1970 was the infant industry argument expressed in a formal model, by Bardhan (1970, ch.7).

Bardhan was inspired by Arrow (1962), and developed a model of "learning by doing" in a small open economy. In his model there are two sectors, manufacturing and primary

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[1] See Ground (1988).

[2] For a historical analysis of protection and its impact on growth, see Vamvakidis (1997).

commodities, with "learning by doing" effects only in the first. The market equilibrium results in smaller manufacturing output than the optimum, because individual firms in manufacturing do not take into account the positive externality their production has on other firms. A government subsidy increases both manufacturing output and productivity through the "learning by doing" effects. An important conclusion of the model is that a production subsidy, not a tariff, is the first best policy. A tariff will increase manufacturing production, but it will also distort consumption, which otherwise would be at an optimal level. However, ignoring the impact on consumption, a tariff will have the same impact as a production subsidy on the prices that manufacturing producers face.[3]

Most countries that followed import substitution policies during the 1950s and 1960s experienced industrialization and faster growth. This experience increased the support for these policies. However, import substitution was only part of a more general state-led industrialization policy that many developing countries pursued during these decades (for indicators of the importance of state enterprises in the economy, see Nellis and Kikeri (1989), and Gwartney, Lawson and Block (1996)). According to one of the most famous descriptions of this policy, in Gerschenkron (1952) and a recent study by Sachs (1996), this policy called for state intervention to mobilize savings toward higher investment in the industrial sector. A "big push" of high investment by the government in the industrial sector was expected to cause a general increase in investment, due to externalities, closing the gap between developing and developed countries. According to this argument, government intervention was necessary because, first, the private financial sector was not developed enough to finance necessary investment, and second, there were coordination failures in private investment. In some newly-independent countries, state-led industrialization was also perceived as a way to create a strong and independent nation.

Empirical evidence by Kornai (1992) and Sachs (1996) shows that the state-led industrialization policy was successful only in the first two decades of its implementation. During this initial period, the effort resulted in the development of a few basic industrial sectors that produced homogeneous products. These sectors represented only a small share of the range of industrial products in the rest of the world. The policy helped create huge and rigid public enterprises that operated on soft budget constraints, and were very difficult to control. The inefficiencies of the state-led industrialization resulted in its failure in the long run (for the inefficient performance of state enterprises, see Shleifer and Vishny 1994).

Finally, protection is often considered as a way to reduce the sensitivity of an economy to volatile terms of trade, and diversify production and exports. Many developing countries export only a few commodities, that have very volatile prices. Some policymakers in these countries argued that protection of non-primary sectors would increase diversification of production and stabilize national income.

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[3] For a more detailed presentation see Bardhan (1970, ch.7) and the Handbook of International Economics, Vol. 1, ch. 4.

To summarize, the supporters of protection saw it as a way, and often the only way, to achieve industrialization in developing countries. They believed that free trade perpetuates economic backwardness resulting in the concentration of production in primary products. The more backward a country, the higher is its share of primary production, and the stronger these implications are.

B. New Trade and Growth Literature (Learning by Trading)

According to the models in the new trade and growth literature, trade leads to faster growth. Many studies in this literature are based on technology spillovers and R&D (research and development), instead of the "learning by doing" effects seen in infant industry models (see for example Grossman and Helpman, 1989, 1990, 1991; Rivera-Batiz and Romer, 1991a, 1991b; and Romer, 1990). However, here too, knowledge accumulated by past production fosters growth. Even though this literature does not always consider the sectors of production separately, its assumptions and results apply primarily to the industrial sector (we would expect technology spillovers and R&D efforts to be more important in industry than in agriculture).

Grossman and Helpman (1991) developed a model where each country produces a variety of products, and growth increases as the number of new varieties increases as a result of R&D. The R&D sector benefits from existing knowledge, which is equal to the varieties already in production. Therefore, the more varieties of products a country produces, the higher is its stock of knowledge, and the more varieties R&D will produce in the future. The faster the innovation is, the faster a country grows. This is like a "learning by doing" effect in the R&D sector. Cumulated past output, and thus the production of varieties in the past, leads to more output today, as in the case of the infant industry argument, even though in the present case these "learning by doing" effects act as technology spillovers.[4]

When an economy does not trade with the rest of the world, its knowledge stock depends on the number of varieties it already produces. However, when the economy is open to free trade, its stock of knowledge increases by the number of varieties the rest of the world has already produced. Thus, international trade results in international technological spillovers, causing faster innovation, and through this channel, faster growth. Coe and Helpman (1995) and Coe, Helpman and Hoffmaister (1997) have provided empirical evidence for these arguments, showing that trade affects the rate of technological progress.

The presence of international spillovers of knowledge is the main difference between the recent trade and growth literature and the old "learning by doing" infant industry literature. Its insight is that a country, and more specifically the industrial sector of a country, benefits not only from its own cumulated past production, but also from the cumulated past

[4] For a detailed presentation, see Grossman and Helpman (1991), and for a summary of their model, Barro and Sala-I-Martin (1995).

production of the countries it trades with. This implies that infant industries grow faster in an open economy, as we will show formally in the next section.

The impact of government intervention on output depends now on the impact it has on domestic and foreign innovation. A production subsidy or a tariff on manufacturing in a country that is a net importer of manufacturing goods will have a positive effect domestically, but a negative external effect in the short run. The long-run effect depends on which of the two effects is stronger, and its impact on the R&D sector. In the main case of the Grossman and Helpman model (see ch. 9), trade liberalization will result in more innovation and therefore faster growth because it eliminates duplicate research.

The recent literature has also provided more insights about the impact of agricultural productivity on growth. According to a two-sector model in Matsuyama (1992), there is a positive link between agricultural productivity and economic growth in a closed economy, but a negative link in an open economy. The model is motivated by the debate in earlier literature on whether progress in agriculture can lead to industrialization. In a closed economy, increasing productivity in agriculture will release resources for the industrial sector. However, for an open economy resource abundance and high agricultural productivity may squeeze out the industrial sector.

III. Learning by Doing and Learning by Trading Reexamined

As the recent trade and growth literature has shown, there are many alternative models that predict industrialization after liberalization under certain conditions, even if an economy has a small industrial sector initially. These models are based on more or less similar stories that expand the way earlier studies thought about this issue. This section considers one such expansion for the infant industry model. It is an example of how an early model of this literature can be modified to include more recent dimensions of the debate. Future research may consider similar exercises for other models and other extensions.

We modify the Bardhan (1970) infant industry model, to include learning effects from imports in the manufacturing sector, in addition to learning by doing effects. The higher the volumes of past output and imports of manufacturing, the higher is the level of knowledge in this sector. As mentioned in the previous section, the recent trade and growth literature analyzes spillover effects from international trade in terms of the transfer of technology and knowledge. The existence of competitive imports provides knowledge that can improve domestic production. In addition, imported manufacturing goods are often used as intermediaries in the production of domestic manufacturing. Even though we do not consider this last feature, it can be added to the model, resulting, however, in a more complicated solution (for a model with imports of intermediate products see Lee, 1993).

When the learning effects come not only from domestic output of manufacturing but also from past imports, any policy that raises the domestic manufacturing output over the free trade level will have two offsetting effects on learning. First, the initial increase in manufacturing output improves learning, leading to a further increase in manufacturing output, as in the infant industry model. Second, the reduction of manufacturing imports decreases learning which then leads to a decrease in manufacturing output.

Whether the manufacturing output will increase or decrease in the long run depends on which of the two effects dominates. In this setting it is no longer obvious that the tariff on imported manufacturing products or even a subsidy to the domestic manufacturing sector will result in an increase of manufacturing output in the long run. Hence, under certain conditions, it seems possible that protection of manufacturing may actually discourage industrialization while the liberalization will encourage it in the long run.

The infant industry model is based on many strong and unrealistic assumptions, as will be obvious in what follows. With the modification explained above as the only exception, we take these assumptions as given. The main goal is not to present a model that describes the economy accurately, but to show that it is very easy to modify the infant industry model in a way that delivers the opposite result (liberalization can promote industrialization). There are many other channels, in addition to knowledge spillovers from importing, that can lead to the conclusion that trade promotes industrialization in developing agricultural economies. Such results can be obtained in a model where imported goods are used as production inputs, in a model where the industrial sector can benefit from economies of scales in a large international market, or in a model where international trade reduces transaction costs in the industrial sector.

The primary objective of what follows is to analyze the impact that a tariff on manufacturing imports has on manufacturing output in the long run. We show that if the following two sufficient conditions hold, the tariff on the imported manufacturing goods will reduce the total factor productivity of domestic manufacturing output in the long run. The conditions are the following:

*(I)*The value of the output of commodities is greater than the value of the output of manufacturing, when each of them is divided by the share of the corresponding product in domestic spending.

(II) The learning coefficient from imports is greater than the learning coefficient from domestic output.

The first condition is expected to hold in developing agricultural economies. The second condition is also expected to hold for such economies since their imports of manufacturing have a relatively advanced technology, or are used as intermediate inputs.

More formally, assume there are two goods, commodities c and manufacturing m, two factors of production, capital K and labor L, and a constant returns to scale technology. The production functions have the form:

$$F_c = F_c(K_c, L_c) = f_c(k_c)L_c$$
$$F_m = F_m(K_m, L_m) = Q^n f_m(k_m)L_m \tag{1}$$

where $k_e = \frac{K_e}{L_e}$, $k_m = \frac{K_m}{L_m}$ are the capital intensities, and Q is the "learning multiplier." The power factor n belongs to the interval (0,1). Manufacturing is assumed to be more capital intensive than commodities, and no factor intensity reversals are allowed, so $k_m > k_c$[5]. Without loss of generality we normalize L=1 and rewrite:

$$F_c = F_c(K_c, L_c) = f_c(k_c)l_c$$
$$F_m = F_m(K_m, L_m) = Q^n f_m(k_m)l_m \tag{2}$$

where, $l_c = \frac{L_c}{L}, l_m = 1 - l_c = \frac{L_m}{L}$ are shares of labor in commodities and manufacturing.[6]

The learning multiplier Q follows the dynamics:

$$\frac{dQ}{dt} = \eta F_m + \gamma Z_m - \delta Q \tag{3}$$

where Z_m are the net imports of the manufacturing goods.

According to the equation (3), the learning multiplier Q depends on past accumulated manufacturing output and past accumulated imports. The weights η and γ convey the importance of each factor respectively in the accumulation of knowledge. The coefficient δ gives the rate of "depreciation" of knowledge due to both forgetting and the old technologies becoming obsolete. This equation is more general than the one proposed by Bardhan, which does not have the learning effect from imports.

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[5] The model can be modified to allow for factor intensity reversals without changing is main implications, since learning by importing in this model increases total factor productivity in manufacturing (Q coefficient).

[6] Note that l_c is not an independent variable, given capital intensities k_c, k_m and the overall country capital to labor ratio $k = K/L$. It can be shown that:
$$l_c = \frac{k_m - k}{k_m - k_c}, l_m = 1 - l_c = \frac{k - k_c}{k_m - k_c}.$$

The assumption that there is no learning in the agricultural sector is one of the flaws in the infant industry argument. It is a strong assumption and its relaxation, which is relatively easy, modifies significantly the final result in terms of output growth. If the agricultural sector is not a static sector and if it experiences learning by doing effects, protecting the industrial sector will have, in addition to the positive long-run growth effect in industry, a negative long-run effect on agriculture.

We have assumed that there is no learning in the rest of the world. Obviously, this is another simplifying assumption of the model. Relaxing this assumption makes the model more complicated, but the result is expected to be stronger toward a negative impact of protection on industrialization. The reason is that the reduction of imports after protection will deprive the country not only of learning effects from the existing stock of knowledge of the rest of the world, but also from learning effects in the future.

The model also assumes balanced trade. This may seem a strong assumption. However, the model considers the impact of trade policy changes on the steady state conditions, where the country should have a balanced trade.

Consumers maximize the present discounted value of:

$$\int_0^\infty U(D_c, D_m) e^{-\varrho t} dt \tag{4}$$

where $U(D_c, D_m)$ is the instantaneous utility function of consumption D_c and D_m of both goods. To get a tractable analytical presentation of the model we consider the case of a Cobb-Douglas Utility function:

$$U(D_c, D_m) = D_c^{\varphi} D_m^{1-\varphi}$$

This function implies constant shares of spending by domestic residents on each good. The case can be easily generalized to any utility function, but the analytical expression will be much more tedious.

Assume that the world relative price $\bar{P}$ of manufactured goods in terms of commodities is given. Also assume, that government introduces an import tariff τ on manufacturing imports, and that the tariff revenue is rebated lump-sum to the consumers. Then, the general equilibrium is characterized by the following conditions:

Households maximize

$$\int_0^\infty U(D_c, D_m) e^{-\varrho t} dt \tag{5}$$

subject to the constraints:
(I) balanced trade constraint

$$z_c + \bar{P} z_m = 0 \tag{6}$$

(II) budget constraint:

$$D_c + \bar{P}(1+\tau) D_m = F_c + \bar{P}(1+\tau) F_m + T \tag{7}$$

where $T = \bar{P}\tau z_m$ is government rebate of the tariff revenues.
Note that households and firms ignore the impact of their decisions on the learning dynamics and tariff revenues.

The optimality conditions are the following:

$$\frac{\partial U}{\partial D_m} / \frac{\partial U}{\partial D_c} = \bar{P}(1+\tau) \tag{8}$$

$$\bar{P}(1+\tau) = \frac{f_c'(k_c)}{f_m'(k_m) Q^n} \tag{9}$$

$$\frac{f_c(k_c) - f_c'(k_c) k_c}{f_c'(k_c)} = \frac{f_m(k_m) - f_m'(k_m) k_m}{f_m'(k_m)} \tag{10}$$

First two equations are the conditions on the marginal rates of substitution and transformation while the third equation ensures that wage to rental ratios are equal across sectors. From now on we refer to the wage to rental ratio as w.

It can be shown that the learning equation (3) can be transformed as:

$$\frac{dQ}{dt} = \left(\eta - \gamma \frac{g}{1+g(1+\tau)}\right) F_m + \frac{\gamma}{\bar{P}(1+g(1+\tau))} F_c - \delta Q \tag{11}$$

where $g = \phi/(1-\phi)$.

Equation (11) provides a good insight. The net effect of the domestic production of manufacturing on learning has the weight of $\eta - \gamma \frac{g}{1+g(1+\tau)}$. Note that the weight γ is multiplied by a coefficient $\frac{g}{1+g(1+\tau)}$ that has a value between zero and one. This term reflects the effect of reduction of the consumption of good m by domestic residents. The coefficient on the output of good m, $\eta - \gamma \frac{g}{1+g(1+\tau)}$ is positive when $\frac{\eta}{\gamma} > \frac{g}{1+g(1+\tau)}$.

Consider the case when $f_c = k_c^\alpha$ and $f_m = k_m^\beta$; $1 > \beta > \alpha$. We are interested how the stationary solution Q^* s.t. $dQ^*/dt = 0$ is changing with respect to change in the tariff. If the solution is stationary then:

$$0 = (\eta - \gamma \frac{g}{1 + g(1 + \tau)}) Q^n f_m(k_m)(1 - l_c) + \gamma \frac{f_c(k_c) l_c}{\bar{P}(1 + g(1 + \tau))} - \delta Q \tag{12}$$

As already mentioned, our interest is in the derivative of the stationary (steady state) value Q^* with respect to the tariff level τ. So we want to know the properties of $\frac{\partial Q^*}{\partial \tau}$. We show that the following proposition holds:

Proposition 1. Suppose the learning coefficient from imports γ is greater than the learning from output coefficient η: $\gamma > \eta$, and is in the steady state under the tariff present $g\bar{P}F_m < F_c$. Then: $\frac{\partial Q^*}{\partial \tau} < 0$. The proof is given in Appendix I.

Proposition 1 is a strong result. It says that for the productivity multiplier Q of manufacturing to decrease in the long run it is enough to require that the learning from imports be stronger than the learning from domestic output, and that the output of commodities be greater than the weighted (by the coefficient g) output of manufacturing. The above inequality is expected to hold for developing agricultural economies. It is reasonable to expect that the manufacturing output in such economies is lower than the agricultural output. Also, according to Engel's law, the share of expenditure ϕ on food declines as income increases. Therefore the value of the coefficient $g = \phi/(1-\phi)$ is expected to be relatively low.

Note that the condition $g\bar{P}F_m < F_c$ can be rewritten as $\frac{1}{1-\phi}\bar{P}F_m < \frac{1}{\phi}F_c$. Intuitively, this condition means that the value of commodities output is greater than value of the output of manufacturing, when each of them is divided by the share of the corresponding product in domestic spending.

Proposition 1 also holds when initially the economy is in the state of free trade ($\tau = 0$). In this case imposition of the tariff will reduce a steady-state value of the learning multiplier. Substituting $\tau = 0$ in the proposition, we get the following:

Corollary

If there is free trade initially (τ=0), and the conditions of the proposition 1 hold, then the imposition of a tariff reduces the value of the learning multiplier in the steady state.
Then: $\frac{\partial Q^*}{\partial \tau} < 0$.

The steady-state value of the manufacturing output is:

$$F_m^* = (Q^*)^n B(w(Q^*, \tau))$$

The conditions derived above are sufficient to increase the steady-state productivity by lowering the tariff (more openness). If the steady-state wage to rental ratio were fixed these conditions would also be sufficient to increase the steady-state volume of industrial output. However, a lower tariff decreases the relative price of manufacturing goods at home and puts upward pressure on the wage to rental ratio, which works in the opposite direction of the increased productivity effect. The change of industrial production depends on which effect prevails. It is possible to derive the analytical conditions, but they are very cumbersome. The conditions for the reduction of the manufacturing output in the steady state will be the same as in the proposition 1 with the condition $g\bar{P}F_m < F_c$ replaced by the condition $g_1\bar{P}F_m < F_c$, for some constant $g_1 > g$. Since our model serves an expositional purpose, we decided to leave the derivation out of the paper. The empirical evidence presented in the next part suggests that the productivity effect dominates.

We could use the same model to show that some industries will disappear after opening to free trade, and new industries will appear increasing net industrial output. If we think of *m* as the number of industrial products a country produces, then the learning equation implies that the more industrial products a country produces and imports, the more industrial products will be produced in the future (this description of the economy is similar to Grossman and Helpman (1991)). Opening to free trade in this case, will decrease *m* in the short run, as some industrial products that were produced domestically will now be imported, but will lead to the production of new industrial products. If the above conditions hold, manufacturing production will increase in the long run.

IV. Empirical Assessment

This section presents empirical evidence showing that protection is higher in developing agricultural economies than in the rest of the world and that liberalization promotes industrialization in these economies. Changes in the empirical specification and the variables in the model test the sensitivity of the empirical results, and confirm their robustness.

A. Openness in Developing Agricultural Economies

From the analysis so far, it is clear that the theory of the infant industry argument is based on very restrictive assumptions and that recent models seem to be closer to reality. For example, the assumption of the infant industry literature that there are learning effects only from domestic production is very hard to justify. In a global and competitive economy, producers learn not only from their own production, but also from that of their competitors, domestic and foreign. This is one of the reasons why most economists today agree with the predictions of the recent trade and growth literature.

As mentioned earlier, protection has often been considered as the engine of industrialization. It is true that protection in developing economies has been reduced during the last two decades compared with previous periods (see Vamvakidis, 1997). As a result, trade shares in many of these economies have increased significantly in the last decade. Nevertheless, protection remains higher in developing economies than in developed economies. It seems that pressures from industrial groups keep the infant industry argument alive, despite the fact that protection has been present too long to be justified by any infant industry considerations.

The empirical evidence that protection is higher in developing countries is presented in Table 1 (the data are from the World Development Indicators (World Bank, 1997) and from Sachs and Warner, 1995). We calculated the Spearman rank correlation coefficients between the trade share or the years a country has been open (using the Sachs and Warner (1995) definition of openness, which is described in section B), and the agricultural share or the GNP per capita, for the period 1970-95. The results show that the higher the share of agriculture value added in GDP, or the lower the GNP per capita of an economy, the lower is its trade share, and the shorter the period it has been open, if it has been open at all. These correlations are statistically significant, at least at the 5 percent level, except for the correlation of trade shares with the GNP per capita, which is positive, but with a t-statistic of 1.5.

According to this evidence, developing countries intervene in international trade more, on average, than developed countries. One important reason for this intervention seems to be an excessive reliance on trade tariffs as a source of tax revenues in developing countries. However, it is also true that trade intervention is often a part of a country's effort to industrialize. The theoretical arguments presented in this paper show that free trade may instead be the appropriate strategy. Which of the two paths is right? Have developing agricultural economies that reduced protection experienced industrialization, or is the opposite true? The following sections address this issue empirically.

B. Trade and Industrialization

In this section we estimate the impact of an increase in openness on the different sectors of production in agricultural developing economies. The empirical evidence in this and the following sections, although consistent with the implications of the model, is not a direct test of the model itself. As noted, the model is just an example, among many others, of how liberalization can promote industrialization in developing agricultural economies.

We consider three different groups of economies: developing, agricultural and highly agricultural (for the countries in each group see appendix II). The first group includes only developing economies (71 countries with available data) using the definition of the World Tables (World Bank). The second group includes the two thirds of the countries in the world with the highest agriculture value added as a share of GDP in 1970 (58 countries with available data). The minimum share of agriculture value added in this country group is 15.1 percent, and the average is 34.2 percent. This group is labeled as agricultural economies. Finally, the third group of countries, labeled as highly agricultural economies, includes the one third of the countries in the world with the highest agriculture value added as a share of GDP in 1970 (28 countries with available data; he sample will be too small if it excludes more

Table 1. Is Protection Higher in Developing Agricultural Economies?

Spearman Rank Correlation Coefficients	Agriculture Value Added/GDP	GNP Per Capita
Trade Share	-0.253 (-2.639)	0.133 (1.450)
Years Open (according to the Sachs and Warner (1995) criteria	-0.851 (-14.960)	0.626 (8.098)

Note: The variables are averages over the period 1970-95. The t-statistic is in the parentheses.

countries). The minimum share of agriculture value added in this country group is 33.2 percent, and the average 44.5 percent. One of the features of the third group is that it does not include any of the East Asian fast growing countries. There are arguments that these economies had a comparative advantage in manufacturing (because of high investment in human capital) to start with. Also, the extent and the speed with which the East Asian economies industrialized may bias the results. All data in the paper are from the World Development Indicators (World Bank, 1997).

Having defined these groups, we first estimate Spearman rank correlation coefficients between the change in trade shares and the change in shares of value added in agriculture, industry and services in the period 1970-95.[7] The question is whether an increase in the trade share of an economy (openness) is correlated with an increase in the share of agriculture or the industrial sector during the same period. We also examine if the results change when the import share is used instead of the total trade share as a measure of openness. The main reason is that agricultural economies may have high export shares because they export large quantities of agricultural products, or because world demand for their products increases, not because they are open[8]. Even though the theory in this paper does not make any predictions for services, we report results for this sector.

The definition of the three sectors of production in what follows is the one adopted by the World Bank in its World Development Indicators. However, based on this definition, the industrial sector includes processing of agricultural products and primary products in general. This implies that what the results show as industrialization may actually be a more advanced agricultural sector. However, for this problem to exist, it should be the case that the increase in agricultural processing is large enough after opening to free trade to offset any other movements in the opposite direction of the rest of the industrial sector. This does not seem possible since most of the activities included in the industrial sector are genuine industrial activities. Having noted this issue, the paper proceeds by defining industrialization as an increase in the industrial sector as classified by the World Bank.

The results in Table 2 suggest that openness and industrialization are positively correlated. The third column of Table 2 shows that developing agricultural economies that experienced an increase in their trade share, or their share of imports, during 1970-95, also experienced a decline of their share of agriculture value added. The Spearman rank correlation coefficient of the changes in trade shares and imports shares with the changes in the share of

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[7] This methodology was chosen because correlation of the rank does not allow outliers to bias the results.

[8] Although the import share is not a direct measure of trade liberalization, it is still a better indicator than the trade share (countries with restrictive trade regimes have high import barriers). Section D uses a direct measure of trade policy, but for a smaller sample of countries because data are not available for all agricultural economies.

Table 2. Spearman Rank Correlation Coefficients of Changes in Openness and Production in Different Sectors in Developing Agricultural Economies

Group of Countries	Variables	Agriculture Value Added/GDP	Industry Value Added/GDP	Services Value Added/GDP
Developing Economies	Trade Share	-0.336 (-2.938)	0.476 (4.461)	-0.188 (-1.578)
	Observations	70	70	70
	Import Share	-0.286 (-2.483)	0.247 (2.116)	-0.043 (-0.359)
	Observations	71	71	71
Agricultural Economies	Trade Share	-0.239 (-1.827)	0.426 (3.489)	-0.131 (-0.983)
	Observations	57	57	57
	Import Share	-0.232 (-1.783)	0.242 (1.871)	-0.065 (-0.487)
	Observations	58	58	58
Highly Agricultural Economies	Trade Share	-0.438 (-2.434)	0.699 (4.888)	-0.223 (-1.146)
	Observations	27	27	27
	Import Share	-0.588 (-3.710)	0.510 (3.024)	-0.101 (0.519)
	Observations	28	28	28

Note: All variables are changes between the period 1970-95. The t-statistic is in the parentheses.

agriculture value added is negative and statistically significant. The estimates in the fourth column show that trade liberalization is positively correlated with industrialization. The Spearman rank correlation coefficient of the changes in trade shares and import shares with the share of industry value added is positive and statistically significant. These results are valid for all three groups of countries being considered. Finally, there seems to be no statistically significant impact of openness on the sector of services.

The share of agriculture in world output has been declining in the last few decades, while the shares of the industrial and the services sectors have been increasing. There are more industrial countries today than two decades ago. However, the empirical results presented in this paper do not capture this global trend. The results imply that if there is such a trend, it is stronger for those developing economies that have opened more to trade than the other developing economies.

These results are also confirmed by regression analysis. We estimate a simple empirical model with the shares of the value added in each sector in 1995 as the dependent variables. Having the final shares as dependnet variables partially controls for the possible reverse causality effect between the change in production and the change in openness. The independent variables are the initial shares of the value added in each sector (in 1970), the log of GDP per capita in 1970 and its squared value, and finally the change of the trade or import share during 1970-95.[9] We expect that the share of a production sector in 1995 will be positively correlated with its share in 1970. Therefore, the inclusion of the initial share controls for differences in industrialization at the begining of the period. We also expect that the higher the GDP per capita of a country, the more industrialized it will be, and this effect to be decreasing as income increases. Controlling for these effects, we can test if countries that have experienced an increase in openness in the period 1970-95 were more industrialized in 1995 than countries that didn't experience such increase.[10]

The estimates in Table 3 confirm that openness promotes industrialization in developing agricultural economies. The third column shows that the economies with the larger increase in their trade and import shares during 1970-95 had a lower share of agriculture value added in 1995. The fourth column shows that these economies ended up with a higher share of industry value added. The last column shows no effect of openness on the service sector. Table 3 also shows that the final share of value added of a sector is positively correlated with the initial share. The initial GDP per capita and its squared value do not have statistically

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[9] This empirical specification is similar to the methodology applied by Rowthorn and Wells (1987) and Rowthorn and Ramaswamy (1997).

[10] Section D addresses in a more direct way the possible reverse causality problem, by comparing industrial shares before and after liberalization using a direct measure of trade policy.

Table 3. The Impact of Changes in Openness on the Different Sectors of Production

regressions		dependent variables		
Countries	Independent Variables	Agr.v.add./GDP1995	Ind.v.add./GDP1995	serv.v.add./GDP 1995
Developing Economies	Change of Trade Share	-0.143 (-4.410)	0.192 (3.697)	-0.044 (-0.916)
	v.a./GDP1970	0.407 (4.650)	0.586 (6.474)	0.516 (5.191)
	GDPpc1970	-7.054 (-0.253)	-5.259 (-0.181)	9.974 (0.370)
	GDPpc-sq1970	-0.094 (-0.052)	0.320 (0.162)	-0.233 (-0.129)
	Adj.R-squared	0.67	0.36	0.42
	Observations	70	70	70
	Change of Import Share	-0.205 (-2.583)	0.269 (2.797)	-0.061 (-0.808)
	v.a./GDP1970	0.409 (4.790)	0.515 (4.659)	0.502 (5.232)
	GDPpc1970	-19.463 (-0.751)	8.338 (0.296)	7.637 (0.278)
	GDPpc-sq1970	0.733 (0.435)	-0.520 (-0.270)	-0.083 (-0.045)
	Adj.R-squared	0.64	0.30	0.42
	Observations	71	71	71
Agricultural Economies	Change of Trade Share	-0.200 (-3.052)	0.313 (3.477)	-0.113 (-1.473)
	v.a./GDP1970	0.411 (3.696)	0.494 (2.954)	0.444 (3.684)
	GDPpc1970	-21.753 (-0.763)	2.137 (0.083)	19.620 (0.688)
	GDPpc-sq1970	1.006 (0.537)	-0.216 (-0.121)	-0.851 (-0.441)
	Adj.R-squared	0.58	0.34	0.31
	Observations	57	57	57
	Change of Import Share	-0.226 (-1.918)	0.344 (2.444)	-0.111 (-1.110)
	v.a./GDP1970	0.424 (3.803)	0.526 (2.606)	0.437 (3.535)
	GDPpc1970	-29.134 (-1.037)	15.221 (0.592)	16.540 (0.553)
	GDPpc-sq1970	1.454 (0.788)	-1.021	-0.685 (-0.339)
	Adj.R-squared	0.54	0.22	0.29
	Observations	58	58	58
Highly Agricultural Economies	Change of Trade Share	-0.350 (-3.625)	0.545 (4.309)	-0.195 (-1.501)
	v.a./GDP1970	0.452 (3.326)	0.630 (2.648)	0.116 (0.511)
	GDPpc1970	-58.250 (-0.756)	-46.099 (-0.365)	103.455 (0.785)
	GDPpc-sq1970	3.594 (0.639)	3.623 (0.383)	-7.161
	Adj.R-squared	0.69	0.57	0.12
	Observations	27	27	27
	Change of Import Share	-0.551 (-6.056)	0.678 (5.090)	-0.068 (-0.571)
	v.a./GDP1970	0.485 (4.361)	0.888 (3.639)	0.145 (0.790)
	GDPpc1970	-69.694 (-1.053)	-74.439 (-0.581)	160.756 (1.171)
	GDPpc-sq1970	4.220 (0.887)	5.958 (0.615)	-11.459 (-1.093)
	Adj.R-squared	0.70	0.47	0.04
	Observations	28	28	28

Note: The period is 1970-95. The t-statistic is in the parentheses.

significant coefficients. However, the initial GDP per capita is statistically significant when the regression does not include its squared value (not shown in Table 3).

These results are robust if we add as an independent variable the change in the ratio of foreign direct investment (FDI) over GDP during this period. FDI was mainly in the industrial sector and therefore, countries that experienced an increase in FDI are expected to become more industrialized, holding everything else constant. However, FDI turns out to be statistically insignificant. The effect of FDI may already be captured by openness, given that open economies may be receiving more FDI. Errors in measuring FDI in developing countries may be another reason for this result. Finally, some developing countries do not have data for FDI and this reduces the sample considerably. Since FDI turns out to have a statistically insignificant coefficient and does not change our main results, we do not report these estimates.

The average growth rate of each economy during the period is another variable that we included in the regression, in an estimation not reported here. The complication with this estimation is that the growth rate is not an exogenous variable, since it is determined, among other things, by industrialization plus almost all the other variables in the right-hand side of the regression we estimate. For example, more openness implies faster growth, which in turn influences industrialization. This means that such an estimate will bias downwards the estimated coefficient of openness and bias upwards the estimated coefficient of the growth rate. It turns out that the trade variables are not significant in the regression for the agricultural sector, but are significant and with positive coefficients in the regression for the industrial sector. Therefore, even in this case the main conclusion remains that free trade and industrialization are not conflicting objectives in developing agricultural economies.

An interesting finding in both Tables 2 and 3 is that the more agriculturally oriented the group of countries is, the larger are the estimates of the openness variables. The impact of opening-up to free trade is estimated to be higher in the highly agricultural economies than in the other two groups, and higher in agricultural economies than in the group of developing countries. The same result is confirmed if the regression for the industrial sector of the developing country group includes an interaction of the change in trade share with the initial level of industrialization. The coefficient of this variable is negative and statistically significant, which implies that the less industrialized a country is at the moment of liberalization, the more positive the impact of opening-up on industrialization.

This result may imply a U-shaped impact of liberalization on the industrial sector for countries that have already developed some industries under a regime of protection. Opening-up to international trade may result in the closure of inefficient protected industries in the short-run, and in the development of new industries in the long-run, where the country has a comparative advantage, hence the U-shaped impact of liberalization on industrialization. Another reason, however, may be that countries with high agricultural shares of production have high underemployment rates. When job opportunities in the industrial sector become available, underemployment in the agricultural sector declines and employment in the industrial sector increases.

An interesting question is what part of the industrial sector increases with liberalization. The data on industrial production include mining and quarrying, manufacturing and electricity, and gas and water. The sector generally believed to be the basis for long-run growth is the manufacturing sector. To address this issue, the empirical model is estimated having the share of manufacturing value added over GDP as the dependent variable. This test can show what is the impact of opening-up to international trade on the manufacturing part of the industrial sector.

The empirical results show that liberalization promotes manufacturing activity. Table 4 shows the estimates of the empirical model when the share of manufacturing value added is the dependent variable. The estimated coefficients for the change of both the trade share and the import share are positive and statistically significant. Therefore, manufacturing is clearly one of the sectors driving the estimated increase in industrial activity in countries that liberalize trade. Unfortunately, very few agricultural developing economies have available time series on manufacturing value added, and the estimates in Table 4 are only for the group of developing countries. Given this limitation, the following sections of the paper present results for the total industry value added, not for manufacturing separately.

C. Real Versus Nominal Changes

The theoretical models discussed in this paper give predictions for the real shares of output in the different sectors of production. However, the results in the previous section are for nominal shares. The countries in this paper are too small to have an impact on international prices, and therefore we should not expect changes in their trade policy to influence their terms of trade or the prices of their sectors of production. Trade policy should be driving only changes in real values. In this section we examine this issue, by deflating GDP, trade, imports, and each sector of production, by their deflators, and then calculating real shares. Otherwise, the methodology is the same as in the previous section.

The results show some small differences from the ones in the previous section, without changing the main conclusions. Estimates for the Spearman rank correlation coefficient are presented in Table 5. In this case, opening to trade does not have a statistically significant impact on the share of agriculture (see the third column), but the estimates are still negative. The results in the fourth column suggest that opening to trade and an increase of the industry share of output are positively correlated. The estimates, however, are not statistically significant for the sample of developing countries. A possible reason may be that the theoretical predictions of this paper are only for agricultural economies. However, the regression analysis that follows does not confirm this conclusion.

Table 6 presents estimates of the empirical model using variables expressed in real shares. The change of the trade share has a negative and statistically significant (at the

Table 4. The Impact of Changes in Openness on Manufacturing

Countries	Independent Variables	Estimates (t-statistic)
Developing Economies	Change of Trade Share	0.138 (2.958)
	Man.v.a./GDP1970	0.815 (7.093)
	GDPpc1970	14.510 (1.246)
	GDPpc-sq1970	-1.268 (-1.407)
	Adj.R-squared	0.59
	Observations	46
	Change of Import Share	0.206 (3.329)
	Man.v.a./GDP1970	0.798 (5.947)
	GDPpc1970	15.843 (1.105)
	GDPpc-sq1970	-1.340 (-1.234)
	Adj.R-squared	0.57
	Observations	46

Note: The dependent variable is manufacturing value added/GDP in 1995. The period is 1970-95. The t-statistic is in the parentheses.

Table 5. Spearman Rank Correlation Coefficients of Changes in Openness and Production in Different Sectors, in Developing and Agricultural Economies: Real Shares

Group of Countries	Variables	Agriculture Value Added/GDP	Industry Value Added/GDP	Services Value Added/GDP
Developing Economies	Trade Share	-0.124 (-0.953)	0.178 (1.331)	0.014 (0.104)
	Observations	60	56	57
	Import Share	-0.144 (-1.112)	0.126 (0.936)	0.112 (0.833)
	Observations	60	56	57
Agricultural Economies	Trade Share	-0.137 (-0.937)	0.370 (2.580)	-0.096 (-0.632)
	Observations	48	44	45
	Import Share	-0.160 (-1.096)	0.296 (2.009)	0.005 (0.035)
	Observations	48	44	45
Highly Agricultural Economies	Trade Share	0.053 (0.255)	0.416 (2.096)	-0.304 (-1.499)
	Observations	25	23	24
	Import Share	-0.071 (-0.340)	0.405 (2.029)	-0.165 (-0.785)
	Observations	25	23	23

Note: All variables are changes between the period 1970-95. The t-statistic is in the parentheses.

Table 6. The Impact of Changes in Openness on the Different Sectors of Production: Real Shares

Regressions		Dependent Variables		
Group of Countries	Independent Variables	Agriculture Value Added/GDP 1995	Industry Value Added/GDP 1995	Services Value Added/GDP 1995
Developing Economies	Change of Trade Share	-0.078 (-1.708)	0.10 (3.239)	0.017 (0.599)
	v.a./GDP1970	0.542 (4.372)	0.557 (4.041)	0.368 (3.886)
	GDPpc1970	-1.122 (-0.387)	0.409 (1.474)	-0.065 (-0.305)
	GDPpc-sq1970	0.007 (0.354)	-0.030 (-1.579)	0.007 (0.478)
	Adj.R-squared	0.52	0.4	0.36
	Observations	60	56	57
	Change of Import Share	-0.08 (-1.091)	0.12 (1.940)	0.032 (0.868)
	v.a./GDP1970	0.525 (4.255)	0.535 (3.762)	0.369 (3.892)
	GDPpc1970	-0.105 (-0.331)	0.397 (1.507)	-0.052 (-0.244)
	GDPpc-sq1970	0.006 (0.262)	-0.028 (-1.585)	0.006 (0.414)
	Adj.R-squared	0.49	0.35	0.36
	Observations	60	56	57
Agricultural Economies	Change of Trade Share	-0.15 (-1.778)	0.21 (4.337)	-0.021 (-0.295)
	v.a./GDP1970	0.547 (3.817)	0.381 (3.782)	0.234 (1.614)
	GDPpc1970	0.383 (0.770)	-0.098 (-0.185)	0.137 (0.302)
	GDPpc-sq1970	-0.030 (-0.855)	0.008 (0.216)	-0.007 (-0.217)
	Adj.R-squared	0.42	0.34	0.17
	Observations	51	47	48
	Change of Import Share	-0.08 (-0.988)	0.12 (1.711)	0.041(0.996)
	v.a./GDP1970	0.412 (2.676)	0.574 (3.111)	0.456 (3.949)
	GDPpc1970	0.161 (0.341)	-0.198 (-0.301)	0.232 (0.539)
	GDPpc-sq1970	-0.015 (-0.462)	0.016 (0.328)	-0.016 (-0.528)
	Adj.R-squared	0.34	0.32	0.31
	Observations	48	44	45
Highly Agricultural Economies	Change of Trade Share	-0.308 (-1.840)	0.139 (0.800)	0.252 (4.216)
	v.a./GDP1970	0.482 (1.885)	0.543 (1.480)	0.528 (5.702)
	GDPpc1970	0.274 (0.404)	-1.071 (-1.211)	0.993 (2.922)
	GDPpc-sq1970	-0.022 (-0.443)	0.080 (1.215)	-0.073 (-3.052)
	Adj.R-squared	0.28	0.33	0.61
	Observations	26	23	24
	Change of Import Share	-0.010 (-0.103)	0.13 (1.292)	-0.00 (-0.006)
	v.a./GDP1970	0.346 (0.995)	0.579 (1.700)	0.445 (3.607)
	GDPpc1970	0.573 (0.847)	-0.990 (-1.018)	0.734 (1.748)
	GDPpc-sq1970	-0.044 (-0.906)	0.074 (1.021)	-0.054 (-1.798)
	Adj.R-squared	0.006	0.36	0.37
	Observations	26	23	24

Note: The period is 1970-95. The t-statistic is in the parentheses.

10 percent level) impact on the agricultural share. The change of the import share also has a negative impact on agriculture, but its coefficient is not statistically significant. The impact of the changes of the trade and import shares on the industrial share is positive and statistically significant at least at the 10 percent level, except for the group of highly agricultural economies. The reason may be that the sample of highly agricultural economies is very small in this empirical specification (only 23 countries).

Despite the fact that the estimates are not always statistically significant when we use real shares, they do show that developing agricultural economies do not experience de-industrialization after liberalization, rather, if anything, the opposite seems to be happening. The results in this section also confirm that the more agricultural the group of countries is, the larger the positive impact of openness on industrialization. One reason why some of the results are not statistically significant may be the existence of measurement errors in the deflators. It is very difficult to calculate price indexes for developing economies, since the available data are relatively poor. When we used nominal shares in the previous section, we implicitly assumed that all variables had the same deflator. This assumption is not accurate,but it may be better than using separate deflators in the presence of serious measurement errors.

D. An Alternative Measure for Openness

This section examines if the results are robust when the Sachs and Warner (1995) measure of openness is used, instead of the share of trade or imports (this openness measure has been used widely by the recent trade and growth literature). Based on their definition, an economy is defined as open if all of the following five conditions hold: *(1)* the average tariff rate is less than 40 percent, *(2)* the average non-tariff barriers are less than 40 percent, *(3)* the black market premium is less than 20 percent of the official exchange rate, *(4)* there is not a communist government, and finally *(5)* there is no state monopoly of major exports. Using this approach, Sachs and Warner review regulations that have changed trade policy in most countries of the world since 1950, and provide the dates of liberalization for countries that are considered as open. Then, they calculate how many years a country has been open, and use this as a measure of openness.

In what follows, we consider all countries that liberalized their trade based on the Sachs-Warner definition, in the period 1970-90. We do not consider countries that liberalized in earlier periods because production data are not always available. This leads to a list of fourteen countries, most of them developing (see Table 7 for the countries and the dates of openness). This is a small number of observations to estimate a regression, and thus we just compare the changes of the sector production shares during the period 1970-95, for countries that opened to international trade versus countries that remained closed.[11] We also examine if the changes in the production shares during this period are correlated with the number of the

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[11] The set of closed economies includes countries that liberalized their trade after 1990, because the time was too short for sectoral adjustments to take place in these countries.

Table 7. Countries and Year of Openness

Country	Year of opennes
Bolivia	1985
Botswana	1979
Chile	1976
Costa Rica	1986
Gambia	1985
Ghana	1985
Guinea	1986
Guinea-Bissau	1987
Indonesia	1970
Korea	1968
Mauritius	1968
Mexico	1986
Morocco	1984
New Zealand	1986

years a country has been open. Finally, we compare production shares before and after opening to international trade, which is a test that can provide some clarification on causality issues.

These tests are descriptive, since the small number of observations does not allow us to control for changes in other variables. Therefore, the results in this section should be treated more as a robustness check of the findings in the previous section, than anything else. Nevertheless, the empirical results in this section can be very instructive for the direction of causality of the relation between openness and industrialization, since they compare changes in industrial and agricultural shares of production before and after liberalization.

The results in Tables 7 and 8 seem to confirm the findings of previous sections. The first column of Table 8 shows that closed economies experienced a small increase in their industrial share of output (a decrease when we consider the real share) and a large decline in the agricultural share during 1970-95 (the share of services increased). However, this trend ismuch stronger for economies that opened to free trade during 1970-90, as the second column shows, for both nominal and real shares. The third column shows that the more years a country was open during the period 1970-95, the more the share of its industrial sector increased and the more the share of its agricultural sector declined. This trend is stronger for real than for nominal shares.

Table 9 shows a comparison of the production shares one year before liberalization with the shares in the final year of the period considered. The fourth column of Table 9 shows that after liberalization the agricultural share decreases, while the industrial share increases on average. The last two columns show that the more years a country has been open, the more the agricultural share has shrunk, and the more the industrial share has increased. These changes are again larger for real than for nominal shares. The estimates for the share of services are still not robust and change signs for nominal and real values. However, the direction of causality is clear in these results, with countries increasing their industrial share of production after liberalization.

V. Conclusions

Despite the existence of a large body of empirical literature on the impact of openness on growth, no study has examined the impact of trade liberalization on different sectors of production in developing economies. This, however, is an issue with important policy implications. Many policymakers in developing agricultural economies have been trying to promote industrialization by restricting trade.

This paper has shown evidence that this policy may lead to the opposite result of the one it was designed to produce. According to the empirical evidence in this paper, developing agricultural economies that increased their openness to international trade during the period

Table 8. Opening to International Trade and Changes in Shares of Production

Sectors	Average Change of Sector Share in 1970-95, Closed Economies	Average Change of Sector Share in 1970-95, Economies that Opened	Correlation (Years Open, Change)
Agriculture Value Added/GDP	-5.26	-6.46	-0.30
Industry Value Added/GDP	1.65	6.64	0.46
Services Value Added/GDP	3.29	1.81	-0.14
Real Agriculture Value Added/GDP	-4.62	-9.38	-0.35
Real Industry Value Added/GDP	-0.36	1.88	0.60
Real Services Value Added/GDP	4.90	7.49	-0.40

Table 9. Opening to International Trade and Changes in Shares of Production

Sectors	Share 1 Year Before Opening	Share in 1995	Change	Correlation (Years Open, Change)	Sp. Rank Corr.(Years Open, Change)
Agriculture Value Added/GDP	25.17	19.42	-5.76	-0.34	-0.503 (-2.018)
Industry Value Added/GDP	27.04	30.77	3.73	0.50	0.648 (2.950)
Services Value Added/GDP	47.79	49.81	2.02	-0.33	-0.301 (-1.094)
Real Agriculture Value Added/GDP	25.36	19.11	-6.26	-0.55	-0.767 (-4.141)
Real Industry Value Added/GDP	27.60	30.94	3.34	0.65	0.574 (2.426)
Real Services Value Added/GDP	44.66	48.41	3.75	0.07	0.429 (1.643

1970-95 experienced an increase in the share of industrial production at the expense of agricultural production. This result is robust to using different measures of openness and adjusting for changes in relative prices. Since liberalization in developing agricultural countries increases industrial production at the expense of agricultural production, the concern that free trade may hurt the infant industries and industrialization in these economies is not justified.

This paper has also presented a theoretical model, showing that it is possible for free trade to result in the industrialization of the developing world. This model extended the infant industry model, to include aspects of the recent trade and growth literature. Under the assumption that there are learning effects from both domestic production and imports in manufacturing, the model shows that the infant industry argument can be in support of free trade.

Even if this paper had simply shown that openness does not hurt industrialization in developing agricultural countries (if the empirical results were not statistically significant), this result would still have important policy implications. However, the evidence shows that openness is actually beneficial for industrialization, or, conversely, that high protection may lead to the survival of inefficient industries at the expense of new and more competitive industries that openness would promote.

Proof of Propositions

Proposition 1 will be proved through the sequence of claims.

Define

$$w = \frac{(1-\alpha)k_c}{\alpha} = \frac{(1-\beta)k_m}{\beta} \tag{A1}$$

or

$$k_c(w) = \frac{\alpha w}{(1-\alpha)} \quad \text{and} \quad k_m(w) = \frac{\beta w}{(1-\beta)} \tag{A2}$$

Substituting in the optimality conditions and simplifying we can express w in terms of the model parameters, the tariff level and productivity level Q as:

$$w(\tau, Q) = H(\overline{P}(1+\tau))^{-\frac{1}{\beta-\alpha}} Q^{-\frac{n}{\beta-\alpha}} \tag{A3}$$

Where

$$H = \left(\frac{\alpha^{\alpha}(1-\alpha)^{(1-\alpha)}}{\beta^{\beta}(1-\beta)^{1-\beta}}\right)^{\frac{1}{\beta-\alpha}} \tag{A4}$$

This expression has the standard property of decreasing wage to rental ratio with the increase of the price and/or productivity in the capital-intensive sector (m). Let's rewrite the learning equation as:

$$\frac{dQ}{dt} = (\eta - \gamma\frac{g}{1+g(1+\tau)})Q^{n}B(w) + \gamma\frac{1}{\overline{P}(1+g(1+\tau))}C(w) - \delta Q \tag{A5}$$

where,

$$B(w) = f_m(k_m((w))(1 - l_c(w)) = \left(\frac{\beta w}{1-\beta}\right)^{\beta}\left(\frac{k - (\frac{\alpha w}{1-\alpha})}{(\frac{\beta w}{1-\beta}) - (\frac{\alpha w}{1-\alpha})}\right) \tag{A6}$$

$$C(w) = f_c(k_c(w))l_c(w) = \left(\frac{\alpha w}{1-\alpha}\right)^{\alpha}\left(\frac{(\frac{\beta w}{1-\beta}) - k}{(\frac{\beta w}{1-\beta}) - (\frac{\alpha w}{1-\alpha})}\right) \tag{A7}$$

We are interested how the stationary solution Q* s.t. dQ*/dt = 0 is changing with respect to change in the tariff. If the solution is stationary then:

$$0 = (\eta - \gamma\frac{g}{1+g(1+\tau)})Q^{n}B(w) + \gamma\frac{1}{P(1+g(1+\tau))}C(w) - \delta Q \tag{A8}$$

Our interest is in the derivative of the stationary (steady state) value Q^* with respect to the tariff level τ. So we want to know the properties of $\frac{\partial Q^*}{\partial \tau}$.

Claim 1:

The derivative:

$$\frac{\partial Q}{\partial \tau} = \frac{\gamma(\frac{g}{1+g(1+\tau)})^2[Q^{n}B(w) - \frac{1}{\bar{P}g}C(w)] - \frac{1}{\bar{P}(1+\tau)}[\frac{1}{\beta-\alpha}(\eta-\gamma\frac{g}{1+g(1+\tau)})Q^{n}B'(w)w + \frac{1}{\beta-\alpha}\gamma\frac{1}{\bar{P}(1+g(1+\tau))}C'(w)w]}{Q^{-1}[\frac{1}{\beta-\alpha}(\eta-\gamma\frac{g}{1+g(1+\tau)})Q^{n}B'(w)w + \frac{1}{\beta-\alpha}\gamma\frac{1}{\bar{P}(1+g(1+\tau))}C'(w)w - (\eta-\gamma\frac{g}{1+g(1+\tau)})Q^{n}B(w)] + \delta} \tag{A9}$$

where w is defined by (A4).

Proof of the claim 1

To find $\frac{\partial Q^*}{\partial \tau}$ we use the implicit function theorem. Differentiating the stationary equation (A8) we get:

$$\begin{aligned} 0 = {} & \gamma(\frac{g}{1+g(1+\tau)})^2 Q^{n}B(w) + n(\eta-\gamma\frac{g}{1+g(1+\tau)})Q^{n-1}B(w)\frac{\partial Q}{\partial \tau} + (\eta-\gamma\frac{g}{1+g(1+\tau)})Q^{n}B'(w)\frac{\partial w}{\partial \tau} \\ & - \frac{\gamma}{\bar{P}}\frac{g}{(1+g(1+\tau))^2}C(w) + \gamma\frac{1}{\bar{P}(1+g(1+\tau))}C'(w)\frac{\partial w}{\partial \tau} - \delta\frac{\partial Q}{\partial \tau} \end{aligned} \tag{A10}$$

Now note that

$$\begin{aligned} \frac{\partial}{\partial \tau}[w(\tau,Q(\tau))] & = -\frac{1}{\beta-\alpha}H(\bar{P}(1+\tau))^{-\frac{1}{\beta-\alpha}-1}Q^{\frac{-n}{\beta-\alpha}} - \frac{n}{\beta-\alpha}H(\bar{P}(1+\tau))^{-\frac{1}{\beta-\alpha}}Q^{-\frac{n}{\beta-\alpha}-1}\frac{\partial Q}{\partial \tau} = \\ & = -\frac{1}{\beta-\alpha}H(\bar{P}(1+\tau))^{-\frac{1}{\beta-\alpha}-1}Q^{\frac{-n}{\beta-\alpha}}[1 + n\bar{P}(1+\tau)\frac{1}{Q}\frac{\partial Q}{\partial \tau}] \end{aligned} \tag{A11}$$

Substituting the expression for $\frac{\partial w}{\partial \tau}$ we get:

$$(\eta - \gamma \frac{g}{1+g(1+\tau)})Q^n B'(w)\frac{\partial w}{\partial \tau} =$$
$$-(\eta - \gamma \frac{g}{1+g(1+\tau)}Q^n B'(w)\frac{1}{\beta-\alpha}H(\bar{P}(1+\tau))^{-\frac{1}{\beta-\alpha}-1}Q^{\frac{-n}{\beta-\alpha}}$$
$$-(\eta - \gamma \frac{g}{1+g(1+\tau)}Q^n B'(w)n\frac{1}{\beta-\alpha}H(\bar{P}(1+\tau))^{-\frac{1}{\beta-\alpha}}Q^{\frac{-n}{\beta-\alpha}-1}\frac{\partial Q}{\partial \tau} \tag{A12}$$

and

$$\gamma \frac{1}{\bar{P}(1+g(1+\tau))}C'(w)\frac{\partial w}{\partial \tau} =$$
$$-\gamma \frac{1}{\bar{P}(1+g(1+\tau))}C'(w)\frac{1}{\beta-\alpha}H(\bar{P}(1+\tau))^{-\frac{1}{\beta-\alpha}-1}Q^{\frac{-n}{\beta-\alpha}}$$
$$-\gamma \frac{1}{\bar{P}(1+g(1+\tau))}C'(w)n\frac{1}{\beta-\alpha}H(\bar{P}(1+\tau))^{-\frac{1}{\beta-\alpha}}Q^{-\frac{n}{\beta-\alpha}-1}\frac{\partial Q}{\partial \tau} \tag{A13}$$

Grouping the terms around $\frac{\partial Q}{\partial \tau}$ we get that the term with $\frac{\partial Q}{\partial \tau}$ is:

$$-\frac{\partial Q}{\partial \tau}[(\eta - \gamma \frac{g}{1+g(1+\tau)}Q^n B'(w)n\frac{1}{\beta-\alpha}H(\bar{P}((1+\tau))^{-\frac{1}{\beta-\alpha}}Q^{\frac{-n}{\beta-\alpha}-1} +$$
$$\gamma \frac{1}{\bar{P}(1+g(1+\tau))}C'(w)n\frac{1}{\beta-\alpha}H(\bar{P}(1+\tau))^{-\frac{1}{\beta-\alpha}}Q^{\frac{-n}{\beta-\alpha}-1} - (\eta - \gamma \frac{g}{1+g(1+\tau)}nQ^{n-1}B(w) + \delta] \tag{A14}$$

Denote the term in brackets $Term_D$

Substituting $H(\bar{P}(1+\tau))^{-\frac{1}{\beta-\alpha}}Q^{-n\frac{1}{\beta-\alpha}} = w$ we get that

$Term_D =$

$$Q^{-1}[\frac{1}{\beta-\alpha}(\eta - \gamma \frac{g}{1+g(1+\tau)})Q^n B'(w)w + \frac{1}{\beta-\alpha}\gamma \frac{1}{\bar{P}(1+g(1+\tau))}C'(w)w - (\eta - \gamma \frac{g}{1+g(1+\tau)})Q^n B(w)] + \delta$$

Grouping the terms without $\frac{\partial Q}{\partial \tau}$. We obtain that the term without $\frac{\partial Q}{\partial \tau}$ ($Term_N$) is:

$$\gamma\left(\frac{g}{1+g(1+\tau)}\right)^2 Q^n B(w) - \frac{\gamma}{\bar{P}}\frac{g}{(1+g(1+\tau))^2}C(w) -$$
$$-(\eta-\gamma\frac{g}{1+g(1+\tau)}Q^n B'(w)\frac{1}{\beta-\alpha}H(\bar{P}(1+\tau))^{-\frac{1}{\beta-\alpha}-1}Q^{-n\frac{1}{\beta-\alpha}} -$$
$$-\gamma\frac{1}{\bar{P}(1+g(1+\tau))}C'(w)\frac{1}{\beta-\alpha}H(\bar{P}(1+\tau))^{-\frac{1}{\beta-\alpha}-1}Q^{-n\frac{1}{\beta-\alpha}} \tag{A15}$$

Substituting $H(\bar{P}(1+\tau))^{-\frac{1}{\beta-\alpha}}Q^{\frac{-n}{\beta-\alpha}} = w$ and rearranging we get that ($Term_N$) is:

$$\gamma\left(\frac{g}{1+g(1+\tau)}\right)^2 Q^n B(w) - \frac{\gamma}{\bar{P}}\frac{g}{(1+g(1+\tau))^2}C(w) -$$
$$-\frac{1}{(\bar{P}(1+\tau)}\frac{1}{\beta-\alpha}(\eta-\gamma\frac{g}{1+g(1+\tau)})Q^n B'(w)w$$
$$-\gamma\frac{1}{(\bar{P}(1+\tau)}\frac{1}{\beta-\alpha}\frac{1}{\bar{P}(1+g(1+\tau))}C'(w)w$$

This can be rewritten as:

$$\gamma\left(\frac{g}{1+g(1+\tau)}\right)^2[Q^n B(w) - \frac{1}{\bar{P}g}C(w)] -$$
$$-\frac{1}{(\bar{P}(1+\tau)}[\frac{1}{\beta-\alpha}(\eta-\gamma\frac{g}{1+g(1+\tau)})Q^n B'(w)w + \frac{1}{\beta-\alpha}\gamma\frac{1}{\bar{P}(1+g(1+\tau))}C'(w)w \tag{A16}$$

Therefore:

$\frac{\partial Q}{\partial \tau} = \frac{Term_N}{Term_D}$ and given by formula (A9).

Q.E.D.

where $Term_N$ and $Term_d$ were derived above.

The sufficient condition for the decline of the steady state productivity multiplier Q with the tariff increase ($\frac{\partial Q}{\partial \tau}$<0) is a positive sign of the numerator and a negative sign of the denominator in the formula A9.

Claim 2.

Suppose:

$$[Q^{n}B(w) - \frac{1}{\bar{P}g}C(w)] < 0 \tag{A17}$$

and

$$\frac{1}{\beta-\alpha}(\eta-\gamma\frac{g}{1+g(1+\tau)})Q^{n}B'(w)w+\frac{1}{\beta-\alpha}\gamma\frac{1}{\bar{P}(1+g(1+\tau))}C'(w)w-(\eta-\gamma\frac{g}{1+g(1+\tau)})Q^{n}B(w)>0 \tag{A18}$$

Then $\frac{\partial Q^{*}}{\partial \tau}<0$.

Proof of the claim 2

Conditions A17 and A18 are sufficient for the numerator to be negative and positivity of the denominator to be positive in the expression (A9). Note the condition (A17) alone is sufficient for the positivity of the denominator and the negativity of the second term in the numerator:

$$-\frac{1}{\bar{P}(1+\tau)}[\frac{1}{\beta-\alpha}(\eta-\gamma\frac{g}{1+g(1+\tau)})Q^{n}B'(w)w+\frac{1}{\beta-\alpha}\gamma\frac{1}{\bar{P}(1+g(1+\tau))}C'(w)w]$$

Q.E.D.

Note that the condition $[Q^{n}B(w) - \frac{1}{\bar{P}g}C(w)] < 0$ can be rewritten as:

$$g\bar{P}F_{m} < F_{c} \tag{A19}$$

It says that in the steady state the free trade *value* of the domestic output of the good *m* is less than the weighted free trade value of the output of the good *c*. The above inequality is expected hold for developing agricultural economies, since it is also reasonable to expect the domestic production of *m* to be lower than the output of the agricultural product c. According to Engel's law, the share of expenditure in food declines as income increases. Indeed, the richer a country is, the smaller its share of spending in agricultural products, and vice versa.

Claim 3
Suppose $\gamma>\eta$. Then condition (A18) holds.

Proof of the claim 3.
Note that

$$B(w) = f_m(k_m(w))(1 - l_c(w)) = (\frac{\beta w}{1-\beta})^{\beta}\left(\frac{k - (\frac{\alpha w}{(1-\alpha)})}{(\frac{\beta w}{(1-\beta)}) - (\frac{\alpha w}{(1-\alpha)})}\right)$$

$$= J_1 w^{\beta-1} - J_2 w^{\beta} \tag{A20}$$

where,

$$J_1 = (\frac{\beta}{1-\beta})^{\beta}\frac{(1-\alpha)(1-\beta)}{(\beta-\alpha)}k; J_2 = (\frac{\beta}{1-\beta})^{\beta}\frac{\alpha(1-\beta)}{(\beta-\alpha)} \tag{A21}$$

$$C(w) = f_c(k_c(w))l_c(w) = (\frac{\alpha w}{1-\alpha})^{\alpha}\left(\frac{\left(\frac{\beta w}{(1-\beta)}\right) - k}{\left(\frac{\beta w}{(1-\beta)}\right) - \left(\frac{\alpha w}{(1-\alpha)}\right)}\right) = I_2 w^{\alpha} - I_1 w^{\alpha-1} \tag{A22}$$

where,

$$I_2 = (\frac{\alpha}{1-\alpha})^{\alpha}\frac{\beta(1-\alpha)}{\beta-\alpha}; \quad I_1 = (\frac{\alpha}{1-\alpha})^{\alpha}\frac{(1-\alpha)(1-\beta)}{\beta-\alpha}k; \tag{A23}$$

Also note that,

$$w^{-(\beta-\alpha)}B(w) = J_1 w^{\alpha-1} - J_2 w^{\alpha} \tag{A24}$$

and

$$Q^n = [\frac{\alpha^{\alpha}(1-\alpha)^{1-\alpha}}{\beta^{\beta}(1-\beta)^{1-\beta}}]\frac{1}{\bar{P}(1+\tau)}w^{-(\beta-\alpha)} \tag{A25}$$

.

Substituting these expressions in the condition A18 and simplifying, we obtain that the condition A18 is equivalent to the condition:

$$\gamma\left(\frac{(1+g\frac{1-\alpha}{1-\beta})(1+\tau)}{(1+g(1+\tau)}\right)>\eta \ , \tag{A26}$$

The fraction in this expression is always greater than one:

$$\frac{(1+g\frac{1-\alpha}{1-\beta})(1+\tau)}{(1+g)(1+\tau)}>1 \ , \tag{A27}$$

because $(1\text{-}\alpha)>(1\text{-}\beta)$ and

$$(1+g\frac{1-\alpha}{1-\beta})(1+\tau)=(1+g\frac{1-\alpha}{1-\beta}\tau)+(1+g\frac{1-\alpha}{1-\beta})>1+g(1+\tau) \ , \tag{A28}$$

Therefore $\gamma>\eta$ is a sufficient condition for the (A19) to hold.
Q.E.D.

Country Groups in the Empirical Sections

Developing Countries.
Algeria, Argentina, Bangladesh, Barbados, Benin, Botswana, Brazil, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, China, Colombia, Congo, Costa Rica, Côte d'Ivoire, Dominican Republic, Ecuador, Egypt, El Salvador, Fiji, Gabon, Gambia, Ghana, Greece, Guinea-Bissau, Guyana, Honduras, India, Indonesia, Jamaica, Kenya, Korea, Lesotho, Madagascar, Malawi, Malaysia, Mali, Malta, Mauritania, Mauritius, Mexico, Morocco, Myanmar, Nepal, Nicaragua, Niger, Nigeria, Oman, Pakistan, Papua New Guinea, Paraguay, Peru, Philippines, Senegal, Sierra Leone, Singapore, South Africa, Sri Lanka, Suriname, Swaziland, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey, Uganda, Uruguay, Zambia.

Agricultural Economies.
Bangladesh, Belize, Benin, Bolivia, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, China, Colombia, Congo, Costa Rica, Côte d'Ivoire, Dominican Republic, Ecuador, Egypt, El Salvador, Fiji, Gambia, Ghana, Greece, Guinea-Bissau, Guyana, Honduras, India, Indonesia, Kenya, Korea, Lesotho, Madagascar, Malawi, Malaysia, Mali, Mauritania, Morocco, Nepal, Nicaragua, Niger, Nigeria, Pakistan, Papua New Guinea, Paraguay, Philippines, Rwanda, Senegal, Sierra Leone, Somalia, Sri Lanka, Sudan, Suriname, Syrian Arab Republic, Thailand, Togo, Tunisia, Turkey, Zaire.

Highly Agricultural Economies.
Bangladesh, Benin, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, China, Côte d'Ivoire, Egypt, Gambia, Ghana, Guinea-Bissau, India, Indonesia, Kenya, Lesotho, Malawi, Mali, Nepal, Nicaragua, Niger, Nigeria, Pakistan, Paraguay, Rwanda, Sri Lanka, Sudan.

References

Arrow, K.J., 1962, *Economic Implications of Learning by Doing*, Review of Economic Studies, 29.

Barro, Robert J., and Xavier Sala-I-Martin, 1995, *Economic Growth*, McGraw-Hill, Inc.

Ben-David, Dan, 1993, *Equalizing Exchange: Trade Liberalization and Income Convergence,* The Quarterly Journal of Economics, August.

Bardhan, Pranab K., 1970, *Economic Growth, Development, and Foreign Trade; a Study of Pure Theory*, Wiley-Interscience.

Coe, David T., and Elhanan Helpman, 1997, *International R&D Spillovers*, European Economic Review, May.

Coe, David T., Elhanan Helpman, and Alexander W. Hoffmaister, 1997, *North-South R&D Spillovers,* The Economic Journal, January.

Gerschenkron, A., 1952, Economic Backwardness in Historical Perspective, Harvard University Press.

Grossman, G., and E. Helpman, 1989, *Product Development and International Trade*, Journal of Political Economy, December.

_____, and E. Helpman, 1990, *Comparative Advantage and Long Run Growth*, American Economic Review, 80.

_____, and E. Helpman, 1991, *Innovation and Growth in the Global Economy*, The MIT Press, Cambridge MA.

Ground, Richard L., 1988, *The Genesis of Import Substitution in Latin America*, Cepal Review, No. 36, December.

Gwartney, J., R. Lawson, and W. Block, 1996, *Economic Freedom of the World* 1975-1995, Canada.

Jones, Ronald W., and Peter B. Kenen, ed., 1984, *Handbook of International Economics*, Vol.1, International Trade, North-Holland.

Kornai, J., 1992, *The Socialist System: The Political Economy of Communism*, Princeton University Press.

Lee, Jong-Wha, 1993, *International Trade, Distortions, and Long-Run Economic Growth* , IMF Staff Papers, Vol. 40, No. 2.

Matsuyama, Kiminory, 1992, *Agricultural Productivity, Comparative Advantage and Economic Growth*, Journal of Economic Theory, 58.

Nellis, J., and S. Kikeri, 1989, *Public Enterprises Reform: Privatization and the World Bank,* World Development, 17.

Rivera-Batiz, L.A. and P.M. Romer, 1991a, *International Trade with Endogenous Technological Change*, European Economic Review, 35.

_____, and P.M. Romer, 1991b, Economic Integration and Endogenous Growth, Quarterly Journal of Economics.

Romer, Paul M., 1990, Endogenous Technological Change, Journal of Political Economy, October.

Rowthorn, Robert E., and J.R. Wells, 1987, *Deindustrialization and Foreign Trade*, Cambridge University Press.

_____, and Ramana Ramaswamy, 1997, *Deindustrialization: Causes and Implications*, in "Staff Studies for the World Economic Outlook", International Monetary Fund.

Sachs, Jeffrey D., 1996, *Notes on the Life Cycle of State-Led Industrialization*, Japan and the World Economy , 8.

_____, and Andrew Warner, 1995, *Economic Reform and the Process of Global Integration*, Brooking Papers of Economic Activity, 1995:1

Shleifer, Andrei, and Robert W.Vishny, 1994, *Politicians and Firms*, Quarterly Journal of Economics, 109(4), November.

Slaughter, J. Matthew, and Phillip Swagel, 1997, *The Effect of Globalization on Wages in the Advanced Economies*, in "Staff Studies for the World Economic Outlook", IMF.

Vamvakidis, Athanasios, 1997, *International Integration and Economic Growth*, Ph.D. thesis, Economics Department, Harvard University.

_____, 1998, *Regional Integration and Economic Growth*, The World Bank Economic Review, Vol. 12, No. 2 (May), p. 251-270.

_____, 1999, *Regional Trade Agreements or Broad Liberalization: Which Path Leads to Faster Growth?*, IMF Staff Papers, No. 46 (March), pp. 42-68.