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TRADE LIBERALIZATION AND LABOR MARKETS IN DEVELOPING COUNTRIES: THEORY AND EVIDENCE

Jorge Saba Arbache*

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Abstract

This paper presents a review of the theoretical and empirical literature on the effects of trade liberalization on the labor markets of developing countries. We discuss models which seek to explain the empirical finding that openness has increased wage inequality in several developing countries.

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Address for Correspondence: Departamento de Economia, Universidade de Brasília, Caixa Postal 04302, Brasília DF 70910-900, Brazil. E-mail: jarbache@unb.br

* Departamento de Economia, University of Brasilia and Department of Economics, University of Kent at Canterbury

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1 Introduction

The increase in wage inequality in several countries in the last two decades has stimulated the search for explanations of the phenomenon in the economic literature. It is a consensus among economists that one of the causes of the growth of wage inequality is the change in the structure of labor demand in favor of skilled workers, reflected in the increase of returns to education and, in some countries, in the rise in unemployment among individuals with fewer qualifications (Freeman, 1995; Gottschalk and Smeeding, 1997). However, there is no consensus about the underlying causes of the change in the structure of labor demand. On the one hand, empirical evidence shows a relationship between an increase in international trade, wage dispersion and the level of employment, which has led several economists to conclude that recent internationalization of economies has contributed to the increase in the dispersion of wages and unemployment. This proposition is sustained by the theorems of Heckscher and Ohlin and Stolper and Samuelson. In contrast, other economists have argued that the recent wave of technological innovations has had a strong impact on the structure of labor demand, since it is labor saving, especially of less skilled labor.[1] Disentangling these two explanations is however not an easy task because they may be potentially associated.

[1] Some other causes have been proposed to explain the increasing income inequality. These include changes in industrial structure and the decline of institutions, especially decreasing union density and bargaining power (Gosling and Machin, 1995), reductions in minimum wages (Fortin and Lemieux, 1997), and the migration of less skilled workers (Borjas *et al*., 1992).

The literature on trade liberalization and the distribution of wages has two main characteristics. The first is that it aims at explaining the experience of developed, especially OECD, countries. The second is that there has been very little theoretical progress on the issue, and the theorems of Heckscher and Ohlin and Stolper and Samuelson continue to be the main analytical tools used to explain the relationship between international trade and the distribution of income. The case of developing countries has received less attention. It is typically assumed that the impact of trade liberalization in these countries is the opposite of that in developed countries. For example, if there is a worsening of the income distribution in developed countries, then there will be a corresponding improvement in the income distribution in developing countries, just as the standard theory of international trade predicts.

The experience of trade liberalization in developing countries is quite varied, but understanding the effects of openness on their labor markets can be a complex task due to a number of reasons. In the first place, many of these countries have recently gone through structural changes and adjustments. Following the instability of the international economy at the end of the 1970s and the beginning of the 1980s, several developing countries adopted programs of structural adjustment to solve imbalances of the balance of payments and to control high inflation rates. Starting from the middle of the 1980s, many of these countries adopted unprecedented economic reforms involving trade liberalization, privatization of state enterprises, deregulation of the financial and capital markets, as well as product and labor markets, together with wide reform of the State, which caused rapid and extensive changes to their economies. Such changes demand that the analysis of the experience of developing countries be more elaborated.

In the second place, many developing countries followed import substitution industrialization strategies until immediately before the trade liberalization. The structure of protection built over decades determined the direction of the allocation of resources. As a consequence, the remuneration of productive factors and, consequently, the rate of investment, was influenced directly by the orientation of industrial and trade policies, and the allocation of resources was quite sensitive to the structure of protection and to the exchange rate. Krueger (1998) argues that such policy distorted relative prices, moving resources away from activities in which the country has comparative advantages and leading to the production of goods of lower quality and at higher prices. As a result, the allocation and the rate of return to factors of production differ from those that would prevail in an open economy. Such effects can have serious implications for the distribution of income after the openness.

In the third place, since technological innovations originate in developed countries where incentives exist for their application, diffusion and propagation (Lucas, 1990; Stokey, 1991; Young, 1991), the literature normally takes for granted that the hypothesis of technological innovations is appropriate to explain the worsening of the income distribution in developed countries. Although some developing countries have been receiving enormous amounts of foreign direct investment and have been experiencing fast technological modernization with significant productivity increases (e.g. Brazil, China, India and South Korea), they tend to import rather than to create technologies. Therefore, if technology affects the labor markets of developing countries, it may follow a different pattern from that of developed countries.

A feel for the complexity of the effects of openness on the labor markets of developing countries can be given by recent empirical studies which show that trade liberalization in some of these countries is associated with an increase in the returns to human capital and a

worsening of the wage distribution, as in the developed countries. To the extent that developing countries have abundant unskilled labor, this result is puzzling. In accordance with the standard theory of international trade, developing countries should specialize in the production of goods intensive in unskilled labor, thus increasing the relative demand for this factor and reducing the wage differential. These results put in doubt the importance of the standard theory of international trade to explain, at least in the short term, the rise of wage inequality in developing countries.

Hypotheses trying to explain the unexpected worsening of the wage distribution in developing countries have only appeared recently. The explanations are still partial and preliminary, but they suggest that the opening to trade unchains a simultaneous – not a sequential, as in developed countries – process of technological modernization and increase of capital stock, provoking a positive impact in the demand for skilled labor, thus increasing the returns to human capital and the dispersion of wages. Discussing these hypotheses in light of the empirical evidence is the main task of this paper.

Hence the aim of this paper is to present a review of the recent theoretical and empirical literature on the effects of trade liberalization on the labor markets of developing countries. The paper is organized as follows. Section 2 presents the standard theory of international trade and income distribution. Section 3 presents a selection of empirical results on openness and labor markets in developed and developing countries. Section 4 discusses theories that seek to explain the rising wage inequality following trade liberalization in developing countries. The final section contains some brief conclusions.

2 The Theory of International Trade and Income Distribution

The basic precept of free trade theory is that it is more efficient for each country to produce the goods it is more able to produce, due to supply conditions of human resources, natural and physical capital, in comparison to its trade partners. This occurs due to the derived gains from specialization of production. The principle of comparative advantage established by David Ricardo suggests that a country should concentrate on producing goods that have the smallest relative cost of production, and not the smallest absolute cost of production. In Ricardo's formulation, labor is the only production factor. What is unclear in that theory is the effects of free trade on the distribution income, since the theory is based on only one factor of production.

The theorem of Heckscher and Ohlin (HO) extends Ricardo's model to two productive factors, namely capital and labor. The model establishes that a country has comparative advantage in the production of goods which are intensive in the factor of production that is relatively more abundant, since this factor is relatively cheaper when compared to the price of the other, relatively scarce, factor. Thus, countries in which capital supply is relatively large should concentrate on the production of capital intensive goods, and vice-versa for countries whose labor supply is relatively large.

Starting from the picture proposed by HO, the theorem of Stolper and Samuelson (SS) was the first theoretical formulation to explain the effects of free trade on income distribution among production factors. The basic result of SS is that protectionism increases the returns of the scarce production factor - labor in developed countries, and capital in developing countries. As a simple illustration, imagine the case of a developing country with an abundant supply of labor. Suppose that the country can produce two goods, A and B, A being intensive

in labor and B in capital. Suppose that the government imposes an import tariff for the good B of X%. As a consequence of the price increase of the imported good of X%, resources are now shifted to the production of good B. As a result, there is an increase in the demand for capital, which is the intensive factor in the production of good B. The larger demand for that factor forces its price to increase relative to the price of labor, changing the relative prices of production factors in favor of capital. Notice that the return to capital increases more than proportionally to the increase of the price of good B due to the 'magnification effect' (Jones, 1965). If, on the contrary, the country faces a policy of trade liberalization, inverse results would be observed. The return to capital falls by a larger proportion than the price reduction of the imported good, at the same time that the return to labor increases, since the country specializes in the production of good A. The message is that developing countries which introduce programs of trade liberalization should have an improvement of the income inequality indicators, since they are abundant in labor. The opposite should happen for developed countries, since they are abundant in capital.

The factor-price equalization theorem (FPE) (Samuelson, 1948, 1949) extends the analysis of SS to show that, under certain hypotheses, international trade homogenizes the absolute return of production factors among economies. Thus, the real wage in developed and developing countries tends to converge to an intermediary point reducing, therefore, the wages of workers in developed countries and increasing the wages in developing countries. The main assumptions used for the formulation of the theory are: the production factors are qualitatively the same between economies; the production functions are also the same among economies; free movement of goods among economies; there are no transport costs or import taxes; and

production factors do not move among economies. Starting from these conditions, Samuelson shows that, in equilibrium, the real prices of factors will be the same among economies.[2]

Starting from the theoretical structure of HO, Rybczynski (1955) examines the effects of an increase in the supply of one of the production factors, keeping constant the supply of the other factor. He shows that the increase in the supply of a factor results in an absolute increase of the production of the good that uses this factor intensively, and in an absolute decrease in production of the other good**.** The result is the worsening of the terms of trade between the goods, with a price reduction of the good that uses the now more abundant productive factor. An important implication of this theorem is that it helps to show how the entry of countries with different factor supplies in the international economy affects factor returns. According to the theorem, the entrance of developing countries in international trade is sufficient to expand the absolute supply of the labor factor in the international market, affecting its returns (e.g. China and India). Notice that this effect will be observed simply with the entry of developing countries in international trade, without requiring changes in the structure of protection. Rybczynski shows that the predictions of SS are applied without recourse to the reduction or elimination of protection. What matters are the effects of the absolute increase in the supply of production factors on their international prices.

The crucial point of the standard theory of international trade is the correspondence between prices of products and prices of factors, which implies that an increase in the relative price of a good results in an increase of the relative return of the factor used intensively to produce

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[2] The predictions of this theory irritated politicians and labor unions in developed countries because of the fear that globalization (and especially NAFTA, in the American case) is a threat to employment and wages (see the discussion in Slaughter, 1999).

that good. The result is that trade liberalization changes the relative prices of the factors of production in an economy in accordance with the changes in the demand of goods determined by the entrance of the country in the international economy.

The recent literature on trade and income distribution elaborates the above analysis by considering capital, skilled *and* unskilled labor as the relevant factors of production. The theoretical justification is the assumption of complementarity of capital and skilled labor, as originally proposed by Rosen (1968) and Griliches (1969), and recently explored by Goldin and Katz (1998), and Krusell *et al*. (1997) among others. Thus, contrary to the traditional theory which treats labor as homogenous factor of production, labor is divided in skilled and unskilled labor, the returns of which can be differently affected by international trade. It is always assumed that developed countries are abundant in skilled labor, while developing countries are abundant in unskilled labor.

The main predictions of the standard theory of international trade for the distribution of wages are summarized in Table 1. Many of the assumptions required for SS and FPE are obviously unrealistic, as Samuelson recognized, especially those concerning the homogeneity of goods, factors and production functions among economies. Therefore, the predictions of the theorems may not be directly applied but instead should be interpreted as long term trends.[3]

[3] There are alternative theories that differ from the SS results like, for example, the factor intensity reversal, the Metzler paradox, and the specific factor model, associated with Ricardo and Viner. The study of these theories goes beyond the scope of this text.

3 Empirical Evidence[4]

Since the early 1970s in the US, the 1980s in some other OECD countries, and the late 1980s and 1990s in several developing countries, it has been observed that earnings have become more unequal between more and less skilled workers. This phenomenon has coincided with periods of trade liberalization which drove economists to search for a causal relation between the two facts. In this section we present a selection of empirical studies on international trade and wage inequality in developed and developing countries.

Two approaches have been widely employed to investigate the empirical relationship between shifts in international trade and changes in the wage dispersion: the factor content of trade analysis used by labor economists, and the trade framework used by trade economists. Slaughter (1999) shows that these two approaches are distinguished by how they model the national labor demand schedule. While trade economists are concerned with the effects of an increase in trade on the production structure and price changes across industries and therefore on the income of the production factors, labor economists concentrate their attention on the effects of trade on the income of factors through the content of production factors in the exported and imported goods which are added to the domestic supplies, and thus determine the effective supply of the factors. Succinctly, while the trade approach assumes multiple sectors, the labor approach assumes a single sector. Consequently, they imply different empirical strategies for analyzing rising wage inequality.

In order to assess the HO and SS predictions, trade economists investigate the impacts of international trade on wages through changes in product prices. When price increases are

[4] For a detailed survey of the theoretical and empirical literature, see for example, Cline (1997).

concentrated in skill-intensive sectors, relative wages of skilled workers adjust in response to demand shifts for these workers, while demand for unskilled workers tends to decrease causing a reduction in their relative wages. Thus, sector bias matters in the explanation for wage changes. In the case where openness alters technology either through trade or inflow of innovations, knowledge, capital and foreign competition, wages tend to rise for workers employed intensively in industries experiencing relatively large technology gains, and vice-versa for workers in other sectors.

To test the factor content of trade, one calculates how much skilled and unskilled labor is contained in the production of goods exported by a country and compares them with the required amount of these workers if the imported goods were produced internally. The difference between the amount of factors used in the exports and imports is interpreted as the net impact of trade in the demand for skilled and unskilled labor, which is then compared with the demand that would be observed in the absence of international trade. If, for example, the exported goods require more unskilled labor than the imported goods, then the increase of trade would raise the demand for this production factor and consequently its relative earnings. A developed country imports goods from developing countries with high content of unskilled labor, but exports goods with high content of skilled labor, which increases the ‘relative supply’ of unskilled labor within the country, and vice-versa for skilled labor. The balance between factors that ‘come in’ and ‘come out’ in the economy through trade determines the impact on relative earnings.

A great deal of work has investigated the role of technological innovations in the demand for skilled workers, i.e., the skill-biased technological change (SBTC) hypothesis. It is claimed that labor demand in many advanced economies has shifted away from unskilled workers

toward skilled workers as a consequence of technologies that require less workers but more qualifications (Berman *et al*., 1994; Berman *et al*., 1998). The SBTC hypothesis has no *direct* link with trade, at least in the case of developed countries, although the same seems not to be true for developing countries, as will be discussed later. The SBTC hypothesis is seen as the main theoretical alternative to the view that trade is the key cause of the rising wage inequality.

3.1 Evidence for Developed Countries

In general, empirical research shows that the impact of international trade on wage inequality is modest. This can be partly explained by the small proportion of products imported from developing countries (Krugman, 1995; Desjonqueres *et al*., 1999). In the United States, for example, only about 30% of total imports come from developing countries, which represents less than 4% of GNP. Most of the trade flow of the OECD countries is limited to trade among themselves, leaving little room for the labor market to be affected by imports from developing countries. Additionally, in the last 30 years, developing countries opened up relatively more than advanced countries. Although the average degree of openness of advanced economies is twice as large as that of developing economies, between 1970 and 1992 the growth rate of the degree of openness of developing countries was larger than that of developed countries.[5]

Empirical work that looks for an association between trade, prices and rising skill premia has had mixed results. On the one hand, Sachs and Shatz (1994) and Haskel and Slaughter (2001) investigate the case of the US and UK, respectively, and find a relative increase of prices of

[5] Calculated with data from Penn World Table 5.6 for medium and low income developing countries and OECD countries. The concept of economic openness used is (exports + imports)/GNP.

products intensive in skilled labor as a result of international trade. Leamer (1994, 1996) also finds an increase of relative prices of products intensive in skilled labor and a fall of relative prices of sectors intensive in unskilled labor (textile, clothes, footwear) for the US, but just in the 1970s, when there was a large increase in American imports. Haskel and Slaughter (2000) find effects of changes in the US trade barriers on wage inequality through sector-biased changes in prices. Greenhalgh *et al*. (1998) find that international trade has a negative effect on the wages of less skilled workers in the UK. On the other hand, Lawrence and Slaughter (1993) and Bhagwati (1991) do not find a clear trend in relative prices of goods in the US during the 1980s. Revenga (1992) measures the impact of changes in imports on wages in the US and finds that the prices of imported goods have small effects on wages. Krugman (1995) shows that American trade with developing countries had only a small impact on prices and wages. Grossman (1987) observes only minor sensitivity of wages to tariff changes and prices of imports in the US, although he finds that the impact on employment levels is significant in a few industries. Freeman and Katz (1991) and Gaston and Tefler (1993) show that international trade has a significant effect on the inter-industry structure of employment in the US in the short term, but only a small impact on wages.

Many studies have addressed the impact of technology on wages in the HO framework such as Baldwin and Cain (2000), Berman *et al*. (1998) and Leamer (1998). Studies assessing the sector bias of technological change find evidence that total factor productivity (TFP) raised skill differentials in the US (Leamer, 1998). Haskel and Slaughter (2001) find evidence on TFP changes and foreign competition in the UK. Feenstra and Hanson (1999) decompose the US TFP and find that computerization (and outsourcing) affected wage inequality.

The literature which uses factor content of trade analysis to test the effects of trade on wages finds favorable evidence for the predictions of the HO. Borjas *et al*. (1992) show that the increase in the relative supply of unskilled labor derived from trade is responsible for the increase of 15% of the income inequality in the US. Sachs and Shatz (1994) find for the US that the increase of international trade reduces the demand for employment in sectors that produce goods intensive in unskilled labor due to the reduction of production of those goods. Katz and Murphy (1992) find that changes in the labor content of US imports have had only a very small effect on wages. Wood (1994) analyzes the case of several developed countries and shows that 20% of the decline of the demand for unskilled labor is a result of international trade. Feenstra and Hanson (2000) employ a more appropriate calculation and industry level disaggregation and find that trade has only a small impact on the relative supply of unskilled workers in the US.[6]

Outsourcing of goods to developing countries has also been seen as a source of wage inequality in developed countries. Slaughter (1995) and Feenstra and Hanson (1996) examine whether the outsourcing of American companies to developing countries contributes to the explanation of the increase of wage inequality in the US and find only a modest contribution as a cause of the decline of wages of unskilled workers. Anderton and Brenton (1998), however, find that outsourcing contributes significantly to explain the decline of relative wages and employment of unskilled workers in the UK. Such effect is found to be especially important in industries that require little capital stock and technology, like the textile and footwear industries.

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[6] Leamer (1998) severely criticizes the factor content of trade approach arguing that exogenous output prices, not endogenous factor quantities, determine relative wages.

Using the SBTC hypothesis, Berman *et al*. (1994) decompose the increase in the demand for skilled labor in the manufacturing sector of the US and find that 70% of the variation can be explained by changes within industries, and that only 30% is due to changes across industries. Such a result is interpreted as that most of the change in the structure of labor demand in favor of skilled workers occurs due to technological innovations, and not to changes associated with international competition. Machin (1996) uses the same decomposition to investigate the case of the UK and finds that 83% of changes in labor demand can be explained by intra-industrial variations. Machin also shows that research and development, technological innovations and, above all, the use of computers, are important factors in the rise in the relative demand for skilled labor. Desjonqueres *et al*. (1999) and Berman *et al*. (1998) show that the increase in relative demand for skilled labor in several OECD countries is associated with the introduction of new technologies. Berman *et al*. also find that the main changes in the structure of labor demand in several developed countries are restricted to the same industries. They interpret this result as evidence that innovations and technological diffusion are concentrated in some industries, independent of whether the sectors are tradables or non tradables. They also show that the share of skilled workers increased in all sectors of the economy, and was not just limited to tradables sector, suggesting that there was an upgrading of technology which cut across the economy.

Overall, the empirical research shows that the increasing wage dispersion in developed countries cannot be unequivocally credited to trade with developing countries. Although there is no consensus on the causes of the rising wage inequality, it is agreed that whatever the reason behind the phenomenon, the change in the structure of labor demand in favor of skilled workers is a common feature.

3.2 Evidence for Developing Countries

This section presents a selection of empirical results on the effects of trade liberalization on the labor markets of developing countries. Although the findings are mixed, there is growing empirical evidence showing that trade is being associated with an *increase*, not a decrease, in the relative demand for skilled workers together with rising wage inequality, thus rejecting the predictions of HO and SS. It seems that while Latin American and other countries have experienced an increase of wage dispersion after trade liberalization, East Asian countries had an improvement in income inequality indicators after openness with strong orientation for exports was introduced in the 1960s and 1970s. Accordingly, Wood (1994, 1999) finds rising demand for unskilled labor and decline in wage inequality in South Korea, Taiwan and Singapore following trade liberalization. These cases are consistent with the hypothesis that the integration of developing countries to the international economy is accompanied by a reduction of income inequality and greater employment (Krueger, 1983, 1990).

The above optimistic hypothesis is however challenged by a large number of papers on countries that opened up to trade later. The evidence is increasingly supporting the view that the debate is no longer on the causal effects of openness on inequality, but rather, it is on the magnitude of the growth of inequality. Robbins (1995) examines the changes of wage differentials in Colombia in response to the increase of exports due to exchange rate devaluations and to the increase of the proportion of imports of capital goods in relation to GDP. He finds an increase in wage differentials, which is attributed to changes in the composition of demand induced by exports, and a positive correlation between the increase of imports of machines, equipment and introduction of new technologies, and the rising demand for skilled labor. Robbins and Gindling (1999) investigate the changes in relative wages and in supply and demand for skilled labor in Costa Rica before and after trade liberalization and

find that the skill premium rose after liberalization as a result of the changes in the structure of labor demand. Robbins (1994a) examines the changes in the structure of wages after the trade liberalization in Chile and finds that although the content of skilled labor in imports exceeds the content in exports, the returns to skilled labor grew following liberalization. Robbins concludes that the most plausible explanation for the result is the increasing imports of capital goods that are complementary to skilled labor. Beyer *et al*. (1999) use a time series approach and find a long term correlation between openness and wage inequality in Chile.

Hanson and Harrison (1999) examine the changes in wages and employment of skilled and unskilled workers after trade liberalization in Mexico. They find little variation in employment levels, but a significant increase in skilled workers' relative wages. However, no correlation was found between the intensity of skilled labor and changes in relative prices, as suggested by the SS model. They also show that foreign companies and the ones linked with exports pay higher wages to skilled labor. Feliciano (1993) and Cragg and Epelbaum (1996) find that the increase in the returns to education in Mexico contributed to the rise of relative wages of skilled workers. Green *et al*. (2001a) find a substantial rise in the returns to college education in Brazil following trade liberalization, which was shown to be due to rising relative demand for college educated workers. However, contrary to what was found for other developing countries, there was no change in overall wage inequality. They show that the small proportion of college educated workers and the rise of wages of illiterate workers contributed to the result. Barros *et al*. (2001) use a computable general equilibrium analysis to assess the effects of trade liberalization on Brazilian labor market and also find no significant impact of openness on income inequality.

Feenstra and Hanson (1997) show that the American ‘maquiladoras’ in the north of Mexico caused a significant increase in the relative demand for skilled workers in the border region with the US, where there is a large concentration of foreign direct investment. They decompose the increase in demand for skilled labor and find that, as in developed countries, most of the change in the structure of demand is explained by intra-industry variations, that is to say, it is associated with the introduction of technologies that require skilled labor. Menezes-Filho and Rodrigues (2001) also employ the same decomposition analysis and observe similar results for Brazilian manufacturing after liberalization. Arbache and Corseuil (2000) find that employment shares in Brazilian manufacturing are negatively associated with import penetration, and this effect is stronger for industries intensive in unskilled labor. They also show that the inter-industry wage premium is positively associated with import penetration. Arbache and Menezes-Filho (2000) also find a positive relationship between the inter-industry wage premium and tariff reductions in Brazil. They show that product market rents are strongly affected by trade liberalization, and that part of the rents are distributed to the labor market in the form of a higher wage premium through increasing productivity.

Another strand of research looks for the effects of trade on employment. If developing countries are full of unskilled workers, openness will lead to an expansion of employment of unskilled labor intensive sectors, which are supposed to dominate their economies, thus increasing employment. Márquez and Pagés (1997) estimate labor demand models with panel data for 18 Latin American countries and find that trade reforms had a negative effect on employment growth. Maia (2001) uses input-output analysis to investigate the impact of trade and technology on skilled and unskilled labor in Brazil before and after openness. She finds that trade destroyed more unskilled than skilled jobs and that technology was responsible for the creation of a very large proportion of the skilled jobs, while it destroyed millions of

unskilled jobs. Currie and Harrison (1997) and Revenga (1997) find for Morocco and Mexico, respectively, a modest impact of reductions in tariff levels and import quotas on employment, which was due partly to firms cutting margins and raising productivity.

Overall, empirical evidence suggests a relationship between trade liberalization, wage inequality and employment which goes in the opposite direction to the predictions of the standard theory of international trade. Whatever the explanation for the phenomena, it requires a more sophisticated theoretical treatment than the available models. A tentative summary of empirical evidence would show a common feature of the impact of trade liberalization on labor markets in developed and developing countries, i.e., a change in the structure of labor demand in favor of skilled workers. This does not imply, however, that the causes of the shift of labor demand are also common for the two groups of countries. In the next section we present and discuss hypotheses and models that try to explain the rising wage inequality in developing countries following trade openness.

4 Trade Liberalization and Wage Inequality in Developing Countries: New Explanations

4.1 Capital, technology and skilled labor

The new growth theory argues that trade liberalization expands markets, induces increases in research and development, reallocates employment to more innovative activities that require more human capital, and increases the knowledge flow among countries. This view is shared by many authors who have contributed to the new growth theories, like Aghion and Howitt (1992), Grossman and Helpman (1991), Parente and Prescott (1994) and Romer (1990). Accordingly, Sarquis and Arbache (2001) argue and show empirically that an economy may

benefit from being more open through enhancing the external effects of human capital, and Edwards (1998) and Cameron *et al*. (1998) present empirical evidence that more open economies grow more quickly and have larger TFP growth rates. While an integrated theoretical body (see a survey of the theory in Aghion and Howitt, 1998), the new growth theory suggests that there exists a positive correlation between openness, growth and human capital, or alternative factors related to education and knowledge like research and development and innovations. In this context, more liberal policies on trade, investment, and financial and capital markets tend to create better prospects for growth and should attract foreign direct investment.

The process of economic openness tends to be accompanied by the introduction of new technologies, new practices of human resources administration, more efficient production processes, and the incorporation of new and more advanced machines and equipment. Additionally, the greater access to international markets of goods and capital reduces the costs of investment and imported machines and technologies, making possible higher growth rates of investment and productivity.

To see how the new growth theory can be employed to explain the relation between trade liberalization and labor markets in developing countries, suppose the following hypothetical – and quite simple – scenario: (i) two countries, one of which is technologically advanced and the other is less advanced; (ii) capital and skilled labor are complementary production factors; and (iii) the advanced technology is built-in to machines and equipment produced in the more advanced country. If the less advanced country introduces a trade liberalization policy, the import price of capital goods should drop. As long as the capital goods have incorporated new

technologies, the increase of imports of machines and equipments should cause a diffusion of technical innovations, changing the technological level of the less advanced country.

The key questions for our purpose are: ‘How does greater capital and technology imports affect the labor market of the less advanced country?’ and ‘Will there be an increase in the relative demand for skilled labor as a result of the complementarity of capital, technology and skilled labor?’. Provided that the capital goods and technologies transferred to developing countries through trade with the more advanced country are biased in favor of skilled labor, since they were developed in the country where this factor is abundant, the structure of labor demand tends to move in favor of skilled labor, and there should be an increase in the returns to human capital. This hypothesis was termed by Donald Robbins (1996) as “skill-enhancing trade”. In fact, Berthélemy *et al*. (1997) use a cross-country analysis and find evidence of a positive correlation between the increase of returns to schooling and economic openness. The intensity of the increase of relative demand for skilled labor will depend, however, on the growth rate of capital per worker (Johnson, 1997). Therefore, the greater is the amount of foreign direct investment and is the increase of imports of machines and equipments, the greater the effects on the structure of labor demand.

Ceteris paribus, the growing demand for skilled labor may have, as a consequence, an increase, and not a decrease, in wage dispersion of developing countries, which is the opposite of what the standard theory of international trade predicts. The change in the distribution of wages will depend (i) on the technological gap between the new and the old technology – the more intensive in skilled labor is the new technology, the larger the changes in the wage distribution will be (O’Connor and Lunati, 1999); and (ii) on how intense the imports of capital are.

Although the complementarity of capital and skilled labor and the complementarity of technology and skilled labor are linked, since technology is built-in to machines and equipment, conceptually these effects are different, since the first refers to the elasticity of substitution between production factors for a given technology, while the second refers to a bias in the technology towards a production factor. Recent studies examine the statistical relationship between technology and demand for labor in developed countries using research and development proxies (Berman *et al*., 1994) and use of computers (Author *et al*., 1998; Green *et al*. 2001b) and find a strong positive correlation between them. Other studies investigate the relation between stock of physical capital and demand for skilled labor (Bartel and Lichtenberg, 1987; Berndt *et al*. 1992; Dunne and Schmitz, 1995; Wolff, 1996) and find a strong positive correlation as well.

The effects of openness on the wage distribution in the short term will, however, be the result of the supply and demand conditions of skilled and unskilled labor and of the nature of the economic transformations provoked by the openness. Given an autonomous increase in the demand for skilled labor, the increase in this factor's supply can grow since developing countries usually have a low enrolment rate in school (in relation to developed countries). That is to say, there is room for increasing the human capital stock. The profile of the distribution of schooling is important in determining the economy's capacity to supply skilled labor in face of an autonomous increase in that factor's demand. The higher the proportion of the population in high school, the greater is the capacity for faster adjustment in the labor market, since with a little investment it can increase the supply of people with higher education. In the case where that proportion is small and most of the population has just primary education, the responsiveness will be slower, which can have adverse effects on

income distribution, even in a middle term. The analysis becomes more complex when the schooling distribution for age *cohorts* and the profile of the age distribution of the population are considered. A young population with a high rate of school attendance provides an ideal and dynamic supply, in the medium and long term, to face the process of economic growth. Lucas (1988) stresses that the quality education is as important as its quantity. Thus, analyses of skilled labor supply should consider not only the schooling of the population, but also the quality of the education.[7]

The relative increase in demand for skilled labor can have more intense effects on developing than on developed countries due to the high shortage of skilled labor. But these effects will depend on the elasticity of substitution between skilled and unskilled labor and on the supply of skilled labor in the short term. The smaller the substitutability of skilled for unskilled labor, and the more inelastic the supply of skilled labor, the larger the dispersion of wages will be. Thus, supposing that there is an autonomous and proportional increase in the demand for skilled and unskilled labor, the new wage equilibrium should show a relative increase in skilled workers' wages, since the supply of unskilled labor is more elastic. This suggests that the mean elasticity of substitution of skilled labor for unskilled labor is larger in developed than in developing countries, since the supply of skilled labor is larger in those countries.

These considerations imply that (i) the introduction of capital and new technologies can increase inequality more quickly in developing countries than in developed countries due to the greater shortage of skilled labor, and that (ii) any spurt in economic growth caused by the

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[7] Wood (1994) and Robbins (1994b) show that the rise in the supply of formal education is a fundamental factor to explain the fall of wage inequality verified in the Asian Tigers and in Malaysia.

openness will not have a neutral effect on relative wages, even if the growth is neutral in relation to the factor inputs and if the supply of these inputs grow at the same rate as GDP. On the other hand, HO and SS would predict that the reduction of wage inequality in developing countries which experienced openness should be modest due to the excess of unskilled labor.

In spite of the elegance of the above arguments which try to explain the increasing wage inequality in developing countries following openness, it may happen that (i) trade liberalization may not have any impact on the accumulation of human capital and on the attraction of foreign direct investments, or that (ii) the worsening of wage inequality indicators in developing countries is a transitory, and not a permanent, effect. In that case, the effects mentioned above may not happen, or the change of the structure of labor demand in favor of skilled labor can be transitory, if it occurs at all.

Lucas (1990) argues that the low or non existent supply of skilled labor in developing countries can reduce foreign direct investment, since financial capital tends to migrate to areas in which human capital is abundant. Based on his 1988 model which shows a dynamic relation between schooling and physical capital – where human capital is measured both as the level of individual schooling (internal effect), and as well as an average level of education which also has a positive effect in the production function (external effect) – Lucas argues that, unlike what is suggested by neoclassical theory, capital does not necessarily migrate from rich to poor countries. The reason is that in poor countries the stock of internal and external human capital and this has an adverse effect on the marginal productivity of physical capital which is higher where there are larger amounts of internal and external human capital. Thus, the availability of human capital would work as an incentive to foreign direct investment. Benhabib and Spiegel (1994) use cross-country analysis to find a positive

relationship between the stock of human capital and investment in physical capital, which suggests that the returns to investment is a positive function of the supply of human capital. Thus, it may be that economic openness is a necessary but not a sufficient condition to attract capital and advanced technologies to developing countries.

Nelson (1994) argues that human capital is not, *per se*, enough to guarantee the attraction of capital and new technologies. The institutional framework can be a decisive factor for the development of new technologies. Romer (1993) also highlights the importance of the institutional framework as a factor to explain economic growth. Other factors may also contribute to growth such as low transactions and transport costs, a well defined regulatory and legal framework, good social infrastructure, political stability, among others. Knowing that not all developing countries enjoy these conditions, it can be said that economic openness is a factor that contributes but does not determine investment in physical capital and technology. In light of these caveats, openness should not be seen as a panacea for growth, nor as a cause of the increase of the wage inequality in developing countries.

Pissarides (1997) presents a model that shows that the increase of wage inequality in developing countries may only be a transitory, and not a permanent, effect. The idea is that openness favors faster transfers of new technologies to developing countries which require skilled labor, increasing the returns to human capital. However, Pissarides suggests that technology transfer is neutral after the effects of a learning period for assimilation and implementation of the new production processes wears off. As soon as workers learn the new technologies, there is a reduction of the effects of openness on the structure of labor demand for skilled labor, since the economy reaches a new technological steady state level. Therefore, the effect of the increase on the returns to human capital is temporary, and the skilled workers

benefit only during the transition period to the new technological level. Furthermore, the supply of skilled labor can increase in the long term as a response to the initial increase in the demand for this factor, resulting in the disappearance in the long term of the wage differential gain for the skilled workers. Goldin and Katz (1998) reach a similar conclusion. They argue that the demand for skilled workers can follow a technological cycle. The demand rises when new technologies and machinery are introduced, but it declines with the learning of their use by workers.

Therefore, the transfer of technologies does not guarantee that the wage inequality observed in the initial stages of openness prevails in the long term. It is necessary to differentiate the process of innovation – which requires cognitive human capital – from the process of productive implementation – which requires learning-by-doing. The imports of capital goods and of new technologies of developed countries is connected to the second case, which does not guarantee dynamic change in the technological level.

4.2 Some other Possible Explanations

Davis (1996) presents a model in which the main hypothesis is that the availability of a country's production factors is taken in relation to a group of countries with similar endowments, not in relation to the international economy. Davis proposes a simplified model with only two cones of production diversification, one for developed and another for developing countries. The countries of one cone produce goods that are not produced in the countries of the other cone. Inside each cone are countries with relatively similar, but not the same, supply of factors, which gives each country different comparative advantages inside its cone, leading it to a specialization of production. Thus, the availability of factors should be taken from the relative, and not from the absolute perspective. In another way, a country may

not be abundant in skilled labor on a global scale, but it can be abundant in skilled labor inside its cone. In the same way, a country that is abundant in skilled labor in a global level may not be abundant in skilled labor inside its cone. What matters in the model is the relative position of the country in its own cone, and not in relation to all the countries.

In this framework, trade liberalization can raise the demand for skilled labor in a developing country as long as it is among the countries of its cone which has a relatively high supply of skilled labor. On the other hand, a country from a cone where there is a greater supply of unskilled labor can experience a reduction in wage inequality. The reduction of the prices of products produced in the other cone (products of developed countries) does not have any effect on the prices of the factors of production in developing countries, since they do not produce the same goods.

Wood (1999) argues that the entry of countries like China, India, Bangladesh, Pakistan and Indonesia in the world market for goods with a high content of unskilled labor in the mid-1980s had an important impact on the explanation of the increased income inequality of medium income countries, particularly those in Latin America. His argument is that the increased supply of unskilled labor-intensive goods changed the structure of supply of goods in the world market, reducing their prices and the return to factors involved in the production of such goods. This harmed the countries which had some comparative advantage in their production. As a consequence, these countries would have been pressured to change their production techniques in a search for comparative advantage in the production of goods which use semi-skilled labor, resulting in an increase of the demand for this type of worker and therefore causing a rise of the wage dispersion.

Feenstra and Hanson (1995) develop a model that shows that the increase of wage inequality in developed and developing countries is consistent with capital flow from advanced to developing countries in an era of globalization. The idea is that the flow of foreign direct investment changes the structure of production and increases the stock of capital of developing countries, which can have significant effects on the level and profile of investment and in the technologies available locally. The model assumes the production of a simple final good that requires a *continuum* of intermediary goods with varying proportions of skilled and unskilled labor. Developing countries have a smaller cost of production for some phases of the final good, and vice-versa for developed countries. As soon as the economies open up, and assuming that capital returns are higher in developing countries, there will be a transfer of capital from developed to developing countries. In an intuitive way, the model suggests that the stages of production which demand less skilled labor (by the measure of the advanced country) will be transferred to the less developed countries where unskilled labor is relatively cheaper. However, the kind of labor that is actually demanded is skilled when judged from the perspective of the developing countries. The specialization of production increases the average requirements of labor in both sets of countries, since the average input will be more intensive in skilled labor. As a result, the relative demand for skilled labor increases in both regions and thus causes rising wage inequality in both groups of countries.

Although Davis' (1996), Wood's (1999), and Hanson and Harrison's (1995) models are quite interesting, they are, strictly speaking, derived from the HO and SS approach, since they borrow the central idea that the returns to factors of production are conditional on their relative distribution among countries. Thus, it seems that there would exist two main classes of models to explain the effects of trade liberalization on the labor market of developing countries: those associated with the HO and SS theory, and those that argue that technological

changes, coming through trade, are the root of the problem. The great difference between the experiences of developed and developing countries is perhaps the timing, since in the former group the liberalization process and technological transformations were sequential, while among the latter it was a simultaneous process.

5 Final Remarks

In this paper, we saw that the impact of trade liberalization on labor markets of developing countries is ambiguous. While the Asian tiger countries experienced a reduction in wage inequality – which is in agreement with the standard theory of international trade – the Latin American and other countries experienced a rise in wage inequality following openness. Several models and hypotheses have tried to explain this phenomenon, but none of them can be taken as a general theory. Although quite interesting, the skill enhancing trade hypothesis can be criticized on the grounds that trade liberalization is a necessary, but not a sufficient condition to explain technological modernization and the increase in the stock of capital per capita, which are supposed to shift labor demand in favor of skilled workers thus causing increased wage inequality. Many developing countries have high degrees of economic openness (e.g. African countries) which, however, does not guarantee incorporation of new technologies, increase in TFP and attraction of foreign direct investment. Human capital, the institutional framework and political stability, for example, all seem to contribute significantly in attracting capital and new technologies. Therefore, openness is a factor that contributes but does not completely determine investment in capital and new technologies. Whatever the reason behind the phenomenon, new technologies seem to play a role in the explanation of the shift of the labor demand.

Finally, it may be that the available empirical evidence shows only a transitory rather than a permanent picture. In this case, the standard theory of international trade would still keep its status as the key analytical tool for understanding the relationship between trade and wages.

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TABLE 1

Predictions of the Standard Theory of International Trade for Wage Distribution

DEVELOPED COUNTRIES	***DEVELOPING COUNTRIES***
The opening affects the prices of factors through the change of relative prices of goods. Openness provokes reduction of the relative prices of products intensive in unskilled labor and increases the relative prices of products intensive in skilled labor. As a consequence, the relative wage of skilled labor should increase, while that of unskilled labor should decrease	The opening affects the prices of factors through the change of relative prices of goods. Openness provokes reduction of relative prices of products intensive in skilled labor and increases the relative prices of products intensive in unskilled labor. As a consequence, the relative wage of skilled labor should decrease, while that of unskilled labor should increase
After liberalization, unskilled labor should suffer a reduction of the relative wage more than proportional to the reduction of the prices of goods intensive in that factor	After liberalization, skilled labor should suffer a reduction of the relative wage more than proportional to the reduction of the prices of goods intensive in that factor
Convergence of the absolute prices of factors of production among countries as liberalization intensifies, the trade barriers are removed, and the imperfections and frictions of market mechanism disappear	Convergence of the absolute prices of factors of production among countries as liberalization intensifies, the trade barriers are removed, and the imperfections and frictions of market mechanism disappear
Wage inequality should increase	Wage inequality should decrease