Trade Liberalization, the Exchange Rate and Job and Worker Flows in Brazil*

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Abstract :

Over the 1990's Brazil experienced a massive trade liberalization and large variation in the real exchange rate. At the same time, employment growth was small and in manufacturing there was a significant employment reduction. The main goal of this article is to identify the effects of the exchange rate and trade liberalization on job and worker flows in Brazil. Using previously unknown sector exchange rate measures, our results suggest that a depreciation of the exchange rate affects net employment growth by increasing job creation and hires, with no effect on job reallocation. Tariffs have no effect on job or worker flows, while import penetration decrease job growth by increasing job destruction. The results suggest that the exchange rate has a very important role on job and worker flows, even after controlling for openness and sector heterogeneity.

Key words : job and worker flows ; trade liberalization ; exchange rate ; Brazil.
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Abstract :

Over the 1990's Brazil experienced a massive trade liberalization and large variation in the real exchange rate. At the same time, employment growth was small and in manufacturing there was a significant employment reduction. The main goal of this article is to identify the effects of the exchange rate and trade liberalization on job and worker flows in Brazil. Using previously unknown sector exchange rate measures, our results suggest that a depreciation of the exchange rate affects net employment growth by increasing job creation and hires, with no effect on job reallocation. Tariffs have no effect on job or worker flows, while import penetration decrease job growth by increasing job destruction. The results suggest that the exchange rate has a very important role on job and worker flows, even after controlling for openness and sector heterogeneity.

1. Introduction

While the usual analysis of the labor market concentrate on unemployment and employment stocks in any period of time, this market is in a constant flux. Workers move between jobs and between employment, unemployment and inactivity many times in their life. Firms are constantly hiring and firing workers in search of good matches between worker skills and firm needs and adjusting employment levels in the face of changing aggregate and individual demand and cost conditions.

Worker flows to and from unemployment have spurred a large theoretical literature on job matching (*e.g.* Mortensen and Pissarides, 1999 for a current survey) using household surveys for empirical applications. On the other hand, based on plant/firm data, the measurement of gross job flows has also received a good deal of attention in the recent years. The degree of demand induced worker reallocation, measured by job creation, destruction and reallocation, is an important characteristic of a labor market (*e.g.* Davis, Haltiwanger and Schuh, 1996). The dynamics of job flows may be different from worker flows, with important implications for the study of unemployment.

At the same time, the Brazilian labor market experienced large changes across the 1990's. From 1994 to 1998 Manufacturing employment fell about 15%, according to RAIS. Over this period the country experienced an overvalued exchange rate and the consolidation of the trade liberalization process that began in 1989. Many authors claimed that the employment decrease was due to the tariff reduction. Yet, after the 1999 devaluation, manufacturing employment grew more than 8% over the 1999-2000 period, while the tariffs remained relatively stable. The experience suggest that both tariffs and the exchange rate have important effects on manufacturing employment.

Many articles have dealt with the effect of trade liberalization and the labor market. But the main focus is on wages, not employment, as one can see from the workshop IPEA/MTE(2001) and Soares, Arbache and Santos(2001) and references therein. The question that remains is what is the specific role and magnitude of tariffs and the exchange rate on employment growth, *ceteris paribus*.

In addition, given the mentioned large literature on job and worker flows, there is to be determined the sources of employment variation from tariffs and exchange rate changes. Trade may have asymmetric effects on job flows, that is it may decrease employment by

increasing job destruction without affecting job creation. At the same time it may decrease employment by reducing hires without affecting the separation rate. The asymmetric effects are important for policy design and need to be determined.

The aim of this paper is, thus, to investigate the effect of trade liberalization that could have affected job and worker flows. We first present a description of job and worker flows in Brazil. Then we present econometric evidence on the effect of trade and the exchange rate on job and worker flows.

Our results indicate that job reallocation and worker turnover in Brazil are very high, suggesting that the labor markets are flexible, despite the perceived strict regulations[1]. The effect of trade liberalization was related to net flows and not pervasive. An overvalued exchange rate decreases net job growth by decreasing job creation, while higher effective penetration reduces net job growth by increasing job destruction. There was no perceived effect on job reallocation as trade related variables did not affect job creation and destruction simultaneously. The effect on worker flows was asymmetric, with worker turnover increasing with a devaluation (through hires) and more imports (through separations).

The paper is divided as follows. The next section provides an overview of the methodology to measure gross job and worker flows. The third section presents and discusses the data set used. Section four presents the main statistics on job and worker reallocation. Section five brings the trade liberalization effects. The last section provides concluding comments.

2. Statistics and Measurement

Employment dynamics at the macroeconomic or firm/ establishment level are usually studied by looking at the net employment changes from period to period (Hamermesh, 1993). The aggregate, or average, measure of net employment change may obscure large differences in individual plant[2] behavior. The net aggregate employment changes also obscure the number of worker movements into and out of employment. In order to explore this heterogeneity, Davis and Haltiwanger (1992) proposed a set of statistics for job flows, that look at the positive and negative part of the employment change distribution at the plant level. These statistics indicate the degree of heterogeneity in the businesses studied and provide a demand-side complement for usual measures of worker flows, such as worker turnover.

2.1. Gross Job and Worker Flows

As mentioned above, in order to measure gross job flows we follow Davis and Haltiwanger (1992) and Davis, Haltiwanger and Shuh (1996), DHS hereafter. The job flow statistics are calculated using employment levels (n_{it}) for individual plants in two points in time. The first statistic provide a weighted average of the employment change distribution, truncated for positive values only, and the second statistic an average truncated for negative values only. They are, respectively,

$$POS_t = \sum_{i=1}^{N} ((n_{it} - n_{it-1}) / X_t) I(\Delta n_{it} \geq 0), \text{ and}$$

$$NEG_t = \sum_{i=1}^{N} (|n_{it} - n_{it-1}| / X_t) I(\Delta n_{it} < 0),$$

[1] In Latin America and other developing countries, it is often claimed that excessive labor market regulations create rigidities with negative efficiency effects (WorldBank, 1995, IDB, 1996).

[2] The measures can be calculated for either plants or firms. To simplify exposition, and since we use plant data, we use plant or establishment only hereafter.

where X_t is the average employment level for t and $t-1$ in the economy, ($X_t=\Sigma_i (n_{it} + n_{it+1})/2$), and $I(.)$ is the indicator function, with 1 if the argument is true and 0 otherwise. One can divide job creation and job destruction (POS_t and NEG_t) in two parts, one for firms that enter and exit the economy, and another for continuing firms, that is, firms that appear both in t and $t-1$. Aggregate net employment change may be calculated as $NET_t = POS_t - NEG_t$.

However, as DHS and Hamermesh *et al.* (1996) point out, job flow measures using data on employment stocks at a point in time are in fact lower bounds on the true number of positions created and destructed and of worker turnover over the period under study.[3] On the other hand, our data set, discussed below, does have information on actual workers' flows (accessions and separations), so it will be possible to measure the differences between job reallocation and total turnover.

We define the accession rate for the period t (H_t) as the sum of accessions in each unit i over period t (h_i) divided by aggregate average employment. The separation rate for the period t (S_t) is the sum of separations in each unit i over period t, (f_i) divided by aggregate average employment:

$$H_t = \sum_{i=1}^{N} h_i / X_t \,, \qquad \text{and} \qquad S_t = \sum_{i=1}^{N} f_i / X_t \,.$$

Aggregate net employment growth may be also calculated from H_t and S_t, *i.e.*, $NET_t = H_t - S_t$.

As a measure of employment adjustment heterogeneity, DHS defined gross job reallocation (SUM_t) as the weighted sum of the absolute value of employment growth rates, that is, the sum of job creation and job destruction rates,

$$SUM_t = POS_t + NEG_t.$$

As this measure increases with the level of net employment change, a measure of job reallocation more closely related to the turbulence of the labor market may be defined as the excess job reallocation (EJR):

$$EJR_t = SUM_t - |NET_t| = 2\ min\{POS_t, NEG_t\}$$

that is, the fraction of the gross job reallocation that cannot be accounted for by the net employment expansion (or contraction). If the economy could be well characterized by a single representative firm, EJR_t would be zero.

Conversely, a measure of employment adjustment heterogeneity and labor market attrition based on worker flows, denoted (total) worker turnover rate may be calculated as the sum of the accessions and separation rates,

$$T_t = H_t + S_t.$$

SUM and T are related, as Davis and Haltinwanger (1995) show. SUM_t may be considered as a lower bound on workers' transitions induced by job changes[4]. Worker turnover (T_t) is at most twice the number of worker transitions, as it double counts job-to-job movements. And gross job reallocation (SUM_t) may be taken as the lower bound to worker turnover (T_t) as the former considers only the difference between worker flows, that is, it does not consider accessions and separations that do not change the total employment level.

This suggests a churning measure, related to the quality of the matching between firms and employees. Abstracting from worker flows due to retirement and imposing a stable job composition within firms, the difference between SUM_t and T_t suggests the amount of worker

[3] See also Davis and Haltiwanger (1995).

[4] Worker transition is the number of workers that participate in transitions between jobs or between a job and unemployment/ inactivity (and vice versa).

turnover not accounted for by employment level adjustments, that is, the level of worker turnover given by the supply side of a match between a worker and a firm.

$$CH_t = T_t - SUM_t.$$

This measure has been called churning by Lane *et al.*(1996). Using the definitions of Turnover and Job Reallocation, one could write $CH_t = (H_t - POS_t) + (S_t - NEG_t)$, making it easier to understand its interpretation. The biggest issue in implementing and comparing the churning measure is the measurement of admissions and separations as Davis and Haltiwanger (1999) point.

3. Data

The data set used is based on the *Relação Anual de Informações Sociais (RAIS* – Annual Social Information Report*)*, microdata. *RAIS* is organized annually by the *Ministério do Trabalho e Emprego (MTE* – Labor Ministry*)*. It is an administrative report filed by all tax registered Brazilian establishments. The information is collected in the first quarter, referring to the previous year, and it covers the whole country. This procedure started in 1986 but due to a steep increasing trend in the coverage until 1990, we will restrict our analysis to the period from 1991 to 2000. The data covers approximately two million establishments and twenty four million workers, on average, every year.

The main variables available from the survey used in this work are: establishment size, measured as the number of salaried workers on December 31st; sector classification (25 IBGE subsectors)[5]; monthly admissions and separations by establishment; and schooling level of workers. The unit of observation is an establishment/workplace, be it an individual enterprise or a branch or plant of a large firm. All tax registered enterprises receive a unique tax number, the *CNPJ*. The *CNPJ* is different for different workplaces/establishments from a single firm. This identifier is used to pool the cross-sections.

Since all businesses should file the *RAIS* report, there is no lower bound on establishment size. In fact, a good portion of the establishments report zero salaried workers. On the other hand, since the *RAIS* information may be used for inquiries about labor legislation compliance, businesses that do not comply with it tend to not to file in *RAIS*. Thus, *RAIS* may be considered a census of the *formal* Brazilian labor market.[6] We understand the formal sector as tax and social security registered establishments only.

In principle, we should expect a good coverage of entry and exit, since every time a business formally starts up (obtains the tax registry number), it must file a *RAIS*. Previous results in the literature suggest that the entry and exit of establishments account for an important share of job flows (*e.g.* DHS for manufacturing). However we may have businesses entering the data when they decide to become formal, maybe due to its growing size. On the other hand, a business will be considered closed every time it does not file a *RAIS* report or reports zero employees.

Unfortunately, as with any data set that uses administrative records, coverage differences across sectors and sizes and across time may generate spurious results. Given preliminary studies, we identified problems of regional coverage and/or reporting errors for very small firms. The main implication of the coverage/reporting errors are overestimated job flow measures. In order to obtain more confidence in the calculated statistics we set a lower bound on average unit size at 5 employees. About 7 to 9% of all jobs in the economy are lost

[5] IBGE Subsector is a classification used by the Labor Ministry that is consistent over the 1990's. There exists other classifications, such as *CNAE* but this classification was introduced in 1995. IBGE Subsector is broadly consistent with ISICv.2. See the apendix for details.
[6] State owned enterprises, public administration and non-profit organizations are also required to file the report.

in this procedure. The cut off level is arbitrary but provides statistics more comparable with other works in the area and should reduce measurement error in job and worker flows.

In addition, three adjustments were necessary to implement the measures presented above. First there are interruptions in the data sequence for some establishments. However there is no information for the reason of these interruptions. It may be originated by a real interruption of the activities (with destruction of all jobs followed by re-creation) or by non compliant behavior, which means that the establishment is operating, but just did not report *RAIS*. Our procedure to sort this out consists in eliminating establishments where there are interruptions that last for only one or two years, considering these as lack of reporting. The establishments that were missing from the data set for more than two years were taken as if they had shut down and re-openned[7]. This procedure eliminated 5% of the original establishments in our database, but only about 1% of total employment, as the units are mostly very small.

Third, there are cases where changes in employment from two consecutive years ends are not consistent with the difference in hires and separations[8]. Investigation on this issue could not uncover any pattern on the inconsistency across firms. Thus net employment growth measures based on worker flows differ from those based on job flows.

Fourth, regarding entry and exit, merges and acquisitions or ownership changes induce a firm identification number change. The change in identification number is used in our estimates as plant failure and/or entry, while in fact, few jobs may be shed and the plant is still operational. This is a problem with other data sets too (e.g., Blanchard and Portugal, 2001). For confidentiality reasons it wasn't possible to identify and correct for such ownership chances. Given the privatization process across the 1990's, the sale of state enterprises may overestimate job flows in the utilities and banking sector. Yet this should not affect aggregate measures as the utilities sector accounts for about 1% of aggregate employment.

4. A view of job and worker flows in Brazil

Table 1 presents the yearly job flows for Brazil covering the formal enterprises with 5 employees, on biannual average, or more. A remarkable feature are large job reallocation rates, above 28%, with a yearly average of 31%. Given an average net employment growth of about 1.1% per year over the period, the excess job reallocation average is almost 29%. Every year, firms created an average of 16% of jobs in a given year, while job destruction rates were of 14,9%, on average, during the 1990's.

Comparison with other countries is limited by sample coverage across countries. Most studies cover only manufacturing, while services and construction tend to have higher reallocation rates. The higher the minimum firm size, the lower reallocation rates tend to be. Boeri and Cramer (1992) have similar coverage for Germany and its reallocation rate is about half of the Brazilian rate.

The dynamics of job flows are different from the US and more in line with European results (for example, Garibaldi, 1998)[9]. Using a simple yearly correlation, job reallocation

[7] We followed advises from the technical staff of Labor Ministry.

[8] Denoting the employment stock on December 31st of year t as n_t and hires and separations over the year t as h_t and s_t respectively, $n_{t-1} = n_t + s_t - h_t$. A source of the inconsistencies may be the way that employment stocks and worker information (such as hirings and separations) are computed. Worker and Firm data are in separate files by year. The sheer size of the data set prohibited the cross-year match of worker data, so that the hiring and separations rates are calculated as January 1st-December 31st changes. As New Year's Day is a holiday, there should not be significant differences in employment stocks between December 31st in year *t-1* and January 1st in year *t*. Nevertheless such differences were indeed observed, with no clear pattern to indicate a way of adjusting the figures.

[9] Again, while data coverage differences would imply some degree of care in comparisons, the "stylized facts" are already taken as valid for whole economies in the literature (see, again, Garibaldi, 1998).

does not seem to be correlated with the cycle Using a fixed effects model with 25 sectors each year, as in Albaeck and Sorensen (2000) does not change the results. On the other hand, Excess Job Reallocation seems pro-cyclical, as in Europe. A stylized fact in the US is the counter-cyclical behavior of job reallocation (Hall, 1999). Using the panel regression, job creation and job destruction are correlated with net employment growth with opposite signs, although with a slightly stronger relationship between job destruction and net job growth. The job destruction and creation dynamics cancel each other, rendering job reallocation uncorrelated with net employment growth.

Table 2 presents the yearly hiring, separation, turnover and churning rates for Brazil. One must note that the worker flows are cumulative over the year, instead of point in time measures. This implies, for example, that more seasonal sectors will tend to have higher worker flows and limits comparison with the literature.

The first feature on worker flows are impressive turnover rates every year, albeit not unusual in the world, as seen below. Hires and separation rates are about 40% of the average employment stock, setting the turnover rate above 80% every year. The churning rate is calculated as the difference between worker turnover and job reallocation and can be understood as a measure of worker turnover not driven by net employment adjustment. The Brazilian figures suggest that this match-driven plus seasonality turnover is above 40% of the employment stock, reaching an yearly average of more than 50%. Job flow rates are about 1/3 of worker flows (POS/H, NEG/S and SUM/T).

The dynamic properties of worker flows are similar to job flows to the extent that hires are procyclical, separations countercyclical, and turnover is not related to the business cycle, as the increase in hires in upturns is similar to the reduction in separations. Other studies found that turnover was procyclical.

5. The Impact of Trade Liberalization on Job and Worker Flows

The above analysis indicated that the Brazilian labor market is very active with high job reallocation and job turnover rates. Over the 1990s, Brazil experienced a very large trade liberalization process and different macroeconomic conditions. Over the period, there seems to be a slight upward trend in job reallocation and worker turnover. It would be interesting to contrast the dynamics of job and worker flows with the trade liberalization process to measure the extent that this structural reform affected the labor market flows. Thus, the main objective of this section is to study the impact of trade liberalization and exchange rate fluctuations on job and worker flows in Brazil.

5.1. Brazilian economic background

During the 1990's Brazil experienced large macroeconomic changes, as seen on Table 9. In the first half of the decade, after a massive recession and failed stabilization plan by President Collor in 1990, the country experienced high inflation rates (above 20% per month) until mid 1994. When the *Real* stabilization plan was introduced in July 1994, it was based on a fixed peg to the US dollar, fiscal surpluses (at least in 1993-1994) and increased external competition to damp price increases rising from post-stabilization real income gains. The first half of the decade also witnessed a wide trade liberalization reform, that actually started in 1988. Its zenith can be associated with the implementation of the *Mercosur/Mercosul* External Common Tariff in late 1994.

During the second half of the decade, after the *Real* Plan, small inflation rates (down to 2% per year) coexisted with an allegedly overvalued exchange rate up to 1999. The external capital flows slowed to the country after the Asian and Russian crises in 1997 and 1998, respectively, worsening the current account problems faced since 1995, due to the

increasing trade deficits. On November 1998, a rescue package from the IMF provided some continuing credibility to the dollar peg. Nevertheless, on January 1999, the exchange rate regime was changed to a flexible one. By March 1999, the *Real* had fallen more than 50% with respect to its dollar value in December 1998. (see, *e.g.*, Amann and Baer, 2000) The labor market responded to these aggregate shocks over the decade.

In particular, the impact of trade liberalization on manufacturing was impressive. From 1991 to 1998, using the RAIS data, this sector employment fell by more than 11%, or almost 300 thousand jobs. After the devaluation in early 1999, manufacturing employment inverted its downward trend, reversing most of the losses of the previous period. In the last tow years of our data, 1999 and 2000, manufacturing employment had a net growth of more than 170 thousand jobs.

In order to provide a better understanding of the trade liberalization process over the 1990's, Figures 1 and 2 present the level of tariffs over 1986 – 1999 and the import penetration level from 1986 to 1998. Mean, median and the first and last decile of average tariffs for 52 sectors are presented[10]. The trade liberalization process involved the extinction of non-tariff barriers and a singnificant decrease in nominal tariffs and the start of the *Mercosul* trade bloc agreement with Argentina, Uruguai and Paraguai (Moreira and Correa, 1998). Median tariffs fell from about 55% in 1986 to 30% in 1990. They reached their lowest value in 1995, to just under 10%, increasing slightly over the next five years to about 15% in 1999. The dispersion of tariffs also decreased sharply from 1986 to 1995 but did not increase with the rebound in mean tariffs from 1995 to 1999.

The actual level of import penetration over the period can be observed in Figure 2. The decrease in tariffs from 1986 to 1994 brought a steady increase in import penetration, particularly after 1990, when non-tariff barriers were sharply reduced. After 1995 with the overvalued exchange rate, imports occupied a larger share of the market across sectors, rising above the 10% level.

Some authors have justified the reversal in the tariff reduction process to the ultimate macroeconomic goal of stabilization from 1994 to 2000. One of the pillars of the *Real* Plan was the increase in foreign competition to forestall price increases of domestic producers, brought about also by the overvalued exchange rate (that worked as an expectations anchor). The goods deficit would be covered by capital influx. After the Asian and Russian crises of 1997/1998, capital flows into the country receded, the commitment to the currency anchor of the *Real* plan pressured the current account and forced the increase in tariffs to reduce the devaluation pressure. In 1999, after the devaluation of the *Real*, tariffs were not increased, suggesting, as Portugal and Azevedo (2000) put, that the restrictions to trade liberalization over 1995-1998 were due to the restrictions of macroeconomic stabilization policy, instead of a desire to turn back the reforms.

The above discussion suggests that the 1990´s were a period with a variety of macroeconomic conditions and different aggregate shocks. Three periods can be clearly set. From 1990 until 1994, with high inflation and the trade liberalization process; from 1995 to 1998, with a fixed/overvalued exchange rate and the slight reversal of liberalization; and 1999 on, with the flexible exchange rate and the reduction in imports.

5.2. Theoretical framework and previous results

The different macroeconomic and trade conditions over the period provide an interesting case for the study of the effect of trade on employment flows. The effects of trade arise from changes in relative prices of domestically produced and imported goods. These changes can be induced by tariff changes and changes in the supply of specific goods, or exchange rate variations.

[10] The data comes from Muendler(2001a, 2001b).

There are possible three channels for the effect of trade related variables mentioned on business profitability and thus, employment flows. First, demand shocks from increased competition in domestic output markets. Second, competitiveness shocks from greater export shares in sector output. Third, cost changes arising from changing input costs. (Gourinchas, 1998). There is also an indirect channel, which is differential access to foreign technology.

Within a sector, the response to these demand/cost shocks may be heterogeneous, as plants differ in their productivity, domestic and foreign competitiveness, and use of imported inputs. Businesses differ in their exposure to foreign trade. The exposure can be through exports or imports. In fact, the data suggest simultaneous output imports and export within a given sector, *i.e.*, within industry trade seems pervasive. Import penetration ratios are not zero in exporting sectors (export share more than 20% of output) and vice versa. In fact most sectors have similar import penetration and export shares.

An example of the effect of trade on employment adjustment could arise from a decrease in tariffs (and currency appreciation). Within the sector, lower tariffs may reduce the price of a certain good, forcing firms exposed to import competition to reduce employment (job destruction). The adjustment may not be identical across businesses, since firms are heterogeneous in the profitability and trade exposure. At the same time, the lower tariffs may provide the opportunity to use better technology leading to employment increases (job creation) or provide access to cheaper inputs, leading possible job creation. In short, a tariff movement could lead to simultaneous job creation and destruction.

At the same time, the employment adjustment forces induce wages of worker reallocation, as businesses try to adjust their worker-job matches under the new profitability conditions. Technological changes may induce changes in the skill composition of the workforce, inducing higher turnover and separations and hires, even with no change in employment levels.

Last but not least, job creation and job destruction measures are based on truncated means of the employment change distribution. Should the effect of trade variables on employment differ not only in the direction but also in the variance of employment changes (due to non-convex adjustment costs (Hamermesh, 1993 and Engle *et al.*, 1997) the effect on job creation and destruction statistics may differ.

The empirical relationship between trade and gross job flows was examined by Gourinchas (1999) for France, by DHS (1996), Gourinchas (1998) and Klein *et al.* (2000) for the US, and by Roberts and Tybout (1996) for Chile and Colombia[11]. DHS and Roberts and Tybout did not find any pervasive effect of trade exposure on gross job flows, once firm characteristics were taken into account.

On the other hand, studies that take into account the effect of the exchange rate, as well as trade exposure, such as Klein *et al* (2000) and Gourinchas (1998 and 1999) did find systematic effects from the exchange rate and the degree of openness on job flow measures. Their method differs from DHS as they use regression analysis instead of ANOVA. Klein *et al.* argue that this accounts for the differences in results.

In fact, what may be the main difference in results is the study of exchange rate effects and not just the effect of the degree of openness on job and worker flows. Klein *et al*. suggest that for the US, job destruction and net employment growth respond to exchange rate appreciations, while job creation is not sensitive to exchange rate movements. Job reallocation was not studied. The sensitivity of job flows with respect to exchange rate movements increase with greater exposure to international trade.

For the US, Gourinchas (1998) found that exchange rate movements effect both job creation and job destruction in the same direction, which is unexpected. A devaluation of the

[11] There are articles that relate trade variables with net employment adjustments, such as Revenga (1992). We do not survey these articles, as our interest is on the job creation/job destruction margins.

US dollar decreases both job creation and destruction, at least for tradable sectors. Periods of depreciation are associated with decreased job reallocation, contrary to Klein *et al.*. For France, Gourinchas (1999) also found a strong influence of the exchange rate on gross job flows, with a more responsive reaction by job creation than job destruction. Yet, contrary to the US, the movements are in opposite directions.

Last, Roberts and Tybout used regression analysis also and could not identify any significant effect from import penetration on sector entry and exit rates[12]. In all, the limited evidence in the literature suggest that trade exposure, per se, is not strong enough to differentiate job flow measures across sectors and time, while exchange rate fluctuations are important.

5.3. Empirical Strategy

To study the impact of trade exposure and exchange fluctuations on gross job and worker flows, using the *RAIS* data we specify two types of models. The focus is on manufacturing employment, as this sector is more exposed to trade. This sector experienced an almost continuous decrease in employment from 1992 to 1998 (with slight increases in 1993 and 1994), when almost 14% of jobs were destroyed. On the contrary, after the 1999 devaluation employment grew remarkably, creating more than 150 thousand jobs.

Two issues motivate the models. First, data coverage over the 1991-2000 period. Tariff and trade flow variables are available only up to 1998. This covers a large period but leaves the sharp 1999 devaluation out of the analysis, which is very important for manufacturing. So a model that does not require trade data would be required to provide some information on the 1999 devaluation on job and worker flows. Second, there is a concern when specifying a model with trade variables, such as the degree of openness (either measured by import penetration and/or export shares), tariffs and the aggregate exchange rate, is that these variables may be endogenous. For example, an increase in sector job destruction may induce an increase in tariffs in order to protect jobs (Muendler, 2002). At the same time, aggregate unmeasured shocks may affect both aggregate exchange rate movements and sector demand.

With this in mind, the first model is a simple exercise of the effect of the 1999 *Real* exchange rate regime change, that caused a 50% devaluation with respect to the previous four years on manufacturing employment using differences-in-differences. Sectors are divided in tradable (manufacturing) and non-tradable (others) and a dummy for the exchange rate devaluation (the 1999-2000 period) is interacted with this classification. Year and sector dummies are included to provide the appropriate controls for aggregate shocks and sector heterogeneity. The dependent variables are the job (POS, NEG, NET, SUM) and the worker (H, S, T, CH) flow measures, and the time period covers from 1992 to 2000.

The 1999 devaluation could be interpreted as an exogenous, or at least, unanticipated change in the exchange rate regime, given the government commitment to the previous regime in effect since the *Real* plan. The commitment had backing from the IMF in important crises over the period, such as the Mexican 1994, Asian 1997 and Russian 1998 crises, suggesting some credibility on the commitment, as mentioned above. This method provides only qualitative evidence and abstract from within manufacturing differences in response. More detailed, quantitative results can be obtained by a more structural model.

The second model is a more structural model, based on Klein *et al.*(2000) in which manufacturing job flow measures are regressed on sector dummies, to control for sector heterogeneity effects, and trade measures, such as import penetration, tariffs and, more

[12] Plant Entry and Exit rates are related to the job creation and destruction discrete margin. They measure the number of firms entering or leaving a sector, instead of the employment flows. They are comparable if one assumes firms enter (and exit) with similar employment sizes across sectors.

important, the sector (log) real exchange rate. Data limitations limit the analysis from the beginning of our data, in 1992, up to 1998, excluding the *Real* float of 1999. The import penetration measures are obtained either as imports divided by sector output or imports divided by domestic absorption. Nominal tariffs are used, as well as tariffs adjusted for aggregate real exchange rate and input use. The original data was constructed by Meundler (2001a, 2001b)[13]. The (log) real sector exchange rates were constructed following Revenga (1992) and Gourinchas (2000)[14]. The sector exchange rate is an import weighted average of the exchange rate of the trading partners of each sector. Contrary to Revenga, the weights are calculated each year.

Yet, in the structural model , a concern in this model is that the trade openness variables are endogenous. Terms of trade (sector US producer price indices) are used as instruments, as in Muendler (2002).

The simple differences-in-differences estimator for the 1999 devaluation presents a first exploratory method for the effect of trade (the exchange rate in particular) on manufacturing job flows. Tables 4 presents the results for job flows. We see that the large devaluation of 1999 had a significant effect on job creation (positive), destruction (negative) and net employment growth (positive) on tradable, that is, manufacturing sectors' employment, when compared to non-tradable, *i.e.* non-manufacturing, and controlling for macroeconomic and fixed sector-specific conditions through time and sector (fixed effects) dummies. Time dummies control for aggregate shocks that influence the sectors as a whole (possibly general equilibrium responses to the devaluation). It is important to note that either job reallocation (SUM) or excess job reallocation (EJR) did not increase with the devaluation. A first message from the exercise is that the exchange rate seems to matter on trade-exposed sectors of the economy[15] [16].

So to provide a more complete picture of the effect of trade on job flows we present a basic structural model in Table 5a. The results suggest that higher trade openness decreases net employment growth by increasing job destruction (although significant at the 15% level only). Its effect on job creation is clearly insignificant. A 1 percentage point increase in import penetration (about 10% of its current value), net employment growth would decrease by 0,57%.

There is a significant effect of the (log) real sector exchange rate, implying that a devaluation of the real increases net job growth, through job creation increase and a non-significant decrease in job destruction. A 10% devaluation of the exchange rate would increase net employment by 0,27% a small response but not too far from the import penetration effect.[17] Job reallocation does not change with higher exposure to trade either by lower tariffs, higher import penetration nor exchange rate movements. The only effect of tariffs seem to be on excess job reallocation, reducing it. Higher tariffs appear to "chill" the labor market.

In order to provide more confidence on the results, the same models were estimated using effective penetration (imports divided by domestic absorption), sector export shares (exports divided by output), both from Muendler (2001a,b). The results are on Table 5b. The same qualitative results were obtained. Tariffs affect EJR only, reducing it; Job creation is influenced by the exchange rate, while job destruction is influenced by imports' effective

[13] The tariff and import penetration series are presented for the *nivel100* or *nível 80* classification. The RAIS data use an alternative classification, denoted "subsetor ibge", that aggregates manufacturing in thirteen sectors. The conversion guide between the sectors is available upon request. The aggregation used simple averages.

[14] Fabio Soares generously provided the raw bilateral trade and exchange rate data and suggestions on the sector rate construction.

[15] The results change marginally quantitatively, but not qualitatively, if the regression is run from 1995-2000.

[16] As a side comment, Table 10 also suggests interesting properties of job flows. Looking at the F tests on sector and time dummies, one sees that the NET flow have a much smaller sector contribution to its total variance. In other words, NET flows are much more similar across sectors than POS, NEG, SUM and EJR. and have relatively more cyclical variation that gross job flows.

[17] But much smaller that the ones in Gourinchas (1998,1999).

penetration and the export share. Both variables influence net flows and none affect job reallocation. In addition, exports increase net job growth by reducing destruction. The effect of a 1 percentage point increase in sector export share of output lead to a 0,44% increase in net employment growth. The figure is slightly smaller that the effect of import penetration, but statistically similar. The results on the effect s of tariffs and the exchange rate seem remarkably robust between specifications.

The possible endogeneity of the trade measures, particularly import penetration[18], is considered, in that we experiment with the US 4-digit price indices, aggregated to match our sector definitions, as an instrument. Before running the instrumental variable panel regressions, we estimated the relevance of the instrument, by looking at the significance of the instrument in an auxiliary regression of import penetration on sector and time dummies and our instrument. Weak instruments may generate results more biased than simple OLS in case of regressor endogeneity (*e.g.* Bound *et.al*,1995). Unfortunately the instrument is not significant at all, so IV regressions are not used.

Regarding worker flows, we consider first the differences-in-differences estimator for the effect of the 1999 devaluation on manufacturing worker flows. Table 6 suggests that there was an asymmetric effect on worker flows, as the devaluation reduced separations but had no impact on hires. Turnover was not affected by the 1999 devaluation, either according to the estimates, just as turnover did not change significantly between periods in manufacturing, as seen from table 4.

Turning to the structural model for manufacturing worker flows, over the 1991-1998 period, on Tables 7a and 7b trade measures but the exchange rate had no effect on hires. A 10% depreciation would lead to a 0,4% increase in hires. On the other hand, separations increase, on average, by 0,7% given a 1 percentage point increase in import penetration. The effect of trade related variables on turnover is very different than on job flows. Contrary to table 5, increasing imports, as well as higher tariffs and a devalued exchange rate, tend to increase worker turnover and churning. An appreciation of the *Real* would lead to a small "chill" in worker movements, as a 10% depreciation would lower turnover by 0,4 percentage points.

The effect of the exchange rate and tariffs on worker turnover and churning are at first view puzzling, as the estimates imply that more protection, either by a devalued exchange rate, or higher tariffs increase worker movements. An increase in turnover was also suggested by a decrease in protection by greater import penetration. A closer look on the tables reveals that the sign of the effects of the exchange rate, tariffs and import penetration are not symmetric for both hires and separations, although with different significance levels. An increase in protection does not have a symmetric effect on worker flows, contrary to job flows. For example, higher imports increase separations, but does not decrease hires. Thus the increase in turnover and churning under both higher and lower openness can be attributed to different reasons, either increases in hires or increases in separations.

On Table 7b, contrary to Table 5a, export shares movements do not affect any of the worker flow variables. The hiring and separation coefficients are of expected signs, but not significant. The import, tariff and exchange rate coefficients are noticeable stable, when comparing Table 7a and 7b, with a small decrease in tariff variables. Sector exchange rates have a greater impact than tariffs, althought possibly not significantly different.

In sum, in this section, the effect of international trade either through the exchange rate, or import penetration or export share, or tariff measures on job and worker flows in manufacturing employment were studied. The first exploratory analysis over 1992 to 2000, based on a differences-in-differences approach, looking at the 1999 devaluation as a natural

[18] We follow Gourinchas and take the sector exchange rate as exogenous, once aggregate dummies are included. Tariffs could be instrumented too, but there were no clear instruments to use.

experiment that affected differently traded (manufacturing) and non-traded (non-manufacturing) sectors suggests that the devaluation affected positively job creation, negatively job destruction and separations and positively net job growth, with no effect on reallocation or turnover measures. In a model with trade openness measures, but covering the 1992-1998 period, import penetration increases job destruction and separations and decreases net job growth. The exchange rate has an opposite effect, increasing job creation and hires and increasing net job growth. Lower tariffs have largely no effects, given the exchange rate and import measures, but to increase excess job reallocation. Worker turnover and churning seemed to be affected by both increasing and decreasing trade exposure. This is due to the asymmetric effects of trade variables on worker flow components.

5. Concluding comments

The goal of this study was to relate job and worker flows behavior with trade liberalization. Two main set of results can be gathered from the study. First, Job and worker flow magnitudes for Brazil seem to be on the upper end of the world figures. Job reallocation is not correlated with the business cycle, mainly due to the effect of businesses entry and exit on net flows. The absence of a negative relationship between job reallocation and the business cycle calls for further study as a large body of literature take the counter-cyclical reallocation result as stylized fact to be replicated. Worker flows figures are large, although not necessarily larger than other figures for sectors such as retail in another countries. Worker flows dynamics appear to be symmetric and of same magnitude, with higher separations and lower hires in downturns. This implies that turnover (and churning) are not related to the business cycle.

The second and more important set of results is the effect of trade liberalization. Over the 1990´s Brazil experienced a variety of macroeconomic conditions, during a process of trade and capital flow openness. Nevertheless, across the decade, yearly gross job and worker flow measures maintained similar levels suggesting that trade liberalization per se cannot be accredited with the high flows identified in this study. In addition, the effect of trade and exchange rate variables is differentiated by flow types. While a devaluation increase net job growth by increasing job creation, import penetration decreases job growth by increasing destruction. The magnitude of effect of the trade variables seems to be small, as a 10% change in them would lead to a less than 1% change in job flows. Job reallocation was not significantly related to the variables studied and tariffs affected only excess job reallocation. Thus trade variables appear to have an asymmetric effect on job flows.

Focusing on worker flows, the effect of trade variables appears to be asymmetric as well. A devaluation of the exchange rate increases hires but does not decrease separations; and more imports increase separations without reducing hires. The asymmetry implies that turnover and churning increases with higher or lower trade exposure from different sources (imports and tariffs and the exchange rate). In summary, trade variables have differentiated effects on labor rearrangement in the economy, as the effects on employment opportunities shuffling (job reallocation) and employee movements (worker turnover) are not the same.

As final comments, one should note that there is a dearth of studies of job and worker flows and trade in developing countries. International comparisons, would enrich the knowledge of worker and job flows. Last but not least, the international trade effects were studied with almost a two digit aggregation, given trade-employment data compatibility problems. A more disaggregated approach could give more confidence on the results obtained.

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Table 1: Job Flows For Brazil, 1991 - 2000

Years	POS	NEG	NET	SUM	EJR
1992	0.1533	0.1648	-0.0114	0.3181	0.3066
1993	0.1517	0.1284	0.0233	0.2801	0.2568
1994	0.1553	0.1397	0.0156	0.2949	0.2793
1995	0.1611	0.1694	-0.0083	0.3305	0.3223
1996	0.1519	0.1538	-0.0019	0.3057	0.3038
1997	0.1548	0.1520	0.0028	0.3069	0.3041
1998	0.1663	0.1444	0.0219	0.3108	0.2889
1999	0.1678	0.1516	0.0162	0.3195	0.3033
2000	0.1783	0.1338	0.0445	0.3121	0.2676
Average	**0.1601**	**0.1487**	**0.0114**	**0.3087**	**0.2925**
Correlation with NET	0.670*	-0.866*	---	-0.383	-0.815*
β_x	0,4937*	0,5063*	---	-0.0125	0,1172*
	(-0,0267)	(-0,0272)	---	(0.0545)	(0,0610)

Source: Authors calculation based on *RAIS* microdata.

Note: * - significant at 10%. $\beta_{\boldsymbol{x}}$ is the slope coefficient of a fixed effect LS regression of each variable on NET, using 25 sectors. Standard errors in parenthesis.

Table 2: Gross Worker Flows in Brazil, 1991-2000

Year	H	S	NET	T	CH
1992	0.3711	0.3883	-0.0173	0.7594	0.4413
1993	0.3905	0.3724	0.0181	0.7630	0.4828
1994	0.4235	0.4008	0.0228	0.8243	0.5294
1995	0.4665	0.4687	-0.0022	0.9352	0.6046
1996	0.4320	0.4180	0.0140	0.8500	0.5442
1997	0.4445	0.4160	0.0285	0.8605	0.5537
1998	0.4298	0.4090	0.0207	0.8388	0.5280
1999	0.4148	0.3857	0.0291	0.8005	0.4811
2000	0.4611	0.4042	0.0569	0.8653	0.5532
Average	0.4260	0.4070	0.0190	0.8330	0.5243
Correlation with NET	0.4921	-0.1994	---	0.1780	0.2728
β_x	0.4131*	-0.4553*	---	-0.0424	-0.0298
	(0.072)	(0.067)	---	(0.135)	(0.133)

Source: Authors calculation based on *RAIS* microdata.

Note: * - significant at 10%. $\mathbf{b}_{\boldsymbol{x}}$ is the slope coefficient of a fixed effect LS regression of each variable on NET, using 25 sectors. Standard errors in parenthesis.

Source: Authors calculation based on RAIS microdata.

Table 3 - Selected Economic Indicators - Brazil, 1990-2000

Year	GDP Growth	Unemployment Rate	Nominal Exchange Rate	Inflation Rate	Trade Balance*	Current Account Balance*
1990	-4,1	4,3	2,48E-05	2900,7	6986	-3823
1991	1,1	5,0	1,48E-04	410,6	6724	-1006
1992	-0,9	5,9	1,64E-03	965,2	11897	6089
1993	4,9	5,4	0,032	2477,2	8739	20
1994	5,9	5,1	0,639	916,5	5515	-1153
1995	4,2	4,6	0,918	22,4	-10652	-18136
1996	2,7	5,4	1,005	9,6	-13518	-23255
1997	3,3	5,7	1,078	5,2	-17394	-30448
1998	0,1	7,6	1,161	1,7	-16719	-33450
1999	0,8	7,6	1,815	8,9	-8261	-25420
2000	4,4	7,1	1,830	6,0	-8305	-24669

Source: ECLAC; *-in million US dollars

Figure 1 – Sector Nominal Import tariff distribution, Brazil, 1986-1999.

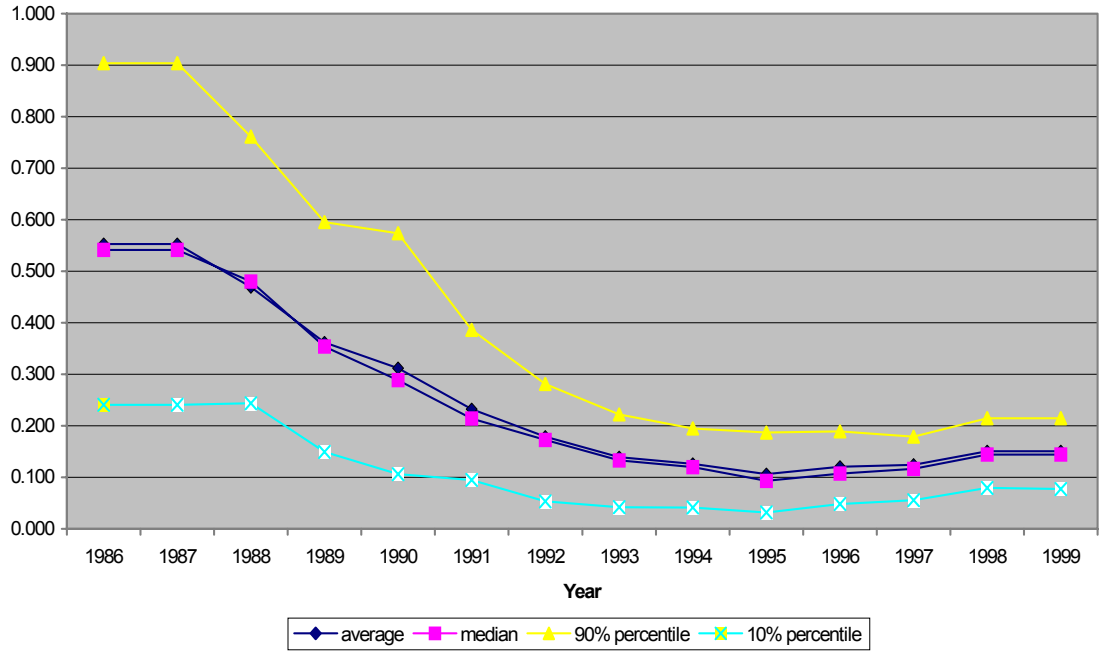

Figure 2 – Sector Import Penetration distribution, Brazil, 1986-1998.

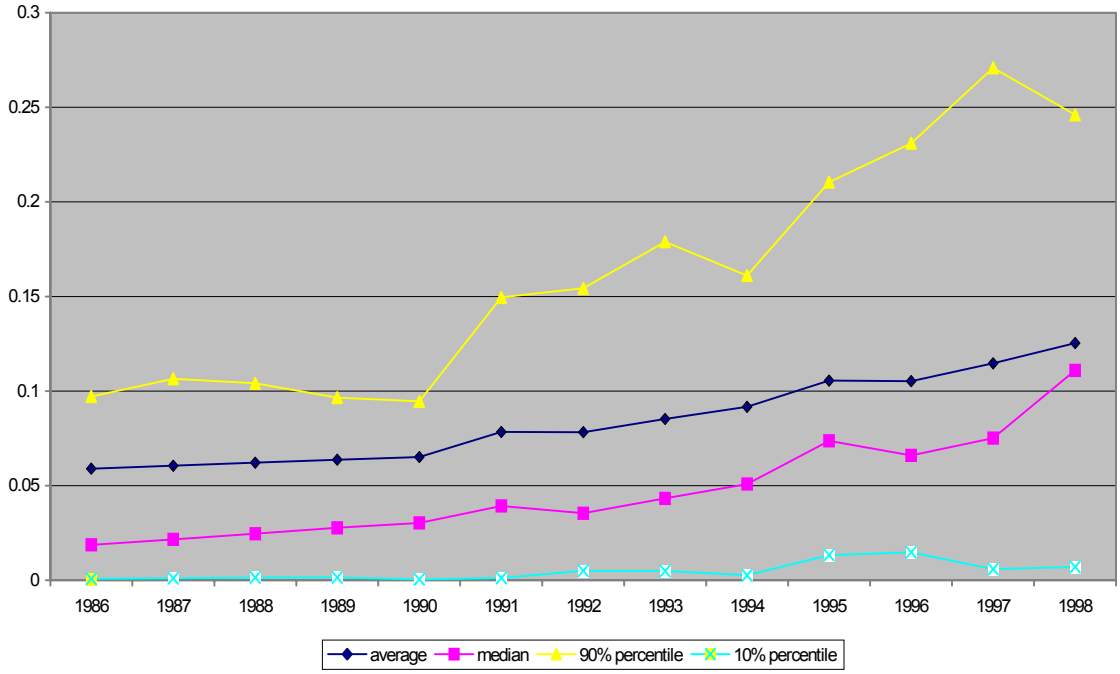

Table 4 – The effect of the 1999 devaluation on manufacturing job flows in Brazil, 1991-2000.

	POS	NEG	NET	SUM	EJR
Devaluation*Tradables	.0251*	-.0313*	.0563*	.0062	-.0053
	(.0093)	(.0095)	(.0143)	(.0123)	(.0139)
R^2	0.0662	0.0674	0.2125	0.0213	0.0297
F-test on 8 time dummies	4.00*	5.57*	5.41*	3.98*	4.03*
F-test on 24 sector dummies	27.34*	23.48*	3.60*	54.18*	38.34*

Note: *- indicates significant at 5%. Fixed Effects Regression of 225 (25x9) sector-year job flow measures with time dummies. *Devaluation* indicates 1999 and 2000 and *tradable*, sectors in manufacturing.

Table 5a: The effect of trade measures on manufacturing job flows in Brazil, 1991-1998.

	POS	NEG	NET	SUM	EJR
Import Penetration	-0.2568	0.3219	-0,5787*	0.0651	-0.4177
	(0,2013)	(0,2062)	(0,3098)	(0,2646)	(0,2804)
Tariffs	-0.0956	-0.1400	0.0444	-0.2356	-0.4685
	(0,1435)	(0,1470)	(0,2210)	(0,1887)	(0,2000)
Sector Exchange Rate	0,0164*	-0.0106	0,0270*	0.0058	0.0072
	(0,0090)	(0,0092)	(0,0138)	(0,0118)	(0,0125)
R2	0.2424	0.0859	0.2508	0.0269	0.0796
F-test	2,46*	3,96*	4,55*	1.42	2,82*

Note: **- indicates significant at 5%, *-indicates significant at 10% . Fixed Effects Regression of 90 (13x7) sector-year job flow measures, with year dummies. Import Penetration are sector imports divided by sector output. Output Tariffs are adjusted for the real exchange rate (US$/Real). The (log real) Sector Exchange Rate is measured in *Reals* by foreign currency; it is a weighted average of trade partner's exchange rate, weighted by imports by sector. See details in text.

Table 5b: The effect of trade measures on manufacturing job flows, Brazil 1991-1998.

	POS	NEG	NET	SUM	EJR
Effective Penetration	-0.3434	0,6274**	-0,9709**	0.2840	-0.3554
	(0,2530)	(0,2496)	(0,3790)	(0,3300)	(0,3546)
Export Share	0.1073	-0,3349**	0,4421*	-0.2276	-0.1048
	(0,1675)	(0,1653)	(0,2510)	(0,2185)	(0,2348)
Tariffs	-0.0953	-0.1037	0.0084	-0.1990	-0,4316
	(0,1432)	(0,1412)	(0,2145)	(0,1868)	(0,2007)
Sector Exchange Rate	0,0166*	-0.0119	0,0285**	0.0048	0.0062
	(0,0091)	(0,0089)	(0,0136)	(0,0118)	(0,0127)
R2	0.2656	0.0219	0.1947	0.0046	0.0562
F-test	2,23*	4,36*	4,68*	1.42	2,43*

Note: **- indicates significant at 5%, *-indicates significant at 10% . Fixed Effects Regression of 90 (13x7) sector-year job flow measures, with year dummies. Effective Penetration is imports divided by domestic absorption. Output Tariffs are adjusted for the real exchange rate (US$/Real). The (log real) Sector Exchange Rate is measured in *Reals* by foreign currency; it is a weighted average of trade partner's exchange rate, weighted by imports by sector. See details in text.

Table 6 – The effect of the 1999 devaluation on manufacturing worker flows, Brazil, 1991-2000.

	H	S	T	CH
Devaluation*Tradeables	0.0107	-0.0373*	-0.0266	-0.0204
	(0.0145)	(0.0131)	(0.0244)	(0.0257)
R^2	0.0184	0.0252	0.0180	0.0207
F-test on 8 time dummies	16.48*	19.09*	19.85*	14.14*
F-test on 24 sector dummies	287.2*	309.88*	372.18*	232.43*

Note: *- indicates significant at 5%. Fixed Effects Regression of 225 (25x9) sector-year job flow measures, with year dummies. *Devaluation* indicates 1999 and 2000 and *tradeable*, sectors in manufacturing.

Table 7a: The effect of trade measures on manufacturing worker flows in Brazil, 1991-1998

	H	S	T	CH
Import Penetration	0.1496	0.6807*	0.8304*	0.7653*
	(0.1932)	(0.2069)	(0.3098)	(0.3586)
Tariffs	0.2087	0.2213	0.4301*	0.6657*
	(0.1378)	(0.1470)	(0.2016)	(0.2557)
Sector Exchange Rate	0.0394*	0.0095	0.0489*	0.0431*
	(0.0086)	(0.0092)	(0.0126)	(0.0160)
R2	0.0452	0.0128	0.0029	0.0283
F-test	15.37*	18.14*	28.02*	15.45*

Note: *- indicates significant at 5%. Fixed Effects Regression of 90 (13x7) sector-year job flow measures, with year dummies. Import Penetration are sector imports divided by sector output. Tariffs are adjusted for the real exchange rate (US$/Real). The Sector Exchange Rate is measured in Reals by Foreign currency; it is a weighted average of trade partner's exchange rate, weighted by imports by sector.

Table 7b: The effect of trade measures on manufacturing worker flows in Brazil, 1991-1998

	H	S	T	CH
Effective Penetration	-0.0293	0.9101**	0.8808**	0.5968
	(0.2424)	(0.2570)	(0.3621)	(0.4584)
Export Share	0.1706	-0.2681	-0.0975	0.1300
	(0.1605)	(0.1702)	(0.2398)	(0.3036)
Tariffs	0.1659	0.2208	.03867*	0.05858*
	(0.1371)	(0.1455)	(0.2049)	(0.2594)
Sector Exchange Rate	0.0404**	0.0090	0.0496**	0.0448**
	(0.0087)	(0.0092)	(0.0129)	(0.0164)
R2	0.1473	0.0318	0.0010	0.0020
F-test	13.80*	16.73*	23.81*	13.11*

Note: **- indicates significant at 5%, *-indicates significant at 10% . Fixed Effects Regression of 90 (13x7) sector-year job flow measures, with year dummies. Effective Penetration is imports divided by domestic absorption. Tariffs are adjusted for the real exchange rate (US$/Real). The Sector Exchange Rate is measured in Reals by Foreign currency; it is a weighted average of trade partners exchange rate, weighted by imports by sector.