TRADE LIBERALIZATION AND LABOR MARKET IN BRAZIL:
IMPACTS ON EMPLOYMENT AND WAGES
IN TRADEABLES AND NONTRADEABLES SECTORS

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Agosto de 2002

26p. (Texto para discussão ; 174)

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* We would like to thank Rafael Augusto Oliveira for his research assistance, as well as Janine Berg for helpful comments. Our remained errors are ours.
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ABSTRACT

The aim of this paper is to analyze the impacts of openness on employment and wages, taking into consideration two crucial aspects. The first, related to labor demand, refers to an increase in the relative employment of less-skilled workers. With Brazil being a developing country with abundant less-skilled labor, it can be expected – based on H-O-S – that income redistribution in favor of unskilled labor may occur after the trade liberalization. The second aspect is the impact on tradeables and non-tradeables. The H-O-S model implicitly admits tradeables goods only. However, the effect on the labor market is also felt on the non-tradeables sector. This aspect has been neglected in the analyses concerning this subject in the Brazilian economy. The conclusion raises the point that it is difficult to define any prevalence of labor demand shifts in the tradeables or non-tradeables sectors. However, when the analysis is carried out after breaking down data based on levels of education, it is possible to conclude that the demand for unskilled workers increased after trade liberalization in Brazil. Nevertheless, demand shifts among sectors suggest that H-O-S framework does not explain the impacts of trade liberalization in Brazil, since the demand for skilled workers increased among the same sectors. This data, however, needs to be looked at with caution since the stabilization in Brazil (1994) changed income distribution by means and through the effects of an inflation tax and forced saving.

Key Words: Trade Liberalization, Employment, Wages, Labor Market

JEL: F16, J31, O33
1. INTRODUCTION

The impacts of trade on economic growth, employment, and income distribution have constituted a theoretical and empirical concern since the time that old models of international trade were introduced (Heckscher-Ohlin). These models have encouraged a subsequent endeavor of which that Stolper and Samuelson (1941) is of a crucial relevance since it generalizes the Hecksher-Ohlin (H-O) model in evaluating the impacts of foreign trade on income distribution.

More recently, this topic has focused on developing as well as developed countries, as both have increased their level of trade and financial openness, mainly after the 1980s. A pioneering concern with trade effect on less-skilled workers in the U.S. can be found in Wood (1991). His theoretical predictions based on the Hecksher-Ohlin-Samuelson (H-O-S) model suggest that decreased barriers to trade should produce a greater skilled-labor demand (an abundant factor in the U.S.) with a greater wage concentration. Furthermore, such an effect on employment would also tend to be painful for less-skilled labor. Since the beginning of the 1980s, the U.S. has undergone an increase in income and wealth concentration, a phenomenon which can partially be explained by the effect of foreign trade flow based on a liberal policy. This has effected not only trade, but also labor market (Dale and Lee, 1996). However, Katz and Murphy (1992), Krugman and Lawrence (1993), Berman et al (1994) argue that technological innovation has been the reason of such an income concentration process. Indeed, for them, technological innovation generally is related to skill labor demand bias.

In Brazil, trade openness started at the end of the 1980s and was deepened at the beginning of the 1990s. Recently, macro and microeconomic impacts of this process have been the most prevalent. From the macroeconomic viewpoint, concern has risen regarding the effects of openness on the current account as well as those on monetary and exchange policy. Since trade openness was followed by a financial liberalization, the effects on the balance of payments are also included on capital accounts. Furthermore, it is only possible to comprehend the stabilization program by understanding the effects of the handling of monetary and exchange policy.

Another important factor, suggested by research in the area, has been the impacts on the Brazilian labor market after trade liberalization. In fact, the crucial question one must observe is whether empirical evidence behaves according to theoretical predictions in the framework developed by Heckser-Ohlin-Samuelson. Concerns regarding research in this area are not only about wage differentials, but also about the macroeconomic and sectorial effects on employment\(^1\). Other studies show a related concern - in this case about a set of different countries.\(^2\)

The aim of this paper is to analyze the impacts of openness on employment and wages, taking into consideration two crucial aspects. The first, related to labor demand, refers to an increase in the relative employment of less-skilled workers. With Brazil being a developing country with abundant less-skilled labor, it can be expected – based on H-O-S – that income redistribution in

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favor of unskilled labor may occur after the trade liberalization. The second aspect is the impact on tradeables and non-tradeables. The H-O-S model implicitly admits tradeables goods only. However, the effect on the labor market is also felt on the non-tradeables sector. This aspect has been neglected in the analyses concerning this subject in the Brazilian economy. Bivens (2001) analyzes this topic as it applies to the U.S. and concludes that it is impossible to evaluate the effects on non-tradeables.

This paper studies the 1981-1999 period based on the Brazilian Household Sample Survey (PNAD) and is organized as follows. The following section discusses the theoretical foundations of trade, growth and distribution. The methodology used to analyze the impacts on relative labor earnings in Brazil is discussed in the third section, whereas the fourth section is dedicated to the empirical evidence. This section also emphasizes the relationship between tradeables and non-tradeables after trade liberalization. The conclusions highlights the difficulties in defining any prevalence of labor demand shifts in tradeables or non-tradeables sectors. However, when the analysis is carried out after breaking down data by levels of education, it is possible to conclude that the demand for less-skilled workers increased within sectors after trade liberalization. Nevertheless, demand shifts among sectors suggest that H-O-S framework does not explain the impacts of trade liberalization in Brazil, since the demand for skilled workers increased among the same sectors. This data, however, needs to be looked at with caution since the stabilization in Brazil (1994) changed income distribution by means of the effects on inflation tax and forced saving. Indeed, since part of dataset used in this study deals with labor earnings, certain effects other than trade liberalization can bias it.

2. TRADE, GROWTH, EMPLOYMENT, AND DISTRIBUTION

2.1. Stylized Facts

In recent years, mainly after the second half of the 1980s, concern has increased over the relationship between trade, economic growth and their effects on employment and income distribution, especially due to a significant increase in international flows of goods and capital. While direct investment flows were almost exclusively limited to developed countries, in the 1990s they also spread to developing countries and the so-called emerging economies. The relationship between trade and growth as well as between trade and distribution is still controversial. What happened in the U.S. is a significant example for the evaluation of trade openness effects on income distribution and wages.

Since the beginning of the 1980s, there has been an increasing gap between skilled and less skilled workers’ income. Although controversial, trade openness is considered to be one of the causes of such a phenomenon. Due to flexibility in the labor market in that country, the effects of such a greater exposure to trade are more clearly seen through the increase in demand for skilled work and the consequent widening of wage gaps. The employment level has not decreased in this

According to the structuralist tradition, the stylized facts are the starting point for the formulation of economic models. Taylor (1991)
case. On one hand, this is due to wage flexibility and, on the other, we can see a persistent growth after the 1992 slowdown. Regardless of the controversy on income concentration in the U.S., Dale and Lee (1996) note that such an event coincides with its rapid trade deficit and expansion of trade with developing countries, which suggests that trade is one of the factors of this process.

Despite some evidence that such inequality comes from trade between the U.S. and developing countries, several authors argue that trade is not responsible for such an outcome. Conversely, it is technological change and development processes which can explain this. (Katz and Murphy, 1992; Bond and Johnson, 1992; Krugman and Lawrence, 1993; Berman et al, 1994). Contrarily, Howell, et al. (1999), based on data from Current Population Survey (CPS) in the U.S., showed that there is limited support for the skill-biased demand shift account of the growth in the U.S. earnings inequality:

“Our results are consistent with the view that demand shifts against low-skilled blue collar jobs in goods producing industries have played a major role in the earnings collapse; these jobs are heavily concentrated in the low wage and employment growth quadrant. We suspect that trade and outsourcing patterns, de-unionization and deregulation all played substantial roles in the declining wages and employment of workers in this part of the economy. On the other hand, many low-skill blue-collar jobs in the service industries appear in high hours growth jobs but have experienced relatively slow wage growth, suggesting a combination of supply-side (e.g. immigration) and institutional (e.g. declining value of minimum wage) factors.” Howell, et al. (1999, pp.02)

However, Dale and Lee (1996) also argue that technological change is not strong enough to explain this in the U.S. Their argument is based on the fact that trade bears a decrease both in wages and industrial employment in the U.S. Based on different empirical studies – with Wood (1994) being one of their main authors, it is possible to identify trade liberalization as one of the elements constituting such an increasing inequality in that country. The growth in trade in the U.S. was particularly painful for less skilled workers. This author, however, does not take the role of technological change into account. As a matter of fact, Wood (1994) argues that technological innovations are part of trade liberalization to the extent that companies search for greater competitiveness for their products.

The discussion on this topic has also become relevant in the developing countries which have broadened their degree of trade and financial openness. This is the case of Brazil after 1990. Several studies analyzed the implications of this process on employment, wages, distribution and economic growth which, in the case of Brazil, was enclosed in a set of “structural reforms” anchored in a pattern similar to those in other Latin-American countries. However, the implications of such reforms cannot be detached from the stabilization that produces by itself a significant impact on distributive variables. In fact, the 1994 stabilization in Brazil brought about redistribution in favor of the lowest income stratum stemming from the effect on no indexed gains. Furthermore, the exchange valuation following the stabilization plan brought about a positive impact on labor earnings.

Despite the initial positive effects on growth and distribution from stabilization in Brazil, it is still necessary to make an in-depth analysis of trade liberalization on the above mentioned variables. As a matter of fact, isolating these effects on employment, growth, and distribution is not
a simple task, especially if one takes into account that stabilization has accomplished its aim. However, this is a stylized fact which should be analyzed for the Brazilian experience, i.e., the fact that increased trade flows have impacts on income distribution and employment. The effect on growth, however, is not quite so clear both empirically and theoretically.

2.2. The Theory

Any study aiming at analyzing the relation between trade and growth should start with an analysis of comparative advantages and the Heckscher-Ohlin (H-O) model. While considering the former, a country should be engaged in trade among countries specializing in goods with comparative advantages in order to increase the welfare in its economy. As for the latter, each country should specialize in those goods whose production intensively uses relatively abundant factors endowment.

The basic H-O model identifies differences in factor endowment among countries as being the cause for foreign trade. More specifically, following the H-O theorem, in a two-country model, each country exports the commodity that uses the country’s more abundant factor more intensively. This model, however, is supported on a restricted hypotheses leading to a reduced possibility of empirical validation in its static version. The first assumption states that production functions exhibit positive, but decreasing, returns to each factor and constant returns to scale. Additionally, the two goods should have distinct production functions, otherwise two different goods would not be possible.

The second hypothesis predicts an identical demand structure in both countries, which implies that the two goods should be consumed at each relative price level as well as being independent of income level (as is the case of the functions of homothetic utility). Finally, the third hypothesis - essential for the model validity – is taking into account the possibility of factor-intensity reversals be excluded. In fact, it is impossible to unambiguously choose the total amount of goods available for all price-factor relations.4

The corollary of the H-O theorem is the Factor Price Equalization theorem, which states that prices equalize across countries under an international immobility of factors. Therefore, under the assumptions above described, countries that engage in international trade in the fashion of the H-O model improve welfare, income, and change the income distribution across countries by means of a best allocation of factors in comparison to autarky(is this a word or a person?)

The SS theorem leads to a generalization of the H-O model since it also includes the effects of trade on employment and income distribution. In the H-O-S version, trade leads to a Pareto-efficient equilibrium through resource reallocation among sectors. Relative-price movements create gain differentials among sectors so that they encourage companies to move their production factors to more profitable sectors to the extent that such gains be eliminated. For example, if a country in which the importable sector is capital-intensive and the exportable sector is labor-intensive, a shift from an import-substitution strategy to an export-oriented strategy would lead to a domestic relative-

4 For a discussion on this topic (factor-intensity reversal), see Gandolfo (1994).
price reduction of importable goods. Hence, if the economy is at the Production Possibility Frontier, the exportable sector’s product will increase, while that of the importable sector will decrease. As in this case the exportable sector is less capital-intense, and a change in the product composition will lead to a growth in the demand for labor and a decrease in the demand for capital. The final result will be an equilibrium in which real wages increase while capital gains (or profits) decrease, producing income redistribution in this economy.

Following the assumptions of the H-O-S model, trade liberalization generates a redistribution process in favor of wages and employment in labor-abundant countries. This is the case of developing countries which, being labor-intensive, would experience an increase of real wages and employment level. Furthermore, growth at the stationary stage would be guaranteed with a more efficient use of resources.

Several authors, revealing the possibility of augmenting this idea by introducing other factor endowments such as different assets or even human capital, developed extensions of the basic H-O-S model. In the latter case, openness allows for a better income distribution, not only through redistribution from capitalists to workers, but also from skilled workers to those who are unskilled. But even in this case of short-run factor immobility, long-run results do not significantly change the traditional model. Despite such extensions of the traditional model, the message in both cases is the same, i.e., in a two-country model, the liberalization impact on trade and income distribution is unambiguous in terms of welfare and distribution.

The H-O-S model is empirically and theoretically limited to show gains in trade, mainly for developing countries. From a theoretical viewpoint, one of the main weaknesses is the time for adjustment. In fact, this model assumes instantaneous adjustment as it admits fully flexible nominal wages, even in the short term, as well as factor immobility. Such hypotheses, however, are very strong and the model’s results are sensible to them. On the other hand, other problems may arise as the basis for factor endowment: inherited comparative advantages, factor-intensive sectors, technological base, rigidity in labor market, institutions, access to new technologies, and other factors implying dynamism in the model.5

An important aspect to be noted when analyzing the effects of openness on employment, income distribution, and wages is the nature of goods in question. Moreover, the H-O-S model shows that an open economy vis-à-vis a closed one would not only increase its welfare but also promote income redistribution in favor of the abundant factor intensively used. In principle, this would occur if all goods produced in that economy were tradeables. In reality, it is the relative price difference of factors that promotes the mentioned redistribution by means of the Factor Price Equalization theorem. The effect on nontradeables goods should certainly be different. According to Bivens (2001), in the U.S., non-tradeables alone are responsible for almost 70% of employment.

“The degree to which globalization adversely affects less skilled labor and generates inequality depends on whether or not earnings in nontraded industries are comparable to those in traded industries for each grade of labor.” (Bivens, 2001, p.3).

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Bivens (2001), using a methodology similar to that of Katz and Murphy (1992), defines a model for the U.S. in which tradeables are distinguished from nontradeables, admitting that the former belong to the manufacturing sector with fixed wages producing primary employment. The latter is the nontradeables sector providing secondary employment which is characterized by more flexible wages than those of the former. This is based on the hypothesis that an increase in trade and capital flows in a certain country induces relative changes in employment in the tradeables sector while producing changes in wages in the nontradeables sector. A similar hypothesis will be tested in this paper by analyzing the effect of the trade liberalization in Brazil on relative earnings of nontradeables, as well as the employment level in the sectors.

3. METHODOLOGY

The data source is the Brazilian National Household Sample Survey (PNAD). The PNAD has been filtered so as to provide a broad cross section of labor groups in Brazil ranging from ages 18 to 65, working 20 to 98 hours/week in their principal occupation, with no null income in major activity. This includes workers in agricultural, industrial, and service sectors, and excludes employers. The sample of workers to be observed is distributed according to sex, age (estimated age), education degree (years of study), branch of activity, and occupational categories. Such data is organized in groups of workers possessing the same characteristics in accordance with these variables.

The data was organized into two samples: the first – that of wages – which is the workers’ earnings; the second – that of quantities – expressing the number of hours worked by those workers.

In the price sample, the measure of work earnings is the average of earning-hour (total earnings in the month received in the major activity divided by the worked hours in the month) of the occupation groups having the same characteristics. Hence:

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6 PNAD is similar to the U.S. Current Population Survey (CPS).
7 The variable age is grouped into 5 age groups: 18 to 24; 25 to 34; 35 to 44; 45 to 54 and 55 or more. The variable education is calculated by means of an algorithm with 18 categories (0 to 17 years of study), regrouped for the sample into 4 categories: illiterate and individuals with at most 3 complete years of study; more than 3 through 7 years of study; more than 7 through 10 years; more than 10 year of study. Branch of activity is defined according to similarity in activity nature. They are 27 activity branches in agriculture, industry, and services. As for occupation, it was defined according to two requisite, socio-occupational and insertion in production. The construction of socio-occupational categories was inspired in a work accomplished by IBGE (1994). Such categories are based on the necessary education level for performing each occupation, allowing an approximation to a socioeconomic scale for occupations. Thus, an occupation grouping into 3 categories is obtained: higher, medium, manual. The variable occupation referring to insertion in production is, in turn, distributed in 2 categories: occupations in agriculture and industry belonging to direct production of goods and occupations in these branches linked to activities out of production.
8 The INPC (National Consumer Prices Index) was used as the deflator, where 1996 is the base year.
$w_{it}$ is the average earning-hour of a group of individuals $(i)$ in the year $(t)$ showing the same characteristics.

In the employment sample, each cell represents total hours worked of the groups of people with the same characteristics. Thus:

$n_{it}$ is the number of hours worked of a group of individuals $(i)$ in the year $(t)$ with the same attributes.

$n_i$ is the number of hours worked in the year $(t)$.

These samples are the basis for the elaboration of relative income matrices $(W)$ and relative employment $(X)$, in the perspective of both labor supply and demand. The income matrix expresses the differential between the average real earning-hour of each group and the average real earning-hour weighed by a demographic factor $(N)$ of all groups in a given year. The demographic factor is, in fact, the average annual participation of each group in the analyzed period. The relative quantity matrix, in turn, expresses the measured employment participation in efficiency units of each group in a given year.

4. SUPPLY, EARNINGS, AND LABOR DEMAND SHIFTS

4.1. Neutrality of Labor Demand

This test is inspired in Katz and Murphy (1992). The test of domestic product of vectors intends to answer whether changes in labor supply entirely explain changes in the relative income structure during the period of 1981-99. According to these authors, the relative income of groups $i$ is defined by the interaction between the relative supply of groups and the aggregate production associated with factor demand patterns. It is a model of partial equilibrium where relative labor demand determinants are not specified. Thus, the observed earnings and amount are assumed to be on the labor demand curve. The starting point is a function of aggregate production with:

$$X_i = D(W_i, Z_i)$$  \hspace{1cm} (1)

$X_i \rightarrow$ vector of labor supply in the year $t$, measured in efficiency units, where $i$ represents the groups of workers;

$W_i \rightarrow$ vector of relative income in the year $t$;

$Z_i \rightarrow$ composed vector of variables associated with changes in the demand composition reflecting the technology effect, demand for products, and other non-labor inputs in the demand for labor.
By using a concave production function, the domestic product of vectors of changes in earnings, and changes in relative net supply of changes in demand should be negative or null. This is true since we can assume neutrality of demand in defining earnings or, in other words, a perfectly elastic relative demand. Formally:

\[ d W_t' (d X_t - D_z d Z_t) \leq 0. \] (2)

For this, it is assumed that \( D_z d Z_t = 0 \), considering the neutrality of demand:

\[ d W_t' d X_t \leq 0 \] (3)

In discrete terms, the test takes on the following form:

\[ (w_{t+m} - w_t)'(x_{t+m} - x_t) \leq 0 \] (4)

Where \( w_t(w_{t+m}) \) is the relative income vector in the year \( t(t+m) \), and \( x_t(x_{t+m}) \) is the relative labor supply vector (hours or individuals) in the year \( t(t+m) \).

If equation (4) is valid, the opposite movement of the two variables indicates that the effects of supply shift prevail on the demand shifts. This fact contradicts Stolper-Samuelson (Katz and Murphy, 1992). As demonstrated before, the SS theorem assumes that it is the change in relative prices of goods stemming from trade expansion – and therefore the shifts in labor demand – which causes the decrease in the differential of earnings between skilled and unskilled workers in developing countries.9

In order to avoid measurement errors, we followed the method accomplished by Katz and Murphy (1992). We took recourse of the averages of income variables and relative supply of groups10 for the periods of 1983 to 1989 and 1992 to 1999, excluding the year 1990 as it proved to be quite atypical in the behavior pattern of such variables. Then, calculi were made for the sub-periods of 1985/89 and 1995/99, in which a difference between the latter (1995/99) and the former (1985/89) appeared, in an attempt to observe the result for the characteristic sub-period of the previous and subsequent phases to the openness11.

Chart 1 shows different results for the sectors. In agriculture, the values indicate that it is the supply shifts that define the income level, as the results are negative or different from zero. This result, though contradicting Stolper-Samuelson, should be expected in such markets as agricultural where more competitive structures prevail. As for the other sectors, mainly industry, the values next to zero suggest that both supply and demand movements may be affecting the workers’ earnings.9

---

9 Robbins (1997) adopts this same method and interpretation but states that a null result in the test of domestic product would only correspond to neutrality of demand if relative supply has not experienced any change; conversely, a null value implies a no null shift in relative demand which is enough to balance the supply shift.

10 Income and supply variables come from matrices \( W \) and \( X \) with the 40 demographic groups in each of the seventeen years.

11 We have considered other subperiods besides those presented in the chart and there are not any significant differences.
Machado e Moreira (2001) found similar results for the Brazilian industrial sector in 1985-97. They found a divergence among the values for agriculture which are also null. Such a divergence can be explained by the absence of the service sector in this study and the distinct definition of worked hours as well.

Bivens (2001) performed a similar exercise for the U.S. service sector using data from the Current Population Survey (CPS), March Files and the Annual Demographic Supplement, for the quinquenniums of 1983/88, 1983/93, 1983/97, 1988/93, 1988/97, and 1993/97. Although positive, the values found for the first five subperiods are very close to zero, which make the author conclude in favor of a stability of labor demand. For 1993/97, the result was negative, though the nearest to zero.

Since the values are close to zero, this test does not allow us to conclude for the prevalence of any kind of shift. The test on the demand shift in the following item may perhaps aggregate some more information on this issue.

4.2. Shifts of Relative Labor Demand

The shifts of relative labor demand are expected to have brought benefits to some groups of workers in the 1981-99 period, as it was a rich period in structural changes in the Brazilian economy. In the same way, a similar pattern was expected through the H-O model. The demand shifts may occur among sectors or within sectors. Some authors\(^\text{12}\) have showed evidence that technological change - biased by labor qualification mainly introduced by the use of computers in industrial segments – leads to shifts in skilled labor demand within sectors. Technological innovations in a given sector change employment composition and, therefore, earnings differential within this sector. In a different methodological line, trade economists (Leamer, 1994), by using the H-O model, argue that technological change will not affect prices and relative earnings if it is disseminated throughout the several sectors.

Since an attempt is made here to identify trade liberalization impacts on a possible labor demand shift they are, therefore, expected to occur in greater intensity among sectors than within sectors. However, possible effects of other changes in the economic environment on relative labor demand should not be overlooked.

The demand shift index is a standard index of fixed coefficients with changes in employment sectorial composition measured in efficiency units. According to Katz and Murphy (1992), an interpretation of this index is that the inputs heavily employed in the expanding sectors would have an increased demand while those used in contracting sectors would tend to have a decreased demand. No assumption is made for the sources of employment changes, and specific sectorial functions of unit cost are held constant.

The demand shift of group \( k \) in the year \( t \) (\( \Delta X^d_k \)) is defined as follows:

\[
\Delta X^d_k = \frac{\Delta D_k}{E_k} = \sum_j \left( \frac{E_{jk}}{E_j} \right) \left( \frac{\Delta E_j}{E_j} \right)
\]

\[
\Delta X^d_k = \left( \sum_j \alpha_{jk} \Delta E_j \right) / E_k \tag{5}
\]

Where \( j \) represents the activity sector, \( \Delta E_j \) is the difference in participation in employment of the sector \( j \) in total employment between the two years measured in efficiency units, \( \alpha_{jk} (= E_{jk} / E_j) \) is the participation of group \( k \) in sector \( j \) in the base period; and \( E_k \) is the participation of group \( k \) in total employment in the base period measured in efficiency units.

This relation expresses the percentage change in relative demand for each group as a weighted average of sectorial employment variations where the weights are the employment sectorial distribution of specific groups. The variable becomes a change index in relative demand when divided by the total employment average in the base period. Therefore, such shifts (\( \Delta D \)) are measured from an index of sectorial labor requirement based on fixed technical coefficients (fixed-coefficient “manpower requirements” index). The role of this index is to measure the demand percentage variation by demographic group as a weighed average of employment increase in the several sectors, the weights being the employment sectorial distribution of the demographic group in the base period.

The empirical application of education levels and skilled work and unskilled work dichotomy, as defined by the grouping of education levels, is taken into account. By definition, skilled workers would be those who had at least completed some of their high-school education 1 and, by a second definition, those who have fully done so. Education levels and the skilled/less-skilled distinction are definitions of demographic groups \( k \).

By using the education level in a first approach, the global shift index of relative labor demand (equation 5) takes into account the branch combination (20 branches – agricultural and industrial branches) and social occupational groups (manual, medium, and higher) as a representation of sectors \( j \) (60 sectors), with \( k \) the 4 education groups for the global demand shift. The breakdown of such a global index is the sum of inter and intra-shifts. The first breakdown element, i.e., intersectorial shifts, takes only 20 activity branches (\( j \)) in equation (5) and \( k \) is maintained as the education group. The second breakdown element, the relative labor demand shift within sectors (\( intra \)), is nothing but the residuals obtained in the difference between global demand shifts and intersectorial demand shifts. It reflects changes occurred in employment between social occupational groups within the activity branches.
As for the less-skilled/skilled labor dichotomy, the rationale is the same, by simply replacing education level by classification. Thus, the variable $k$ no longer represents four groups and assumes only two values.

The period chosen as the basis to be used is from 1981 to 1999. Thus, the participation of sector $j$ in the total employment of group $k$ ($\alpha_{jk}$) is the average contribution in the period as well as the contribution of group $k$ in the total employment ($E_k$). Such information comes from matrix $X$ as it is expressed in efficiency units. The regroupings required for the calculus of such contribution are made in terms of education groups ($k=4$); global demand shift sectors ($j=60$); and inter-sectoral demand shift ($j=20$); or, in the second case, in terms of skilled/less-skilled, where only variable $k$ ($k=2$) is changed.\textsuperscript{13}

Table 1 shows global, inter-branch, and intra-branch shifts expressed in $(1 + \log \Delta X)^* 100$ by education level. Katz and Murphy (1992), however, show low values for the U.S. between 1967 and 1987 (they are in the interval from 0 to 20%). Robbins (1997) also presents different results for developing countries.

<table>
<thead>
<tr>
<th></th>
<th>GLOBAL</th>
<th>INTER</th>
<th>INTRA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981/89</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incomplete Elementary School</td>
<td>-4.11%</td>
<td>-0.52%</td>
<td>-3.57%</td>
</tr>
<tr>
<td>Incomp. Junior High School</td>
<td>-0.53%</td>
<td>0.70%</td>
<td>-1.25%</td>
</tr>
<tr>
<td>Incomp. High School</td>
<td>1.40%</td>
<td>0.34%</td>
<td>1.07%</td>
</tr>
<tr>
<td>Completed High School</td>
<td>2.91%</td>
<td>-0.36%</td>
<td>3.26%</td>
</tr>
<tr>
<td>1990/99</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incomp. Elementary School</td>
<td>6.89%</td>
<td>-9.02%</td>
<td>14.64%</td>
</tr>
<tr>
<td>Incomp. Junior High School</td>
<td>8.43%</td>
<td>-0.60%</td>
<td>8.97%</td>
</tr>
<tr>
<td>Incomp. High School</td>
<td>6.18%</td>
<td>5.10%</td>
<td>1.13%</td>
</tr>
<tr>
<td>Comp. High School</td>
<td>-16.88%</td>
<td>4.88%</td>
<td>-22.99%</td>
</tr>
</tbody>
</table>

Source: prepared by the authors based on Tabulações Especiais da (special tabulations) PNAD/IBGE

From 1981 to 1989, previous to the deepening of trade liberalization in Brazil, it is possible to identify an increase in the demand for workers with schooling higher than the complete elementary degree, a shift explained by changes within the sectors. From 1990 on, an increased demand for all workers, except for those who have at least completed high school, (Fred, do you want to say here …at least those who have completed at least SOME of their highschool education…OR do you want to say…at least those who have completed ALL of their highschool education?) can be observed. Here again, changes within sectors prevail in explaining a change in the employment composition.

\textsuperscript{13} The data deriving these estimates came from matrix X, measured 240 by 17, as it has 20 branches, 4 education levels, and 3 occupational categories, making up 240 groups with the same characteristics as for personal attributes and the nature of the job. In order to apply the demand shift index together with skilled/less-skilled labor, the relative demand volume was redefined according to the methodology already referred to and the normalized percentage was applied to this matrix which resulted in a correspondent one with 120 groups.
Machado e Moreira (2001) observed a demand shift behavior, which favored unskilled workers, and such a relation tends to be monotonic and negative as it advances in the distribution by education level. The intersectorial shifts have prevailed over the intrasectorial ones after 1990.

Green et al. (2001) find a substantial rising trend in the returns to college education in Brazil following trade liberalization. This behavior is 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 this result.

Analyzing the service sector, which is the best representation for nontradable commodities disaggregated into 7 branches, a similar labor behavior was observed for the agricultural and industrial sectors. Previous to trade liberalization, the highest education groups were favored whereas, after 1990, less educated by the firms. And it is the changes occurring within the branches which can explain this labor demand behavior.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Relative labor demand shift according to education in the service sector</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GLOBAL</td>
</tr>
<tr>
<td>1981/89</td>
<td></td>
</tr>
<tr>
<td>Incomplete Elementary School</td>
<td>-7.24%</td>
</tr>
<tr>
<td>Incomp.Junior High School</td>
<td>-2.49%</td>
</tr>
<tr>
<td>Incomp.High School</td>
<td>0.29%</td>
</tr>
<tr>
<td>Completed High School</td>
<td>3.28%</td>
</tr>
<tr>
<td>1990/99</td>
<td></td>
</tr>
<tr>
<td>Incomp. Elementary School</td>
<td>4.09%</td>
</tr>
<tr>
<td>Incomp. Junior High School</td>
<td>4.69%</td>
</tr>
<tr>
<td>Incomp.High School</td>
<td>1.88%</td>
</tr>
<tr>
<td>Comp. High School</td>
<td>-4.14%</td>
</tr>
</tbody>
</table>

Source: prepared by the authors based on Tabulações Especiais da (special tabulations) PNAD/IBGE

In order to make the relative labor demand shifts more evident according to the theory and aiming at adjusting the analysis to the disaggregation present in the literature on the subject, the disaggregated *inter* and *intra* global demand shifts are presented in Table 3, according the skilled/less-skilled labor classification.

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Relative labor demand shift according to qualification level in the agricultural and industrial sectors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1st qualification definition</td>
</tr>
<tr>
<td></td>
<td>GLOBAL</td>
</tr>
<tr>
<td>81/89</td>
<td></td>
</tr>
<tr>
<td>Unskilled</td>
<td>-2.16%</td>
</tr>
<tr>
<td>Skilled</td>
<td>2.50%</td>
</tr>
<tr>
<td>90/99</td>
<td></td>
</tr>
<tr>
<td>Unskilled</td>
<td>7.72%</td>
</tr>
<tr>
<td>Skilled</td>
<td>-9.97%</td>
</tr>
</tbody>
</table>

Source: prepared by the authors based on Tabulações Especiais (special tabulations) PNAD/IBGE
In table 3, it can be observed that the results according to qualification groups confirm those obtained for the disaggregation according to education levels. Both in the first qualification definition (workers who have at least completed a part of their high school education) and in the second definition (workers who have at least completed all of their high school education), it can be verified that, before trade liberalization, demand for skilled workers is widened. Afterward, there is a demand shift to less-skilled workers. Those changes prevail within the branches and not within sectors, as predicted by the theory.

As for the non-tradeables (service sector in our previous definition) there is no distinction as to the sign of the result obtained for the analysis according to education levels either (Table 4).

### TABLE 4
Relative labor demand shift according to qualification level in the service sectors

<table>
<thead>
<tr>
<th></th>
<th>1st qualification definition</th>
<th>2nd qualification definition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GLOBAL</td>
<td>INTER</td>
</tr>
<tr>
<td>81/89</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unskilled</td>
<td>-4.43%</td>
<td>-0.67%</td>
</tr>
<tr>
<td>Skilled</td>
<td>2.68%</td>
<td>0.42%</td>
</tr>
<tr>
<td>90/99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unskilled</td>
<td>4.44%</td>
<td>-6.83%</td>
</tr>
<tr>
<td>Skilled</td>
<td>-2.89%</td>
<td>4.06%</td>
</tr>
</tbody>
</table>

Source: prepared by the authors based on the Tabulações Especiais (special tabulations) PNAD/IBGE

Even though the results show a change in the employment sectorial composition in the analyzed period, one can verify that demand shifts for less-skilled workers tend to prevail within the branches, indicating that internal factors may be acting upon this composition. These factors include aspects such as changes in organizational techniques in the firms. Conversely, if intersectorial shifts were prevalent, consumers’ preferences and differentiated increase in productivity between branches and foreign trade could be plausible explanations.

Katz and Murphy (1992) observed that a demand shift occurs towards the more educated workers and significantly within the sectors, indicating, according to the authors, technological changes biased on qualification. Berman, Bound, and Griliches (1994) showed that a significant portion of qualification upgrading from 1973 to 1987 in the U.S. was due to an increase in the proportion of workers not directly linked to production in the economy. These authors’ results demonstrated that the intrasectorial component prevails over the intersectorial component. For 0.552 percentage points of annual increase in the participation of workers not linked to production in the industrial employment from 1979 to 1987, the \textit{intra} component in industry accounts for 0.387 percentage points, or 70%, and the \textit{inter} component, with 30%. Berman, Bound, and Machin (1999), using another methodology, also observed positive shifts towards skilled labor in developed countries in the 1980s, independent of the stability or earnings increase for this kind of worker.

These results are similar to other developing countries. In Mexico during the 1980s, earnings differential between skilled and unskilled workers increased due to domestic changes in sectors and
industry towards a greater absorption of skilled workers (Hanson e Harrison, 1995). Revenga (1997) pointed out that trade liberalization was mild in relation to the labor market as a whole. However, there was a demand shift for skilled workers at the firm’s level.

Robbins (1997) verified an increased labor demand for skilled workers in Latin America (Chile, Argentina, Costa Rica, Colombia and Uruguay), and Southeast Asian (Malaysia, the Philippines, and Taiwan). Positive intersectorial shifts prevailed in Colombia, Argentina, Malaysia, the Philippines, and Taiwan. Positive intrasectorial shifts occurred in Chile, Colombia, and Argentina. Negative intrasectorial shifts in Costa Rica, Malaysia, the Philippines, and Taiwan. For this author, positive demand shifts for skilled workers inter sectors followed by an increase in their relative earnings do not support the neoclassical theory of international trade. An explanation can be found in the combination of two factors. On the one hand, they may be reflecting strategies of product sophistication and, on the other, the use of technologically modern equipment in intensive sectors so far with unskilled labor force. A technological change biased by qualification would be embedded in equipment modernization in national firms or through outsourcing.

Menezes Filho and Rodrigues Junior (2001), taking recourse in the methodology used by Berman et. al. (1994) and using R&D as a proxy for technical progress, showed that the intrasectorial component has prevailed in explaining changes in the relative use of skilled labor in the Brazilian industrial sector over the last two decades. They explain such behavior by means of variables, such as R&D, tariffs, and relative earnings. They found a positive and significant relationship between both relative employment and inter-industrial wage mass to the technological variable (according to the several sources of R&D used by the authors) for 1994-97, which evidenced a strong complement between technology and skilled labor, and physical capital and skilled labor as well. Concerning the trade effect it is understood as an intersectorial effect estimated by means of the tariff variable, and it has been shown to be limited and scarcely significant.

Maia (2001) examined the impact of trade liberalization, technological change, and final demand on the Brazilian employment structure by qualification level in the years 1985 and 1995. By disaggregating such effects and using the methodology of Greenhalgh et al.(1998), she observed an increase in skilled workers vis-à-vis unskilled workers which has been caused by trade liberalization and technological changes. She has also observed the importance of the trade liberalization as it exposes the economy to new technological patterns thus increasing productivity and encouraging labor qualification. However, despite the evidence pointing to a relative decrease in the demand for unskilled labor, trade openness has not managed to invert factor intensity, i.e., the Brazilian pattern of comparative advantage is still unskilled-labor intensive.

Working with two subperiods subsequent to the trade liberalization, we only partially confirmed the results obtained by Menezes Filho and Rodrigues Júnior (2001) and Maia (2001). In fact, Table 5 shows a decreased demand for unskilled labor (1992/95). However, contrary to the results found by the mentioned authors, intersectorial shifts prevail, which can be explained by the difference of periods. We have taken only the 1992-95 period into account, while the first two authors took two decades and the latter (Maia, 2001) only one decade, 1985-95. The prevalence of intersectorial effects coincides with that found by Machado and Moreira (2001) for the 1993-97 interval.
TABLE 5
Relative labor demand shift according to the qualification level in the agricultural and industrial sectors

<table>
<thead>
<tr>
<th></th>
<th>1st qualification definition</th>
<th>2nd qualification definition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GLOBAL</td>
<td>INTER</td>
</tr>
<tr>
<td>92/95</td>
<td>Unskilled</td>
<td>-0.93%</td>
</tr>
<tr>
<td></td>
<td>Skilled</td>
<td>1.09%</td>
</tr>
<tr>
<td>96/99</td>
<td>Unskilled</td>
<td>3.35%</td>
</tr>
<tr>
<td></td>
<td>Skilled</td>
<td>-4.11%</td>
</tr>
</tbody>
</table>

Source: prepared by the authors based on the Tabulações Especiais da (special tabulations) PNAD/IBGE

In the period between 1996 and 1999, when the Brazilian economy experienced an economic crisis under the Real Plan, we observed an increased demand for unskilled workers and such inversion was mainly due to changes within sectors.

5. CONCLUSIONS

The first approach of this paper was to identify whether wage differences in Brazil were a result of demographic features or due to labor supply and/or labor demand shifts. The dataset stresses industry, agriculture and services sectors, with the latter representing the non-tradeables goods. The vector of relative income does not allow for having clear evidence regarding which kind of shift is more important.

In order to get more disaggregated results we broke down the labor demand index in educated levels for these sectors (industry, agriculture, and services). In each sector, from 1981-89 (before trade liberalization) there were demand shifts for skilled workers, whereas after trade liberalization this demand shift benefited unskilled workers. Even though the results stress changes in the employment sectorial composition, one can verify that the demand shift for unskilled workers tend to prevail within the branches. This indicates that internal factors may be acting upon this composition, such as changes in organizational techniques in the firms. Conversely, if intersectorial shifts were prevalent, consumers’ preferences, differentiated increase in productivity between branches, and foreign trade could be plausible explanations. As for the non-tradeables there is no distinction as to the sign of the result obtained from the analysis according to education levels either, revealing that this sector does not change the results.

Analysing the results by qualification definition, the former results are confirmed. Either for the first definition (workers with who have not completed high school) or the second one (workers with at least a high school education), there was a demand shift benefiting skilled workers only within sectors. This contradicts the traditional theory of international trade, where the demand shifts should occur among (or between) sectors. This data, however, needs to be taken with caution since the stabilization in Brazil (1994) changed income distribution by means of an inflation tax and a forced saving. Indeed, since part of the dataset used in this study deals with labor earnings, effects other than trade liberalization can bias influence the result.
6. REFERENCES


