Labor Reallocation in Response to Trade Reform*

Naércio Aquino Menezes Filho‡
Universidade de São Paulo

Marc-Andreas Muendler¶
University of California, San Diego and CESifo

June 27, 2005
Preliminary and incomplete first draft.
Please do not quote without authors' permission.

Abstract

This paper investigates the impact of trade reform on labor reallocation using a rich matched data set for individual employers and employees in Brazil over nine years following a large-scale trade liberalization. The sector affiliation of high- and low-turnover workers is found to be non-random so that worker characteristics matter crucially for trade-related covariates of hiring, displacement and transition probabilities. Higher foreign import penetration and reduced product market tariffs significantly depress hiring rates at formal-sector manufacturing firms, significantly raise displacement rates, and significantly raise the likelihood of a worker's transition into informal work status. However, manufacturing sectors with higher degrees of comparative advantage and high-productivity firms fail to absorb workers after trade-induced job losses for extended periods of time. JEL F14, J23, J63

*We thank Paulo Furtado and the Brazilian ministry of labor for invaluable assistance with the *RAIS* worker data, and Alexandre Brandão and Aline Visconti at IBGE for tabulations of the *PIA* firm data. We are grateful to Jennifer Poole for excellent research assistance.

‡naerciof@usp.br (*www.econ.fea.usp.edu/naercio*)

¶muendler@ucsd.edu (*econ.ucsd.edu/muendler*), corresponding author. Ph: +1 (858) 534-4799.

1 Introduction

The success of trade reforms and the realization of gains from trade crucially depend on factor reallocations to sectors with a comparative advantage and, within sectors, to high-productivity firms. This paper uses a rich matched employer-employee data set for all sectors of the Brazilian economy to trace individual workers and their employers for nine years after Brazil's trade reform in 1990 in order to assess the workings of the reallocation process.

The impact of trade reform on factor reallocation is an unresolved issue. Among the earlier studies to examine the effects of trade liberalization on employment, Revenga (1992, 1997) find that import competition reduces net employment at the sector level in the U.S. and Mexico. Meanwhile, a large part of the literature adopts the Davis, Haltiwanger and Schuh (1996) approach of generating gross job flow statistics by sector and year and regressing those statistics on measures of trade exposure and exchange rates. Roberts (1996), for instance, does not report any pervasive effect of trade exposure on gross employment flows in Chile and Colombia, once sector characteristics are taken into account. Neither do Davis et al. (1996) identify a clear effect of trade on factor reallocation using U.S. data.

However, studies that consider exchange rate effects beyond trade exposure, such as Klein, Schuh and Triest (2003) or Gourinchas (1999), do find systematic effects on employment flows. Klein et al. (2003), for instance, suggest that for the U.S., job destruction, job reallocation and net employment growth respond to exchange rate movements, while job creation is unresponsive. In the Brazilian case, Ribeiro, Corseuil, Santos, Furtado, Amorim, Servo and Souza (2004) compute industry-level rates of job creation and destruction to find that greater openness reduces jobs through increased job destruction, with no effects on job creation, and that exchange rate depreciation increases job creation with no effect on job destruction. Recently, Haltiwanger, Kugler, Kugler, Micco and Pagés (2004) use a panel of sectors in six Latin American countries to find that a reduction in tariffs and exchange rate appreciations increase job reallocation within sectors and that net employment growth tends to decline as trade exposure rises.

To assess transitions from and into informality, Goldberg and Pavcnik (2003) use a two-step methodology: they first regress informality status on industry indicators using individual worker data, controlling for individual-specific characteristics, and then regress time-varying industry coefficients for informality on trade and industry indicators in the second stage. They find that tariff declines are not associated with increases in the probability of informal work status in Brazil. However, in Colombia, where labor markets seem to be more rigid, they find a negative association between tariffs and informality for the period preceding labor market reform.

Sector-level statistics of net employment changes and net job creation rates in these studies are suggestive of reallocation flows of workers across firms and sectors but do not capture them directly. Sector-level data cannot follow workers over time

and fail to control for worker-specific effects so that a changing employment composition (in terms of observable and unobservable worker characteristics) within sectors may result in a biased picture in several studies. Our estimates indicate that individual worker effects play a crucial role in the reallocation process. Only when we control for worker characteristics and worker-fixed effects in displacements and hires do sector-level covariates such as foreign trade exposure significantly matter for displacement and hiring likelihoods. There seem to be high-turnover and low-turnover workers whose sector affiliation is not random.

Sector-level turnover and net job creation statistics can be misleading statistics for the quality of the adjustment process if the reallocation process involves several job transitions instead of direct moves to the ultimate absorbing sector. In fact, we find that around half of all displaced manufacturing workers move to the services sector. Only about a third of the displaced manufacturing workers move to other manufacturing firms within their sectors, or to employers in tradable goods sectors with a comparative advantage. In the case of informality, for instance, if workers switch sectors besides moving to informality as a result of trade reforms, then studies that use sector-level data likely underestimate the impact on informality.

Most of the existing literature focuses on the sectoral exposure to foreign competition, typically using tariffs, import penetration and real exchange rate as covariates. While these regressions detect the differential response of net job creation to varying degrees of foreign competition, they remain only suggestive of the desired reallocation process according to sectoral comparative advantage and firm-level productivity. Controlling for rehiring firms' and sectors' characteristics appears to be essential for an assessment of the quality of the reallocation process. The Brazilian evidence indicates that the desired reallocation process is slow at best. Neither productive firms nor sectors with comparative advantage seem to succeed in absorbing displaced workers over a period of nine years following trade reform, resulting in a massive drop in manufacturing employment that can be partly related to trade reform.

The empirical literature on the effects of trade liberalization on several other economic outcomes is large. Various papers use firm-level data to examine the impact of trade liberalization on productivity growth and generally find induced productivity improvements (Pavcnik 2002, Ferreira and Rossi 2003, Muendler 2004b). Another set of papers examines the impact of trade reform on wage inequality, with the results depending on the relationship between initial tariffs and skill intensity (Hanson and Harrison 1999, Beyer, Rojas and Vergara 1999, Robertson 2004, Gonzaga, Menezes Filho and Terra 2004). Some papers investigate the effect of displacement on workers' subsequent earnings (see, for instance, Kaplan, González and Robertson (2005) for Mexico and Menezes Filho (2004) for Brazil). These studies use Jacobson, LaLonde and Sullivan's (1993) methodology and data sets similar to the one constructed here to compare the wages of displaced workers with those of workers that remain in the same firm, and find significant displacement effects on wage levels, even after a few years. These papers, however, are not directly concerned with the effects of trade

liberalization.

To our knowledge this is one of the first papers, if not the first, that aims at a comprehensive picture of the effects of trade liberalization on labor reallocation using individual employee and employer data by assessing displacement, hiring and re-hiring probabilities, and the transitions to informality, self-employment and unemployment. We restrict attention to prime age male workers in São Paulo state, where more than half of value added in Brazilian manufacturing originates.

We find that higher foreign import penetration and reduced product market tariffs significantly depress hiring rates at formal-sector manufacturing firms, significantly raise displacement rates, and significantly raise the likelihood of a worker's transition into informal work status. However, manufacturing sectors with higher degrees of comparative advantage appear to be little permeable for labor reallocations. About half of all displaced formal manufacturing workers who find re-employment within a year are reallocated to the formal services sector and, if reallocated to manufacturing, most frequently move to sectors with neither a strong comparative advantage nor a strong disadvantage.

Logit estimates of hires, displacements, and work status transitions corroborate that trade-induced net workforce reductions neither result in labor reallocations to sectors with comparative advantage nor to moves to more competitive firms. In sectors with a revealed comparative advantage, both hiring and displacement probabilities are significantly reduced the higher the comparative advantage of the employing sector. Similarly, more productive firms also show less labor turnover as both hiring and displacement rates are significantly lower the higher the productivity of the employing firm. The resulting ambiguity of net hiring rates in comparative-advantage sectors and at high-productivity firms predicts that these sectors and firms likely fail to absorb displaced workers after trade reform to a sufficient degree—contrary to the implications of standard trade theory and contrary to implications of trade models with firm heterogeneity.

The paper proceeds as follows. We discuss our main data sources *RAIS* (for worker and establishment information), *PIA* (for firm-level information), and *PME* (for household-level information on work status beyond formal employment) in Section 2. Details are relegated to the Appendix. Section 3 briefly summarizes Brazil's trade liberalization programme and labor-market related measures of trade exposure. Section 4 presents descriptive statistics of the labor reallocation process in São Paulo state during the 1990s. We investigate determinants of labor turnover in Section 5 and determinants of the labor reallocation process across sectors and work status in Section 6. Section 7 draws first conclusions from this draft of the paper.

2 Data

We base our main analysis on annual records of individual workers and their jobs in São Paulo state's formal manufacturing sector, and these workers' transitions to other sectors or a different work status. The worker data provide information on demographic characteristics, occupations and plant tenure, along with establishment ID codes for the employing plants and firms. From a separate firm-level data set we obtain information on manufacturing firms and numerous firm-level characteristics. Identical firm ID codes in the worker and firm data sets make it possible to match the observations. Finally, we use complementary worker-level information for São Paulo city from a metropolitan household survey that also covers information on informal employment. We discuss main features of our worker and firm data here but relegate some details and a discussion of accompanying sector-level data to the Appendix.

Worker data. Our individual worker data derive from the labor force census *RAIS* (*Relação Anual de Informações Sociais* of the Brazilian labor ministry *MTE*), which is a comprehensive annual census of workers formally employed in any sector (agriculture, commerce, construction, manufacturing, utilities, services; our version of *RAIS* excludes the public sector). We restrict our core worker sample to prime age workers (at least 18 years and at most 49 years of age) with a proper 11-digit worker ID (*PIS*) and a single job at a medium-sized to large manufacturing firm in São Paulo state (for which we have firm-level information) between 1990 and 1998. We trace these 2.36 million (2,355,828) workers to their prior and past formal-sector employments at manufacturing firms or firms in any other private sector in São Paulo state.

The basic unit of observation in our version of *RAIS* is the filled job. We have no information on vacancies. Every observation is jointly and uniquely identified by the following five variables: (i) the worker ID (*PIS*), (ii) the firm ID (*CNPJ*), (iii) the establishment ID within the firm, (iv) the month of hiring, (v) the month of separation. Within a given year, the month of hiring and the month of separation are sufficient for identification of the filled job since either variable takes a missing value if hiring occurred in a prior year or if a separation is yet to occur in a future year.

For employment information and the extraction of our initial sample we use filled jobs on December 31st of any year. For information on displacements and hires of individual workers, we use the first observed displacement in a given year and the last observed hire of an individual worker in given year if a worker holds more than one job in that year. For information on rehiring subsequent to displacements, we use the first observed rehire of an individual worker in the year of displacement or any subsequent year. In the case of simultaneous employments, separations, hires, or rehires, we use the respective filled job with the highest wage.

In the available version of *RAIS*, workers' ages are reported in terms of eight age ranges. For regression analysis, we construct a proxy for potential labor force

experience from the nine education categories and the mean age within a worker's age range. For example, a typical Early Career worker (34.5 years of age) who is also a Middle School Dropout (left school at 11 years of age) is assigned 23.5 years of potential labor force experience. Our education variable regroups the nine education categories included in *RAIS* to correspond to five typically considered categories. Appendix A provides further details on the construction of our education and experience variables.

Occupational classifications in *RAIS* follow the *CBO* (*Classificação Brasileira de Ocupações*). To make this system comparable to standard international classifications, we mapped the *CBO* for 1994 to the commonly-used *ISCO-88* (*International Standard Classification of Occupations*, Muendler, Poole, Ramey and Wajnberg (2004)). The *ISCO-88* reclassifications are in turn mapped into five broad occupational categories (professional and managerial, technical and supervisory, other white collar, skill-intensive blue collar, and other blue collar).[1]

Firm data. For the firm-level data, we use the firm survey *PIA* (*Pesquisa Industrial Anual* from *IBGE*, the Brazilian census bureau) for 1986 through 1998. The data form a representative sample of all but the smallest manufacturing firms in São Paulo state. *PIA* includes a wide range of input, output and profitability measures. We obtain log total factor productivity (TFP) measures for every firm from Muendler (2004a). The TFP measures subtract weighted averages of log inputs from log outputs and therefore reflect both quality-related price markups beyond competitor prices as well as individual firm efficiency.

IBGE's publication rules allow data from *PIA* to be withdrawn in the form of tabulations of cells having at least three firms. We construct firm groups using three-firm random combinations drawn from within each *Nível 50* sector, headquarter location (metropolitan São Paulo city or rural), and possible sequence of consecutive calendar years. The *Nível 50* sectors consist of 31 manufacturing sectors, corresponding roughly to the two-digit *SIC* sectors in the U.S. (see Appendix B for a list). We assign a *PIA* firm to one and only one group observation. A single four- or five-firm group is defined within a sector-years-location cell when the number of firms in the sector-years-location cell is not divisible by three. For each three-to-five-firm group observation, we calculate the number of firms as well as the sum, mean, and standard deviation of the relevant *PIA* variables. While the observations are aggregated, we retain the firm identifiers behind each newly-created composite observation, permitting the matching of *RAIS* workers to the composite observations. This procedure yields 11,985 annual three-to-five-firm group observations for up to eight years, covering

[1]Brazil's *CBO-94* generally provides classifications at a finer level of detail than does *ISCO-88*. The level of detail in the Brazilian system permits the reclassifications needed for transforming the more profession-based Brazilian classifications into the more skill-based international classifications. For a small number of 1990 observations, *RAIS* includes *CBO* codes that are not used in *CBO-94*. We set these to "Other" within the relevant subcategory.

7,670 *PIA* firms in São Paulo state. Muendler (2003) provides a detailed description of the data source and discusses the time-consistent preparation of firm panels.

Complementary household survey data. The Brazilian metropolitan Monthly Employment Survey *PME* (*Pesquisa Mensal de Emprego*, from *IBGE*) provides complementary information on informal employment. We relegate a discussion of *PME* work status definitions, and a comparison of variable definitions with *RAIS*, to Appendix A.

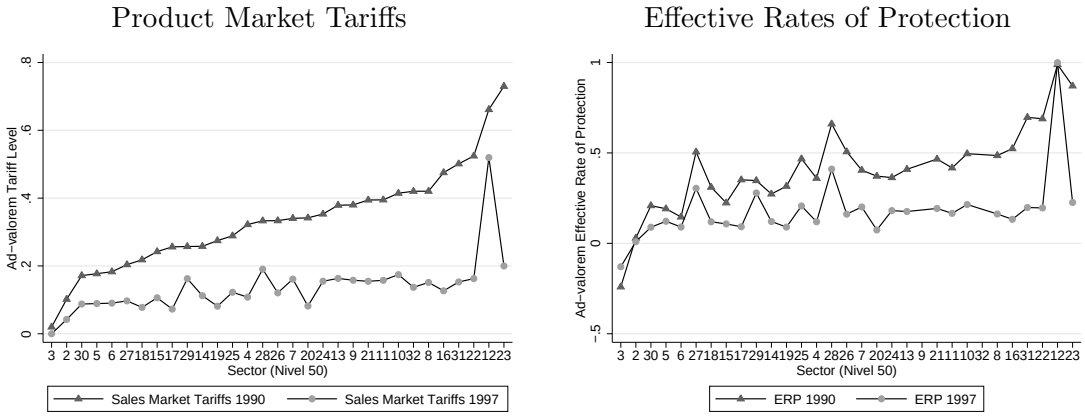
PME data derive from a probabilistic sample of households in six metropolitan regions. *IBGE* collects *PME* data from a rotating panel and follows households for a total period of 16 months, with an eight-month interval after the fourth interview.[2] Because of changes to the sample design that affect worker panels starting in odd years, we use only individuals whose first survey occurred in the even years 1986, 1988, 1990, 1992, 1994, 1996 or 1998. In the present draft, we do not restrict our sample to São Paulo city or prime age male workers but keep approximately 38,500 household observations from São Paulo, Rio de Janeiro, Belo Horizonte, Porto Alegre, Salvador and Recife for all ages and both genders to increase sample size. We only trace changes in the work status between the 4th and the 8th interviews for each household member in order to control for an individual's work status reports during the three months prior to the 4th interview.

3 Trade Reform and Comparative Advantage

In the late 1980s, after decades of import substitution and industry protection, the Brazilian federal government under president Sarney initiated an internal planning process for trade reform but, lacking popular support, took little legislative initiative. Among several competing proposals, a reform plan (authored by a group of economists at Pontifical Catholic University Rio de Janeiro for the planning ministry) proposed the complete elimination of non-tariff barriers and the gradual reduction of tariffs in order to force Brazilian manufacturers to modernize under foreign competition. In 1990, the newly elected president Collor de Melo adopted this reform plan, issued a presidential directive to eliminate non-tariff barriers and special import regimes on his first day in office, and presented a detailed schedule for tariff reductions to be completed by 1994.

Tariffs on equipment not produced in Brazil, for instance, were immediately reduced to zero and non-tariff barriers were eliminated. Tariffs for information technology, however, remained at 40 percent in order to protect Brazil's fledgling computer industry. The government's declared objectives for dismantling trade barriers were first to instill competition in inefficient sectors and second to discipline concentrated

[2]Denoting months with m, individuals within households are surveyed at m, $m+1$, $m+2$, $m+3$, $m+12$, $m+13$, $m+14$, $m+15$ for a total of eight interviews over this 16-months period.



Source: Own calculations based on nominal tariff series from Kume, Piani and Souza (2000) and economy-wide input-output matrices (*IBGE*). Sectors at *Nível 50* ranked by their 1990 product market tariff (for sector definitions see Table 9 in the Appendix).

Figure 1: **Manufacturing Tariffs and Effective Rates of Protection**

industries in their pricing power so that hyper-inflation could be fought more effectively. As a consequence, and contrary to common political-economy outcomes, mostly sectors with sluggish efficiency performance were targeted with low tariffs. The liberalization programme was concluded in less than three years by July 1993. This speed and the far reaching removal of non-tariff barriers shocked the domestic manufacturing sector considerably, and resulted in significant productivity increases among firms (Muendler 2004b). When president Cardoso took office in 1995, however, liberalization efforts were partly reversed in select sectors, leading to renewed tariff dispersion under the Southern Cone (*Mercosur*) trade agreement.

Figure 1 depicts product market tariffs by manufacturing sector for the years 1990 and 1997 in the left-hand-side graph, and contrasts the measures with effective rates of protection in the right-hand-side graph. The tariff schedule exhibits a considerably lower and more uniform ad-valorem level mostly between 10 and 15 percent in 1997 than its steeper and more elevated counterpart in 1990—with the notable exception of the automobile sector (12).

Effective rates of protection, however, provide a more adequate picture of the competitive effect of trade reform since effective rates of protection control for both the competition-inducing effects of lower product tariffs and the competition-alleviating effects of lower input tariffs. In fact, effective rates of protection decline much less than product tariffs in most sectors. The reason is that import tariffs drop faster between 1990 and 1997 for most sectors than do product tariffs so that the effective rate of protection does not fall as fast as product tariffs. At the low extreme, however, the mining sector (2) suffers a negative effective rate of protection by 1997 because for that sector product tariffs drop faster than tariffs on its imported inputs. To

Table 1: Revealed Comparative Advantage and Tariff Correlations

$RADV_{i,t}$	Sector FE		OLS	
	1986-98	1990-98	1986-98	1990-98
	(1)	(2)	(3)	(4)
Product Market Tariff	.052	.234	.485	.504
	(.059)	(.076)***	(.125)***	(.140)***
Sectoral Intermediate Input Tariff	-.015	-.085	-.603	-1.343
	(.059)	(.124)	(.156)***	(.231)***
Constant (mean FE for FE regressions)	.978	.975	1.048	1.070
	(.037)***	(.034)***	(.056)***	(.036)***
Observations	387	267	387	267
R^2 (within for FE regressions)	.005	.055	.042	.116
p-value: Joint test for nonzero year indicators	1.000	.809	1.000	.875

Sources: Revealed comparative advantage and *ad-valorem* tariff measures based on economy-wide input-output matrices and national accounting data from Ramos and Zonenschain (2000), and on nominal product tariff data from Kume et al. (2000). Controlling for year effects (only joint χ^2 test statistic reported). Standard errors in parentheses: * significance at ten, ** five, *** one percent.

control for the important opposite effects of import and product tariffs, we include both import and product tariff measures in subsequent regression analysis.

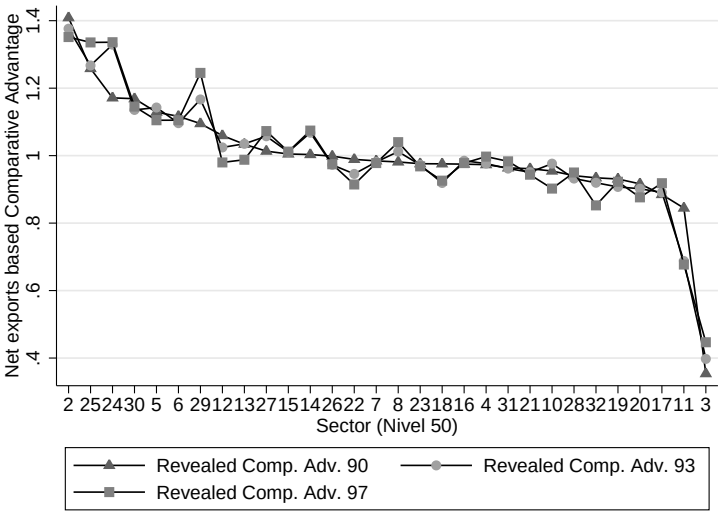
Trade theory predicts that the reduction of trade barriers induces factor reallocations from sectors with comparative *dis*advantage to sectors with comparative advantage. Controlling for potentially dampening effects of monetary exchange rate conditions, Brazil's trade reform should induce this factor reallocation. We measure *revealed comparative advantage* based on net exports of sector i in year t with

$$RADV_{i,t} \equiv 1 + \frac{X_{i,t} - M_{i,t}}{Y_{i,t}}, \tag{1}$$

where $M_{i,t}$ are imports, $X_{i,t}$ are exports and $Y_{i,t}$ is output. $RADV_{i,t}$ is the highest in sectors where Brazil has the strongest revealed comparative advantage. The standardization by output removes sector-size effects from the time series.[3]

Our interpretation of the relative net exports statistic $RADV_{i,t}$ as a measure of comparative advantage is especially adequate if the net exports pattern remains relatively stable over time. Indeed, regressions of $RADV_{i,t}$ on tariff measures, year indicators and sector indicators show that $RADV_{i,t}$ is highly sector specific, unrelated to input tariffs, and time-invariant (columns 1 and 2 in Table 1). Year indicators are neither individually nor even jointly significantly different from zero. However,

[3]The lack of a producer price index series for Brazil renders the construction of comparative advantage measures based on international price differences impossible. In fact, we found wholesale price based comparative advantage measures to be negatively correlated with net exports over the sample period. Lacking autarky cost measures for Brazil and its trading partners, one could also view the revealed net export pattern as an approximation to the underlying trade-inducing productivity or factor endowment differences between Brazil and its trading partners.



Sources: Own calculations based on International Financial Statistics (IMF) and national accounting data from Ramos and Zonenschain (2000) (*IBGE*). Estimates of revealed comparative advantage fixed effects (FE) from a sector-fixed effects regression on output tariffs, input tariffs and year indicators (Table 1, column 2). Sectors at *Nível 50* ranked by the revealed comparative advantage FE (for sector definitions see Table 9 in the Appendix).

Figure 2: **Revealed Comparative Advantage**

product market tariffs reduce sectoral import volumes. Consequently, product market tariffs are significantly positively correlated with sectoral net exports and thus positively related to our net-export-based comparative advantage measure during the 1990s (but not over the entire period 1986-98).

Figure 2 ranks sectors by sector-fixed estimates of comparative advantage and depicts revealed comparative advantage measures for 1990 and 1997 alongside. The sector-fixed effects are predictions from an according fixed effects regression of revealed comparative advantage on product tariffs, input tariffs, and year indicator variables—as reported in column 2 of Table 1. Figure 2 confirms that Brazil's sectors of revealed comparative advantage—measured by their relative net exports $RADV_{i,t} \equiv 1+(X_{i,t}-M_{i,t})/Y_{i,t}$—remain largely the same over the period 1990 through 1997. While some outlier sectors such as Automobiles (12) worsen their net exports position and other sectors such as Footwear (24) and Sugar Manufacturing (29) improve, the overall sector ranking by comparative advantage stays largely unaltered. The correlation coefficients for revealed comparative advantage measures over time are .92 between 1990 and 1993, .87 between 1990 and 1997, and .97 between 1993 and 1997. Accordingly, the ranking of sectors by their (time-invariant) sector-fixed comparative advantage estimates is very similar to rankings for individual years. So, the patterns of trade and comparative advantage appear to have remained very sim-

Table 2: Job Allocation Across Sectors and By Formality

	Agricult.	Commerce	Manufact.	Services	*Total*
	(1)	(2)	(3)	(4)	(5)
	Formal job allocation across sectors (*RAIS*)				
1990	.018	.151	.398	.433	1.000
1997	.041	.171	.288	.500	1.000
	Share of informal jobs (*PNAD*)				
1990	.605	.444	.220	.543	.415
1997	.429	.492	.352	.518	.457

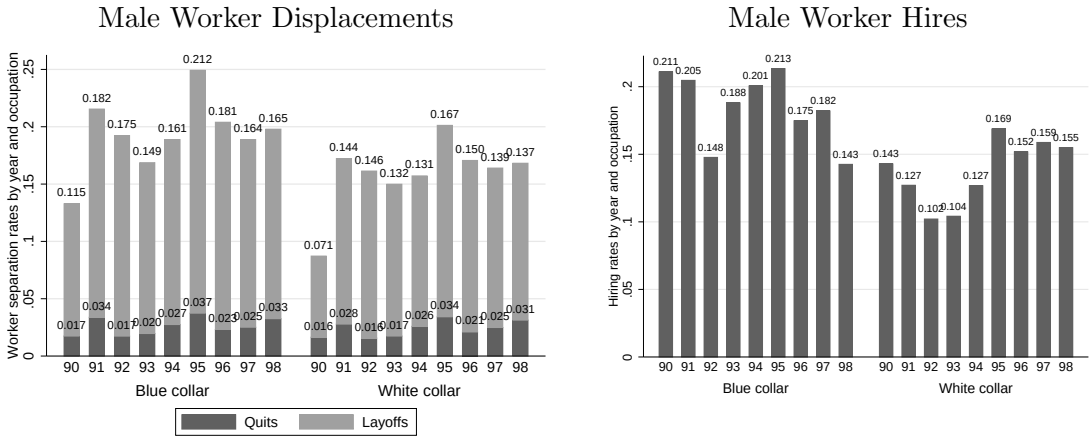
Source: Own calculations based on *RAIS* and *PNAD* for São Paulo state, 1990 and 1997.

ilar over time. This provides a stable setting to assess factor reallocation due to comparative advantage.

4 Descriptive Labor Market Evidence

Formal manufacturing employment in Brazil fell strongly over the course of the 1990s, while both informal employment in manufacturing and the service sector expanded. As Table 2 shows for São Paulo state, the employment share of the manufacturing sector dropped from .40 to .29 between 1990 and 1997 while the share of services employment increased from .43 to .49. Simultaneously, the share of informal jobs increased from .22 to .35 in the manufacturing sector. However, labor reallocations across manufacturing sectors are less pronounced. This suggests that the emergence of a specialization pattern according to comparative advantage suffers a considerable delay.

PME household data show that almost 90% of workers in the manufacturing sector had a formal job in the early 1980s, but that this share declined continuously since 1990, when trade reforms started. Interestingly, the share of formal sector workers also declined substantially in construction and agriculture. Since Brazilian construction services are largely non-traded and agricultural tariffs remained unchanged, this fact suggests that trade liberalization is not the only factor behind the expansion of informal employment. The new Brazilian constitution from 1988, for instance, introduced a series of changes to labor market legislation. The added rigidity to formal employment may play a partial role in the decline of formal employment across sectors.



Source: Male workers in *RAIS* (São Paulo state) with December 31st employment at a *PIA* firm in at least one year between 1990 and 1998. Displacements from and hires at *PIA* firms.

Figure 3: **Male Worker Displacements and Hires in Manufacturing**

Displacements and hires. Labor turnover in Brazilian manufacturing is substantial during the 1990s. As Figure 3 shows, up to one in every five workers can be displaced within a given year (displacements per filled jobs beginning-of-year). By far most displacements are layoffs; quit rates seldom exceed three percent. Hiring rates (hires per filled jobs end-of-year) attain similar magnitudes as displacements on average but exceed displacement rates in the early 1990s and fall short of displacement rates in the late 1990s. Blue-collar workers experience both more frequent displacements and more frequent hirings than their white-collar co-workers. While displacement rates increase until the mid 1990s, hiring rates drop over the same period. In 1995, as manufacturing firms undergo restructuring with the successful elimination of hyper-inflation in August 1994 and incipient exchange rate overvaluation, both displacement and hiring rates reach their peaks. They level off again subsequently.

Table 3 decomposes the aggregate displacement and hiring rates at *PIA* firms and provides comparisons by sector characteristics, firm performance and worker demographics for the years 1990, 1994 and 1997.

Varying degrees of comparative advantage are associated with different net hiring rates (hiring rates per filled job beginning-of-year less displacement rates per filled job end-of-year). In 1990, the prevalent picture of the later years emerges already: Both sectors in the low quintiles with a comparative *dis*advantage relative to Brazil's trading partners and sectors in the high quintiles with a comparative advantage show lower net hiring rates. By 1994, intermediate sectors with neither a strong comparative disadvantage nor a strong comparative advantage keep adding to their workforces, whereas sectors at either extreme (with a strong comparative disadvan-

Table 3: Male Worker Displacements and Hires in Manufacturing

(in %)	1990			1994			1997		
	Displ.	Hire	*Net*	Displ.	Hire	*Net*	Displ.	Hire	*Net*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Sector: Revealed Comparative Advantage Quintile[a]									
1st quintile	9.7	16.7	7.0	16.1	15.1	-1.0	23.3	15.7	-7.6
2nd quintile	13.3	23.3	10.0	14.8	14.9	.1	23.0	18.5	-4.5
3rd quintile	14.8	22.6	7.8	21.9	23.1	1.2	19.4	17.6	-1.8
4th quintile	10.2	16.3	6.2	15.2	16.2	1.0	20.8	18.4	-2.4
5th quintile	12.7	17.1	4.4	24.6	19.4	-5.3	32.5	18.1	-14.4
Sector: Product Market Tariff									
Below 10%	21.8	33.9	12.1	19.2	15.8	-3.4	20.5	17.3	-3.2
10% to 20%	11.0	13.6	2.6	19.0	19.9	.9	24.2	18.9	-5.3
20% to 30%	12.9	19.6	6.7	16.3	12.8	-3.5	32.1	24.1	-8.0
30% or more	11.9	19.2	7.3	5.8	4.0	-1.8	6.2	4.5	-1.6
Firms: Total Factor Productivity Quintile[b]									
1st quintile	14.3	22.0	7.7	21.6	19.5	-2.1	22.5	17.4	-5.1
2nd quintile	10.9	16.5	5.6	15.4	14.8	-.5	18.9	16.0	-2.9
3rd quintile	13.3	17.3	4.1	15.7	15.3	-.4	15.8	14.5	-1.3
4th quintile	12.7	20.8	8.1	18.3	18.4	.1	26.4	17.1	-9.3
5th quintile	10.6	16.1	5.5	20.0	15.2	-4.8	27.9	20.2	-7.7
Workers: Occupation									
Prof'l. or Managerial	7.6	10.0	2.4	15.8	9.9	-5.9	20.3	13.6	-6.7
Technical or Superv.	9.8	14.1	4.3	16.3	13.3	-3.0	21.3	16.4	-5.0
Unskilled White Collar	10.7	18.5	7.7	19.6	14.7	-5.0	24.1	17.6	-6.5
Skilled Blue Collar	12.8	17.8	5.0	19.1	18.2	-1.0	23.0	16.4	-6.6
Unskilled Blue Collar	12.0	25.6	13.5	21.8	33.3	11.5	27.7	30.2	2.5
Workers: Education									
Complete College	7.2	17.6	10.4	16.4	15.1	-1.3	20.9	20.3	-.5
Some College	8.4	20.7	12.3	19.6	16.5	-3.2	23.1	21.1	-2.1
High School	12.4	27.3	14.9	21.9	22.7	.8	28.1	16.0	-12.2
Middle School or less	10.9	23.8	12.9	20.9	19.6	-1.3	27.0	16.9	-10.0
Workers: Age Range									
18-24	18.8	34.8	16.0	24.1	37.1	13.0	25.4	34.5	9.0
25-29	14.5	20.3	5.8	20.9	20.2	-.7	24.8	21.2	-3.6
30-39	10.4	13.1	2.7	17.1	13.4	-3.7	21.4	14.6	-6.9
40-49	6.1	8.6	2.5	15.7	8.9	-6.8	22.0	9.1	-12.9
50-64	11.2	11.1	-.1	20.2	3.9	-16.2	26.4	5.1	-21.3

[a]Revealed comparative advantage quintile (5: strongest advantage) in a given year.

[b]Total factor productivity quintile (5: highest TFP) in a given year.

Source: Male workers in *RAIS* (São Paulo state) with December 31st employment at a *PIA* firm in at least one year between 1990 and 1998. Displacements from and hires at *PIA* firms.

tage or a strong advantage) start reducing their workforces. By 1997, net hiring rates are negative for all sectors but net displacements are the largest in magnitude for firms in sectors at either comparative advantage extreme.

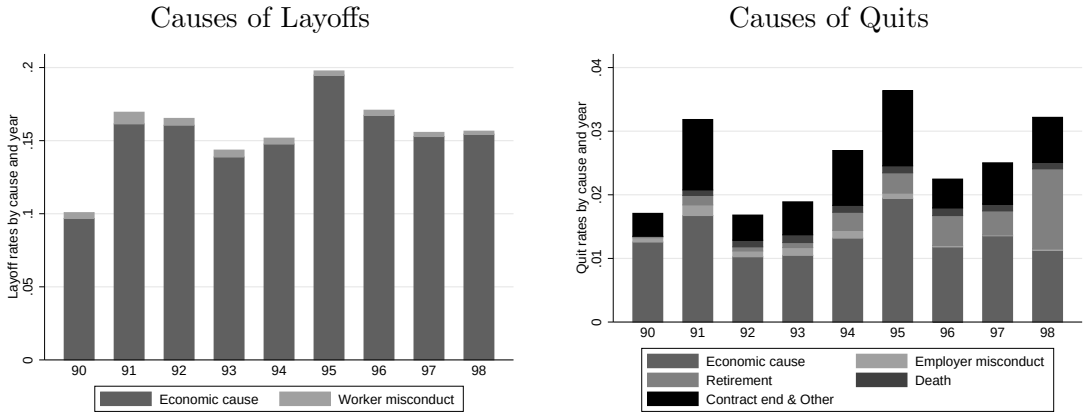
Higher product market tariff levels afford protection from foreign competition, and sectors with higher product market tariff protection exhibit higher net hiring rates at or above 10% ad-valorem tariffs in 1990. However, sectors with very low or no tariff protection below 10% ad-valorem tariffs exhibit the highest net hiring rates. Just as in the case of comparative advantage, the picture is less pronounced and less supportive of standard trade theory predictions in 1994 and 1997. Together, these facts may indicate that factor reallocation in the Brazilian manufacturing sector does not reach a new steady state until the late 1990s. However, labor turnover (as indicated by gross displacement and hiring rates) is the lowest for firms in the most protected sectors with product market tariffs at 30% or above in 1994 and 1997.

Firms with either low or high total factor productivity at year end typically exhibit lower mean net hiring rates during the year than firms with intermediate levels of productivity. So, firms with higher productivity do not seem to attract monotonically more factors in the reallocation process during the adjustment process of the 1990s. Low net hiring rates at relatively unproductive firms may have to do with attempted productivity improvements or product-line closures under increasing competition. Low net hiring rates at high productivity firms, on the other hand, may be related to high workforce reductions during the year that result in productivity improvements by the end of the year.

Unskilled blue-collar occupations expand at manufacturing firms throughout the 1990s, even in 1994 and 1997 when jobs in all other (more skill-intensive) occupations suffer net reductions. Until 1994, mostly high school graduates without college education fill the new jobs at *PIA* manufacturing firms. In 1997, however, high school graduates suffer the highest displacement rates, whereas college educated workers are retained most frequently. So, manufacturing firms restructure their workforces to become relatively more educated but simultaneously fill relatively more jobs in less skill intensive occupations over the course of the 1990s. Younger workers are hired more frequently but also being displaced more frequently. However, hiring rates exceed displacement rates more often for younger age groups than for older ones—indicating that firms strive to rejuvenate their aging workforces.

Figure 4 discerns displacements by cause. Economic conditions are the dominant reasons for displacements. Employers report in *RAIS* that layoffs are almost exclusively due to economic causes, whereas worker misconduct plays a negligible role. Employers declare less than .1 percent of layoffs to be due to worker misconduct. Similarly, employers rarely report their misconduct as a cause of workers' quits. The main cause for workers' quits is economic in nature too, just as in the case of layoffs.

Having restricted our core worker sample to prime age workers (at least 18 years and at most 49 years of age) with a single job at a *PIA* firm, retirements become more prevalent in later years of the sample period as we trace workers from our core



Source: Male workers in *RAIS* (São Paulo state) with December 31st employment at a *PIA* firm in at least one year between 1990 and 1998. Displacements from *PIA* firms. Contract end is considered an economic cause of quits through 1994.

Figure 4: **Causes of Male Worker Layoffs and Quits in Manufacturing**

sample to subsequent jobs (Figure 4). Sample workers approach (early) retirement age. Moreover, *RAIS* reports retirements among 'other' reasons for displacements until 1994. We will treat layoffs and quits separately in subsequent regression analysis to control for their distinct economic nature. While quits may be affected by reporting differences over time such as those regarding retirements, layoffs should not be affected.

The descriptive relationships of displacement and hiring rates to sector- and firm-level variables seem to suggest that high labor turnover in Brazilian manufacturing during the 1990s may be part of an adjustment process that does not result in a new steady-state factor reallocation by 1998.

5 Displacement and Hiring

Descriptive evidence in the preceding Section 4 suggested that neither manufacturing sectors with a comparative advantage absorb labor on a large scale, as standard trade theory would predict, nor do high-productivity firms clearly attract labor after trade reform as industrial-organization inspired theory would predict. However, workforce compositions may differ across sectors and firms, and individual worker characteristics prove to be an important determinant in labor turnover that needs to be controlled for.

The main estimation approach in this Section is a *conditional logit model for*

worker panels (FE cLogit) with

$$Pr\left(\sigma_{i,t}|\mathbf{x}_{i,t},\mathbf{y}_{J(i),t},\mathbf{z}_{S(J(i)),t}\right)=\frac{\exp\{\alpha_i+\mathbf{z}_{S(J(i)),t}\beta_z+\mathbf{y}_{J(i),t}\beta_y+\mathbf{x}_{i,t}\beta_x\}}{1+\exp\{\alpha_i+\mathbf{z}_{S(J(i)),t}\beta_z+\mathbf{y}_{J(i),t}\beta_y+\mathbf{x}_{i,t}\beta_x\}}, \quad (2)$$

where the indicator $\sigma_{i,t}$ takes a value of unity for the outcome (layoff, quit, or hire) for worker i at time t and zero otherwise. α_i is a worker-fixed effect; $\mathbf{z}_{S(J(i)),t}$ is a vector of sector-level covariates of the worker's displacing or hiring sector $S(J(i))$; $\mathbf{y}_{J(i),t}$ is a vector of firm-level covariates of worker i's displacing or hiring firm $J(i)$; $\mathbf{x}_{it}$ is a vector of covariates that are worker or job specific, or both; and β_z, β_y, β_x are coefficient vectors.

However, the FE cLogit estimator bases identification of the coefficient vector β_x for worker- and job-level covariates on the time variation within or across jobs. So, coefficients on job-level covariates are only identified for displaced or hired workers who also change occupation. Similarly, the identification of coefficients on worker-level covariates requires changing educational attainment over time on the job or across jobs. Consequently, the job- and worker-level coefficient estimates β_x may be more severely affected by measurement error and be imprecise even for our large sample sizes of several million workers. We therefore also fit a common *unconditional logit estimator* (Logit) to the data, leaving out the worker fixed effect but restricting the standard errors to be clustered by firms.

The FE cLogit estimator is only identified for workers who experience at least one displacement (or hire). This reduces sample size. However, the large magnitude of labor turnover in Brazil (with annual displacement rates of more than ten percent even in the most tranquil years), the size of the sample, and the sample time span of nine years all suggest that estimates remain well identified.

Sector- and firm-level covariates. Table 4 shows FE cLogit estimates of hire (column 1), quits (column 2) and layoffs (column 3) for the entire sample period, and includes firm-level covariates, which result in a loss of year 1991 observations (when *PIA* information is unavailable). Year indicator variables account for time-varying and economy-wide demand, price and exchange rate conditions. The year indicators (reported in Table 10 in the Appendix) detect steadily and significantly dropping hiring probabilities and steadily and significantly increasing displacement probabilities between 1992 and 1998. These estimates point to an accelerating secular workforce decline in the manufacturing sector over the course of the 1990s.

Controlling for worker-fixed effects proves to be important for the estimation of sector and firm effects β_z and β_y. Columns 5 and 6 in Table 4 show that unconditional logit estimates of hires and displacements result in several insignificant sector- and firm-level coefficient estimates. Especially the revealed comparative advantage measure, its interaction with tariffs, foreign import penetration, and firm-level total factor productivity (TFP) do not appear to be significantly related to displacements

Table 4: Logit Estimates of Male Worker Displacements and Hires

	Worker FE cLogit				Logit	
	Hire	Quit	Layoff	Displ.	Hire	Displ.
	(1)	(2)	(3)	(4)	(5)	(6)
Sector-level covariates						
Revealed Comp. Adv.	-.361	-.167	-.495	-.760	*.293*	*.345*
	(.047)	(.083)	(.041)	(.038)	(.240)	(.245)
Import Penetration	-1.312	3.759	.272	*.081*	*-.661*	*.415*
	(.094)	(.157)	(.080)	(.071)	(.419)	(.435)
Product Market Tariff	.374	3.297	*.089*	-2.633	*-.160*	-1.447
	(.057)	(.112)	(.063)	(.050)	(.275)	(.871)
Prd. Trff. × R. Adv. 90	.795	.788	-1.321	*.009*	*.022*	*.344*
	(.069)	(.105)	(.052)	(.049)	(.513)	(.431)
Intm. Input Tariff	-1.924	-6.655	.425	2.491	-1.347	*-.936*
	(.112)	(.208)	(.106)	(.093)	(.726)	(.787)
Herfindahl Index	-.217	-5.574	-.642	-1.916	-1.431	*-.472*
	(.065)	(.132)	(.059)	(.052)	(.317)	(.335)
FDI Stock	-.019	*-.006*	-.155	-.107	*.003*	*-.022*
	(.003)	(.006)	(.003)	(.003)	(.015)	(.019)
Sector Real Exch. Rate	-1.632	2.567	2.027	2.859	7.286	7.389
	(.177)	(.370)	(.156)	(.141)	(1.119)	(1.199)
Firm-level covariates						
Log Employment	-.088	-.300	-.477	-.581	-.184	-.152
	(.003)	(.006)	(.003)	(.003)	(.014)	(.018)
Log TFP	-.009	-.016	-.010	-.014	*-.007*	*.001*
	(.0009)	(.002)	(.0008)	(.0007)	(.005)	(.005)
Log Intm. Inp./Workf.	-.001	*-.001*	.004	.006	*.0009*	*.0009*
	(.0005)	(.001)	(.0005)	(.0005)	(.003)	(.004)
Worker- and job-level covariates						
Tenure (at firm)		-.013	1.867	1.359		-.245
		(.008)	(.005)	(.004)		(.024)
Pot. Labf. Experience	-.012	-.134	-.095	-.099	-.105	-.017
	(.001)	(.003)	(.001)	(.001)	(.003)	(.003)
Squared Pot. Lbf. Exp.	.0008	.003	.002	.002	.0008	.0006
	(.00003)	(.00005)	(.00003)	(.00002)	(.00005)	(.00008)
Prof. or Manag'l. Occ.	-1.089	-.496	-.033	-.040	-1.055	-.083
	(.018)	(.033)	(.016)	(.014)	(.045)	(.031)
Tech'l. or Superv. Occ.	-.917	-.397	-.066	-.046	-.753	-.123
	(.014)	(.029)	(.013)	(.012)	(.049)	(.031)
Unsk. Wh. Collar Occ.	-.996	-.305	*-.011*	*.005*	-.794	-.072
	(.013)	(.029)	(.012)	(.011)	(.039)	(.025)
Skilled Bl. Collar Occ.	-.765	-.143	-.094	-.060	-.568	-.076
	(.009)	(.020)	(.009)	(.008)	(.042)	(.039)
Observations	1,727,278	446,954	2,688,332	3,303,311	5,828,768	5,828,878
Pseudo R^2	.127	.159	.249	.253	.095	.046

Source: Male workers in *RAIS* (São Paulo state) with employment at a *PIA* firm in at least one year between 1990 and 1998 (no *PIA* information in 1991). Controlling for year effects (reported in Table 10 in the Appendix) and high-school or college education (not reported). Standard errors in parentheses (insignificant point estimates at the five percent level in *italics*)

and hirings when workers are treated as homogeneous but the covariates are significantly related to turnover when worker-fixed effects are accounted for. The pseudo R^2 measure of the goodness of fit indicates considerably less predictive power of unconditional Logit estimates compared to FE cLogit. The larger sample sizes in the unconditional Logit regressions, where workers who experience no displacement can be retained, suggest that lacking significance and worsening fits are largely due to the neglect of worker-fixed effects. So, there seem to be high-turnover and low-turnover workers whose sector affiliation is not random.

Sectors with a revealed comparative advantage exhibit lower turnover than other sectors over the period 1990-98. Both hiring and layoff (quit) probabilities are significantly reduced the higher the comparative advantage of the employing sector. The resulting ambiguity in net hiring may help explain why sectors with a comparative advantage fail to absorb displaced workers after trade reform—contrary to the predictions of standard trade theory. While sectors with revealed comparative advantage do not clearly attract workers from other sectors, increasing product market penetration with foreign imports significantly depresses hiring rates and raises quits and layoffs. To control for potentially different effects of tariff reductions on sectors with varying degrees of comparative advantage, we include as regressors both product market tariffs and their interaction with the revealed comparative advantage measure in 1990. Hiring rates are significantly higher in sectors with elevated product market tariffs and, evaluated at the annual average revealed comparative advantage measure of one, layoffs are significantly less frequent behind elevated tariff barriers. Though workers in tariff-protected sectors also quit their jobs more frequently, overall displacement rates (column 4) remain significantly reduced in the presence of elevated tariff barriers.

Intermediate input tariffs exhibit the converse pattern of product market tariffs, correlating significantly negatively with hires and positively with layoffs. While this is sometimes interpreted as possible evidence for workforce reductions in favor of foreign outsourcing, the idea of effective rates of protection suggests a different interpretation: elevated intermediate goods tariffs push input prices for Brazilian manufacturers above world-market level. Hence, elevated input tariffs raise competitive pressure, contrary to high product tariffs.

More concentrated industries (with higher Herfindahl indexes) and industries with a larger stock of foreign investment exhibit less labor turnover, with both reduced hiring and reduced displacement rates. Surprisingly, depreciated sectoral real exchange rates Ep_i^*/p_i (where E is the nominal exchange rate, and p_i^* and p_i are foreign and domestic sector price levels) are associated with less frequent hires and more frequent displacements. So, despite relatively reduced competitive pressure from a depreciated exchange rate compared to other sectors, workforce reductions are more likely. This sectoral correlation could be partly due to reduced domestic competition in sectors with relatively high domestic markups and thus prices p_i. Coefficients on other covariates typically indicate that reduced competitive pressure is associated

with higher hiring rates and less layoffs.

Concerning firm-level covariates, larger firm sizes are associated with less labor turnover and both reduced hiring and reduced displacement rates. Similarly, more productive firms also show less labor turnover. As is the case for sectors with a revealed comparative advantage, both predicted hiring and predicted layoff (quit) rates are significantly lower the higher the productivity of the employing firm. In turn, the resulting ambiguity in net hiring may help explain why more productive firms fail to attract workers after trade reform—contrary to predictions of trade models with firm heterogeneity. Firms with higher levels of intermediate inputs per worker exhibit lower hiring and increased layoff rates, indicating potential net workforce reductions from outsourcing.

Table 5 splits the sample period into the subperiods 1990-94 (columns 1 through 3) and 1995-98 (columns 4 through 6) to detect potentially changing displacement and hiring patterns for the same regressors (losing year 1991 observations again). With a few exceptions, most signs of coefficient estimates for the two subperiods resemble those for the period as a whole. Most surprisingly, however, sectors with a revealed comparative advantage and firms with higher productivity exhibit increased quit and layoff rates in 1995-98, contrary to estimates for the period as a whole and estimates for 1990-94. So, the labor reallocation process becomes even less likely to function smoothly in later years.

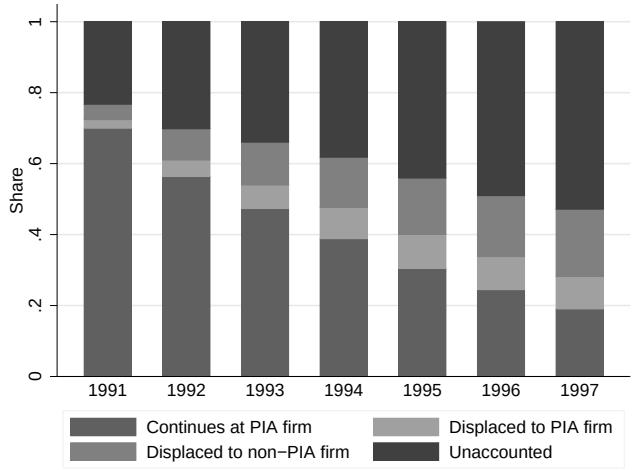
Worker- and job-level covariates. FE cLogit estimates in Table 4 for the full period 1990-98 show that workers with longer tenures at their firms are less likely to quit but more likely to be laid off, conditioning on their unobservable characteristics with worker-fixed effects and their potential labor force experience. Potential labor force experience reduces the hiring likelihood, possibly because of older worker age. Table 5 shows similar patterns for the subperiods 1990-94 and 1995-98.

Tables 4 and 5 do not report estimates on educational attainment indicators (for some high school, some college and a college degree). The FE cLogit estimator can only identify effects of educational attainment for workers who change category through additional education. Employer reports of worker education, however, are partly inconsistent so that educational attainment indicators in *RAIS* seem to approximate mostly employers' views of their workers likely education but do not necessarily reflect the precise education level. In the FE cLogit model, which requires exact records of educational attainment switches, we therefore view education categories mostly as controls for other worker characteristics in addition to the worker-fixed effects. We leave a detailed interpretation of occupational hiring and dislocation patterns, calculating the according relative logistic probabilities, for future drafts.

Table 5: Logit Estimates of Male Worker Displacements and Hires by Period

	FE cLogit 1990-94			FE cLogit 1995-98		
	Hire	Quit	Layoff	Hire	Quit	Layoff
	(1)	(2)	(3)	(4)	(5)	(6)
Sector-level covariates						
Revealed Comp. Adv.	*.069*	-1.171	*-.067*	-1.434	2.147	3.072
	(.085)	(.165)	(.078)	(.117)	(.176)	(.106)
Import Penetration	-1.670	-1.161	.835	-.962	13.075	5.348
	(.151)	(.286)	(.138)	(.218)	(.309)	(.194)
Product Market Tariff	.586	.802	-1.593	*.155*	3.699	5.565
	(.095)	(.234)	(.116)	(.141)	(.219)	(.170)
Prd. Trff. × Rev. Adv. 90	2.631	1.817	-1.510	-1.043	*.200*	1.109
	(.119)	(.173)	(.088)	(.153)	(.221)	(.130)
Intm. Input Tariff	-4.480	-2.375	2.373	-4.046	-28.079	-9.768
	(.166)	(.326)	(.162)	(.447)	(.808)	(.447)
Herfindahl Index	-1.374	-3.484	-1.396	*-.026*	-6.051	-2.045
	(.116)	(.214)	(.108)	(.138)	(.250)	(.132)
FDI Stock	.016	*.014*	-.150	-.104	-.050	-.018
	(.007)	(.014)	(.007)	(.010)	(.015)	(.009)
Sector Real Exch. Rate	-2.703	*-.832*	1.889	-4.632	24.486	-1.515
	(.258)	(.528)	(.233)	(.659)	(1.232)	(.596)
Firm-level covariates						
Log Employment	-.174	-.237	-.468	-.016	-.404	-.583
	(.005)	(.009)	(.005)	(.007)	(.013)	(.007)
Log TFP	-.008	-.006	-.016	.006	*.006*	.005
	(.001)	(.002)	(.001)	(.003)	(.004)	(.002)
Log Intm. Inp./Workf.	.005	-.007	.006	-.034	-.010	.003
	(.0008)	(.002)	(.0007)	(.002)	(.003)	(.002)
Worker- and job-level covariates						
Tenure (at firm)		.457	2.578		-.101	2.636
		(.015)	(.011)		(.015)	(.013)
Pot. Labf. Experience	.013	-.090	-.088	-.027	-.092	-.091
	(.002)	(.005)	(.002)	(.003)	(.006)	(.003)
Squared Pot. Lbf. Exp.	.0003	.002	.002	.001	.002	.002
	(.00006)	(.0001)	(.00005)	(.00007)	(.0001)	(.00007)
Prof. or Manag'l. Occ.	-1.296	-.541	*.001*	-1.014	-.480	*-.033*
	(.030)	(.052)	(.025)	(.038)	(.071)	(.040)
Tech'l. or Superv. Occ.	-1.050	-.395	-.066	-.876	-.375	*-.033*
	(.023)	(.044)	(.021)	(.031)	(.060)	(.033)
Unskilled Wh. Collar Occ.	-1.038	-.205	*-.028*	-.946	-.463	.070
	(.021)	(.045)	(.020)	(.030)	(.062)	(.031)
Skilled Bl. Collar Occ.	-.713	-.076	-.117	-.879	-.293	*-.005*
	(.013)	(.030)	(.013)	(.021)	(.044)	(.023)
Observations	578,245	118,939	865,101	513,253	126,340	745,822
Pseudo R^2	.168	.110	.294	.260	.262	.417

Source: Male workers in *RAIS* (São Paulo state) with employment at a *PIA* firm in at least one year between 1990 and 1998 (no *PIA* information in 1991). Controlling for year effects and high-school or college education (not reported). Standard errors in parentheses (insignificant point estimates at the five percent level in *italics*)



Source: Male workers in *RAIS* (São Paulo state) with December 31st employment at a *PIA* firm in 1990. Displacements from *PIA* firms.

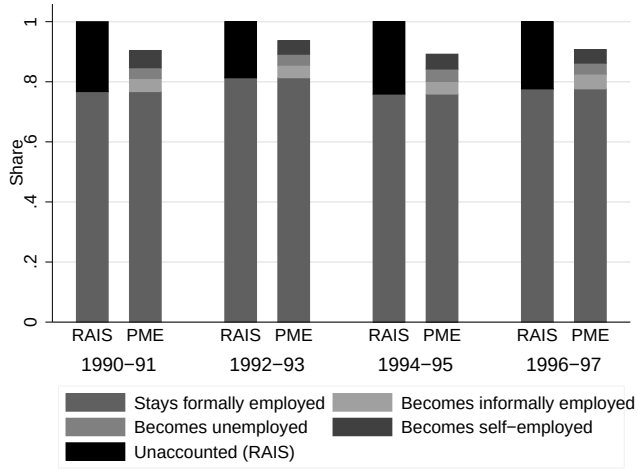
Figure 5: **Labor Market Experience of Male Manufacturing Workers with Formal Employment in 1990**

6 Labor Reallocation

Descriptive evidence in Section 4 and estimates in the preceding Section 5 suggest that neither more productive firms nor sectors with a revealed comparative advantage attract sufficiently many workers after trade reform to compensate for displacements from import competing firms and sectors. This Section traces displaced workers to their subsequent employment and work status.

Formal sector rehiring. Figure 5 depicts the labor market experience of prime-age male workers who are employed at a formally established manufacturing firm in São Paulo state on December 31, 1990. By December 1991, around 70.0 percent of these worker remain employed at the same firm, while 2.4 percent are displaced and rehired at another *PIA* firm, and 4.3 percent are displaced and rehired at some non-*PIA* firm in *RAIS*. 23.3 percent are not accounted for in this breakdown. By 1997, the share of unaccounted 1990 *PIA* workers rises to 52.9 percent. These workers may have retired, moved out of state, or died, which we will be able to account for in future drafts of this paper (more detailed *RAIS* data for Brazil as a whole have become available to us recently). Alternatively, their firms may have exited or may be active but not reporting. However, these workers may also have become informally employed, unemployed, self-employed, or employers.

To assess likely transitions of *PIA*-*RAIS* workers out of the sample, we use complementary information from the Monthly Employment Survey *PME*. Figure 6 compares



Sources: Male workers in *RAIS* (São Paulo state) with December 31st employment at a *PIA* firm in 1990, 1992, 1994, and 1996. Displacements from *PIA* firms. Complementary *PME* information on displaced male workers between 4th and 8th interviews (employer status excluded) with formal employment share re-scaled to match *RAIS* share.

Figure 6: **Male Manufacturing Workers and Their Labor Market Experience Over the Course of One Year**

PME information on displaced male workers in São Paulo state to the proportion of unaccounted *RAIS* workers at the one-year horizon. Since *PME* data also suffer from sample attrition because of retirements, moves out of metropolitan areas, or deaths, the share of rehired workers to the formal sector is re-scaled to match the *RAIS* share. The *PME* data help narrow the share of unaccounted transitions in *RAIS* from 23.3 percent in 1990 to 9.6 percent and suggest that around 4.4 percent of metropolitan formal manufacturing workers are displaced to an informal job, 3.5 become unemployed, and 5.8 percent self-employed.

The displacement patterns from the formal sector do not exhibit overly pronounced time variation during the 1990s. However, transition probabilities for formally employed workers into informal employment increase from 3.4 percent in 1988 to 5.0 percent in 1990 and subsequently remain at an elevated level. An adequate functioning of the labor market in the reallocation of workers requires that their transition likelihood out of the informal sector change, too, in response to higher displacement rates from the formal sector. Indeed, *PME* data show an increase in the transition rates out of informal into formal employment in the early nineties from 28.1 in 1990 to 37.3 percent in 1994, and a subsequent drop. However, as informality levels in Table 2 suggest, this increase in the transition likelihood back to formality could not prevent the overall increase in informality in the manufacturing sector.

Table 6 records continuation and transition rates for male workers in *RAIS* (São

Table 6: Year-over-Year Sector Continuations or Transitions of Male Workers between 1990 and 1998

(in %)	Manufacturing Comparative advantage quintile[a]									*Total*
	1st	2nd	3rd	4th	5th	Agric.	Comm.	Cnstr.	Srvcs.	
Manufact.[a]										
1st quintile	73.41	14.90	0.94	0.62	0.26	0.35	1.45	0.64	7.44	100
2nd quintile	13.95	51.18	21.90	0.85	0.31	0.33	1.61	0.88	8.98	100
3rd quintile	0.46	15.66	59.03	12.11	0.52	0.60	1.80	1.04	8.79	100
4th quintile	0.49	5.06	13.92	61.48	9.04	0.44	1.32	0.83	7.41	100
5th quintile	0.34	0.53	1.20	12.97	70.97	3.41	1.33	0.96	8.29	100
Agriculture	2.01	1.72	4.28	4.16	10.03	64.47	1.88	1.78	9.66	100
Commerce	2.91	4.73	6.96	4.25	2.07	0.80	58.97	1.81	17.50	100
Construction	2.40	4.34	6.69	5.36	2.85	1.52	3.63	53.98	19.23	100
Services	2.83	4.29	6.06	4.09	2.16	1.16	3.40	1.99	74.01	100
Total	9.67	13.56	18.08	15.39	8.82	2.14	4.71	2.34	25.30	100

[a]Revealed comparative advantage quintile (5: strongest advantage) in a given year.

Source: Male workers in *RAIS* (São Paulo state) with December 31st employment at a *PIA* firm in at least one year between 1990 and 1998. Percentages include both continuously employed workers and displaced workers who are rehired within a year following separation.

Paulo state) who hold a job at a *PIA* firm on December 31st in at least one year between 1990 and 1998. Manufacturing firms are grouped into their sector's comparative advantage quintiles by year. The information in Table 6 is based on retained workers as well as displaced workers who are rehired within the year following their separation. So, continuation rates within a sector include both continuing workers and displaced workers who find a new job within the same sector. In contrast, Table 7 shows sector transitions for displaced workers only.

At the annual horizon, the majority of workers stays within the same sector. However, turnover is substantial with between a quarter and half of all workers switching sector by Table 6. Surprisingly, reallocation flows from manufacturing sectors to other sectors go mostly to firms in manufacturing sectors with neither a strong comparative advantage nor a strong disadvantage, and to the services sector. With a total absorption rate of 18.1 percent, the third quintile manufacturing sector (with neither a strong disadvantage nor a strong advantage *vis à vis* Brazil's trading partners) accounts for the second highest rate of retentions and rehires, second only to the services sector with 25.3 percent. The off-diagonal entries for the five advantage-ranked manufacturing sectors are very small and frequently below one percent, especially for hiring sectors whose comparative advantage rank is two or more quintiles away from the displacing sector.

So, manufacturing sectors with different degrees of comparative advantage appear to be little permeable for labor reallocations. This fact is also consistent with the evidence on hardly changing comparative advantage patterns in Section 3. Sectors

Table 7: Year-over-Year Sector Transitions of Displaced Male Workers between 1990 and 1998

(in %)	Manufacturing Comparative advantage quintile[a]									*Total*
	1st	2nd	3rd	4th	5th	Agric.	Comm.	Cnstr.	Srvcs.	
Manufact.[a]										
1st quintile	18.89	11.41	3.84	2.57	1.49	2.83	8.88	6.13	43.95	100
2nd quintile	3.41	13.00	9.41	3.15	1.37	2.51	9.48	7.50	50.18	100
3rd quintile	1.31	6.35	18.74	4.65	1.80	5.04	9.69	7.84	44.58	100
4th quintile	1.50	2.99	5.33	18.33	6.99	4.09	8.24	7.89	44.63	100
5th quintile	0.90	1.55	4.25	2.41	29.33	17.41	5.76	6.16	32.23	100
Agriculture	1.83	1.28	4.38	3.30	8.65	57.87	2.64	3.77	16.29	100
Commerce	2.74	5.32	8.27	4.62	2.70	2.26	30.60	5.35	38.16	100
Construction	1.54	3.61	5.93	4.72	2.91	3.53	6.09	38.94	32.73	100
Services	3.33	5.68	8.42	5.11	3.59	3.58	8.14	6.51	55.64	100
Total	3.21	5.66	8.52	5.65	5.52	7.80	9.63	8.49	45.51	100

[a]Revealed comparative advantage quintile (5: strongest advantage) in a given year.

Source: Displaced male workers in *RAIS* (São Paulo state) with December 31st employment at a *PIA* firm in at least one year between 1990 and 1998. Percentages include only displaced workers who are rehired within a year following separation.

with different degrees of comparative advantage seem to remain fairly distinct over time.

The high diagonal entries for manufacturing sectors in Table 6 are not due to rehires within the same sectors but largely to retentions within the same firm. A comparison to Table 7, which shows transitions for displaced workers only, clarifies this. Table 7 documents that the services sector absorbs almost half (45.5 percent) of all displaced workers if they are rehired within a year, whereas manufacturing sectors only rehire a total of 28.6 percent of displaced workers within a year. Among the manufacturing sectors, the third quintile sector (with neither a strong comparative disadvantage nor a strong advantage) accounts for the highest rate of rehires (with 8.5 percent), but the construction sector absorbs as many displaced workers and commerce even more (9.6 percent). So, the high continuation rates on the diagonal in Table 6 are due to retentions, and not to rehiring within the same sector.

Together, the sectoral and time patterns of reallocations in Tables 3, 6 and 7 suggest that firms with a strong exposure to import competition or to foreign export markets are most likely to reduce their workforces. Firms in sectors with neither strong import competition nor a strong export exposure are most likely to absorb displaced workers until 1994 but start reducing their workforces too in the late 1990s. Not the manufacturing sectors with a comparative advantage but the services sector absorbs displaced workers. This finding is at odds with standard trade theory, which posits that economies specialize in activities where they have a comparative advantage by reallocating factors of production to their export sectors. Brazil's export sectors

Table 8: Multinomial Logit Estimates of Work Status for Rehired Male and Female Workers

Work status t	Formal			
Work status $t+1$	Informal	Self empl.	Unempl.	Out of lbf.
	(1)	(2)	(3)	(4)
Sector-level covariates				
Product Market Tariff	-.697	-1.178	*-.438*	*-.563*
	(.349)	(.347)	(.381)	(.343)
Intm. Input Tariff	.894	2.541	*.308*	1.317
	(.543)	(.546)	(.595)	(.493)
Worker-level covariates				
Formal empl. for 3 months or less	1.615	1.350	.551	.923
	(.064)	(.069)	(.096)	(.067)
Indic.: Male Worker	*-.032*	.241	*.100*	-1.399
	(.070)	(.077)	(.084)	(.056)
Age	-.146	.112	*-.034*	-.226
	(.033)	(.037)	(.041)	(.029)
Age squared	.002	-.002	*.000*	.003
	(.0004)	(.0005)	(.0006)	(.0004)
Some Middle School Education	*-.072*	-.190	*.005*	*.016*
	(.085)	(.084)	(.102)	(.075)
Some High School Education	-.315	-.444	*-.076*	-.295
	(.089)	(.088)	(.104)	(.082)
Some College Education	-.373	-.506	-.279	-.518
	(.102)	(.101)	(.122)	(.094)
Observations	31,237			
Pseudo R^2	.058			

Source: Male and female workers in *PME* with displacement from formal manufacturing employment at the 4th interview and work status report at 8th interview. Baseline category: Formal employment at 8th interview. Controlling for year (reported in Table 10 in the Appendix) and region effects (not reported). Standard errors in parentheses (insignificant point estimates at the five percent level in *italics*).

with comparative advantage do not absorb displaced workers but reduce their own workforce.

Formality, informality, and work status transitions. We use a multinomial logit (MNL) model to estimate the effects of trade liberalization on workers' transitions from the formal manufacturing sector. The set $\mathbb{S}$ of work status categories $\sigma_{i,t+1}$ includes five alternatives: (1) worker retains present formal manufacturing job or switches to new formal job (not necessarily in manufacturing); (2) worker moves to an informal job (not necessarily in manufacturing); (3) worker moves to self-employment (not necessarily in manufacturing); (4) worker moves to unemployment; and (5) worker leaves the labor force. We condition the individual's present work

status $\sigma_{i,t} = \sigma$ to be formal manufacturing employment.

Under the MNL assumptions, an individual household member's work status is

$$Pr(\sigma_{i,t+1}|\sigma_{i,t} = \sigma; \mathbf{x}, \mathbf{z}) = \frac{\exp\{\mathbf{z}_{S(i),t}\beta_z^\sigma + \mathbf{x}_{i,t}\beta_x^\sigma\}}{\sum_{\varsigma\in\mathbb{S}} \exp\{\mathbf{z}_{S(i),t}\beta_z^\varsigma + \mathbf{x}_{i,t}\beta_x^\varsigma\}}, \tag{3}$$

where $\mathbf{z}_{S(i),t}$ is a vector of sector-level covariates of the worker's displacing sector $S(i)$; $\mathbf{x}_{it}$ is a vector of covariates that are worker specific; and β_x^ς and β_z^ς are coefficient vectors for the according future work status $\varsigma \in \mathbb{S}$.

In the implemented MNL model, we choose as the baseline work status category (1) that the worker retains the present formal manufacturing job or switches to a new formal job. We pool the *PME* household data at the annual horizon (between the 4th and 8th interview) for the yearly transitions over the full *PME* sample period between 1986 and 1998, and treat the data as a single cross-section controlling for year effects, region effects and worker gender. We create an indicator variable that takes a value of unity if formality status lasted for less than three months prior to the 4th interview. This variable serves as a proxy for worker-level heterogeneity.

Table 8 presents the MNL estimates. Elevated product market tariffs are associated with reduced probabilities of transitions from formal manufacturing employment to any other alternative work status. This also corroborates our estimates of displacements probabilities for male *RAIS* workers from *PIA* firms, which showed that overall displacement rates are significantly lower in the presence of elevated tariff barriers (Table 4, column 4). Most strikingly, and contrary to findings in indicator regressions by Goldberg and Pavcnik (2003), transitions from formal manufacturing employment to the informal sector and to self-employment are significantly higher in the presence of reduced product market tariff barriers. Similarly, competition-aggravating high input tariffs correlate positively with transitions to informal employment and self employment (similar to our prior findings for displacement probabilities in Table 4, column 4). So, reduced barriers for foreign competition seem to significantly raise informality, contrary to previous evidence.

Estimates for the prior formality duration indicator suggest that individuals who recently moved to the formal sector are more likely to move out to any other work status again. Additional MNL show that there is no significant difference between male and female workers in their switching probabilities to informality, that male workers are less likely to leave the labor force, that educational attainment (especially a college degree) is negatively associated with transitions out of the formal sector, that transitions to informality fall with age at a decreasing rate and that all transitions out of the formal sector rise substantially over time (reported in Table 10 in the Appendix), even after controlling for observable workforce characteristics.

7 Conclusions

We investigate the impact of Brazil's large-scale trade reform on the labor market in São Paulo state, where more than half of Brazil's manufacturing value added is produced, using a rich matched employer-employee data set for Brazil.

Higher foreign import penetration and reduced product market tariffs significantly depress hiring rates at formal-sector manufacturing firms, significantly raise displacement rates, and significantly raise the likelihood of a worker's transition into informal work status. However, logit estimates of hires, displacements, and work status transitions indicate that trade-induced net workforce reductions neither result in labor reallocations to sectors with comparative advantage nor to moves to more competitive firms. For an extended period of time, the Brazilian economy may have suffered welfare losses from a delayed specialization in sectors with comparative advantage and incomplete labor reallocation within sectors.

Our estimates also indicate that individual worker data are crucial since worker effects play a key role in the reallocation process. Only when controlling for worker-fixed effects do sector-level covariates such as foreign trade exposure significantly matter for displacement and hiring probabilities. So, there seem to be high-turnover and low-turnover workers whose sector affiliation is not random. To follow through on this emerging pattern, future drafts of this paper will model the interaction of sectoral comparative advantage and firm productivity measures with individual worker characteristics, beyond the covariates themselves, to account for the varying impact of trade reform on different worker types and their dislocations in even more detail.

Extensions of the data and analysis in future drafts will complete the emerging picture. *PME* household data prior to 1990 suggest that certain reallocation patterns seem to have emerged before trade liberalization and are likely also driven by forces unrelated to trade. The *PME* data show that the share of workers who move from manufacturing to the services sector and to the retail sector also rises prior to trade reform. A recently obtained extension of our individual *RAIS* worker data to the years between 1986 and 1989 will help us control for these secular, not necessarily trade-related labor reallocation trends in future drafts.

Future drafts of this paper will also attempt to account for adverse real exchange rate conditions more explicitly—beyond year indicators in the regression analysis. Since around 1994, the labor reallocation process following Brazil's trade reform in 1990 coincided with a real exchange rate misalignment. Monetary reform in August 1994 had resulted in an overvalued national currency until the crawling peg *vis à vis* the U.S. dollar was abandoned in January 1999. The overvaluation ended a slight initial increase in Brazil's relative trade volumes (the sum of absolute export and import values over GDP) and its relative trade balance (net exports over GDP) between 1990 and 1994, and turned the relative trade balance negative by 1995. Only after 1999 did the trade volume increase markedly and the trade balance gradually move back towards surplus. This real exchange rate misalignment may be partially

responsible for the delayed reallocation process. A recently obtained extension of our individual *RAIS* worker data to the years past 1998 will help us control for reallocation patterns in the absence of real exchange rate misalignments.

Appendix

A Data

Brazilian law requires all Brazilian establishments to submit detailed annual reports with individual information on their workers and employees to the ministry of labor (*Ministério de Trabalho*, *MTE*). This census is called *Relação Anual de Informações Sociais*, or *RAIS*, and typically concluded at the parent firm by late February or early March for the preceding year of observation.

An establishment's failure to report its labor force information can, in principle, result in fines proportional to the labor force size but fines are rarely issued. A strong incentive for compliance is that workers' benefits depend on *RAIS*. Most importantly, the payment of the worker's annual public wage supplement (*Abono Salarial*) is exclusively based on *RAIS* records. The ministry of labor estimates that currently 97 percent of all formally employed workers in Brazil are covered in *RAIS*, and that the coverage exceeded 90 percent throughout the 1990s.

Screening. In *RAIS*, workers are identified by individual-specific *PIS* (*Programa de Integração Social)* IDs that are similar to social security numbers in the U.S. (but *PIS* IDs are not used for other purposes than the administration of the wage supplement program *Abono Salarial*). A given establishment may report the same *PIS* ID multiple times within a single year in order to help the worker withdraw seniority pay deposits from the worker's individual savings account (*Fundo de Garantia do Tempo de Serviço*, *FGTS*) through spurious layoffs and rehires. Moreover, bad compliance causes certain *PIS* IDs to be recorded incorrectly or repeatedly. To handle these issues, we screen the census records as follows. (1) Observations with *PIS* IDs having fewer than 11 digits are removed. These correspond to either informal (illegal) workers or measurement error from faulty bookkeeping. (2) Observations of workers who are not employed on December 31st are removed. (3) Multiple employments on December 31st are removed. For a worker with multiple employments on December 31st, we only keep the observation with the highest average monthly wage level (in cases of wage level ties, we drop duplicate observations randomly). (4) For this paper, we also remove observations with workers 50 years or older at the time of their first sample appearance in a December 31st job.

Experience, education and occupation. The following tables present age and education classifications from *RAIS*, along with the imputed ages used in construction of the potential experience variable. We use the age range information in our version of *RAIS* to infer the "typical" age of a worker in the age range as follows:

	RAIS Age Category	Imputed Age
1.	Child (10-14)	12
2.	Youth (15-17)	16
3.	Adolescent (18-24)	21
4.	Nascent Career (25-29)	27
5.	Early Career (30-39)	34.5
6.	Peak Career (40-49)	44.5
7.	Late Career (50-64)	57
8.	Post Retirement (65-)	*excluded*

We group age information in *PME* into the same categories.

The occupation indicator variables are obtained from the *CBO* classification codes in the *RAIS*, as reclassified to conform with the *ISCO-88* categories (Muendler et al. 2004). The mapping between *ISCO-88* categories and occupation levels is given as follows:

	ISCO-88 Category	Occupation Level
1.	Legislators, senior officials, and managers	Professional & Managerial
2.	Professionals	Professional & Managerial
3.	Technicians and associate professionals	Technical & Supervisory
4.	Clerks	Other White Collar
5.	Service workers and shop and market sales workers	Other White Collar
6.	Skilled agricultural and fishery workers	Skill Intensive Blue Collar
7.	Craft and related workers	Skill Intensive Blue Collar
8.	Plant and machine operators and assemblers	Skill Intensive Blue Collar
9.	Elementary occupations	Other Blue Collar

Finally, we define the education indicator variables as follows:

	Education Level	*RAIS* Education
1.	Illiterate, or Primary or Middle School Educated	1-5
2.	Some High School or High School Graduate	6-7
3.	Some College	8
4.	College Graduate	9

Complementary household survey data We use Brazil's Monthly Employment Survey *Pesquisa Mensal de Emprego* (*PME*) for the metropolitan area in São Paulo city to identify workers with a manufacturing job during the 4th or 8th interview, or both.

PME household data permit a distinction between formal employment (with a labor ID card *carteira*) and informal employment (without a labor ID card). The labor ID card entitles workers to benefits mostly borne by the employer. Household members who work for their own account and do not employ others are considered self-employed. Individuals without employment are considered unemployed if they declare that they actively looked for work during the week prior to the interview and are considered to be out of the labor force otherwise. We exclude individuals who become employers.

B Sectors at *Nível 50*

A list of English descriptions of sectors at *nível 50* is given in table 9.

Table 9: Manufacturing Sectors

Nível 50	English description
2	Mineral Mining (except combustibles)
3	Petroleum and Gas Extraction and Coal Mining
4	Nonmetallic Mineral Goods Manufacturing
5	Iron and Steel Production and Processing
6	Nonferrous Metals Production and Processing
7	Other Metal Products Manufacturing
8	Machinery, Equipment and Commercial Installation Manufacturing
9	Machinery Maintenance, Repairing and Installation
10	Electrical Equipment and Components Manufacturing
11	Electronic Equipment and Communication Apparatus Manufacturing
12	Automobile, Truck and Bus Manufacturing
13	Other Transportation Equipment and Vehicle Parts Manufacturing
14	Wood Sawing, Wood Products and Furniture Manufacturing
15	Paper Manufacturing, Publishing and Printing
16	Rubber Product Manufacturing
17	Non-petrochemical Chemical Manufacturing
18	Petroleum Refining and Petrochemical Manufacturing
19	Miscellaneous Chemical Products Manufacturing
20	Pharmaceutical Products, Perfumes and Detergents Manufacturing
21	Plastics Products Manufacturing
22	Textiles Manufacturing
23	Apparel and Apparel Accessories Manufacturing
24	Footwear and Leather and Hide Products Manufacturing
25	Coffee Manufacturing
26	Plant Product Processing (including tobacco)
27	Slaughtering and Meat Processing
28	Fluid Milk and Dairy Product Manufacturing
29	Sugar Manufacturing
30	Seed Oil Refining and Food Fats and Oils Processing
31	Other Food and Beverage Manufacturing
32	Miscellaneous Other Products Manufacturing

Sources: *PIA* 1990 and 1997, and *RAIS* 1990 and 1997 for São Paulo state.

Sector data. We construct sector-level variables from various sources. We use national accounts data from Ramos and Zonenschain (2000) at *IBGE* to derive our measure (1) of *revealed comparative advantage* based on net exports of sector i in year t: $RADV_{i,t} \equiv 1 + (X_{i,t} - M_{i,t})/Y_{i,t}$, where $M_{i,t}$ are imports, $X_{i,t}$ are exports and $Y_{i,t}$ is output.

We also use the Ramos and Zonenschain (2000) national accounting data to calculate the *effective rate of market penetration* with foreign imports. Arguably, domestic firms find the absorption market corresponding to $A_{i,t} \equiv Y_{i,t} - (X_{i,t} - M_{i,t})$ the relevant domestic

environment in which they compete. We define the effective rate of market penetration as $M_{i,t}/A_{i,t}$.

We use data on nominal tariffs by sector and year from Kume et al. (2000). We combine these tariff series with economy-wide input-output matrices (from *IBGE*) to arrive at intermediate input tariff measures by sector and year. We calculate the vector of sector-level input tariff indices as $\tau_{i,t}^{in} = W_{i,t}' \tau_{i,t}^{out}$ in year t, where $W_{i,t}$ is the matrix of sector-specific shares of inputs. We finally combine these tariff series with average sector-level value-added information from *PIA* to calculate effective rates of protection by sector and year. The vector of sector-level *effective rates of protection* is defined as $\text{ERP}_{i,t} \equiv (\tau_{i,t}^{in} - \bar{\alpha}_{i,t}\tau_{i,t}^{out})/(1-\bar{\alpha}_{i,t})$, where $\bar{\alpha}_{i,t}$ is the sector mean of intermediate input shares in output.

We use cumulated foreign direct investment stock data from the Brazilian central bank (*Banco Central do Brasil*) for 1986 through 1995. A central bank survey in 1995 suggests that cumulated FDI stocks were overestimated prior to 1995, and we correct them down by an according adjustment factor. From 1996 on, we use central bank figures of FDI flows, based on new sector definitions adopted since December 1995, to infer FDI stocks through 1998.

We construct sector-specific real exchange rates from the nominal exchange rate to the US dollar E, Brazilian wholesale price indices P_S, and average foreign price series for groups of Brazil's main trading partners P_S^* by sector i, and define the real exchange rate as $q_S \equiv EP_S^*/P_S$ so that a low value means an appreciated real sector exchange rate. We artificially re-base the underlying price series to a value of 1 in 1995. We use Brazil's import shares from its major 25 trading partners in 1995 as weights for P_S^*. We obtain sector-specific annual series from producer price indices for the 12 OECD countries among Brazil's main 25 trading partners (sector-specific PPI series from *SourceOECD*; US PPI series from *Bureau of Labor Statistics*). We combine these sector-specific price indexes with the 13 annual aggregate producer (if unavailable wholesale) price index series for Brazil's remaining major trading partners (from *Global Financial Data*), for whom sector-specific PPI indices are not available in general.

Table 10: Estimates of Year Effects

	FE cLogit 1990-98		MNL 1986-98: Transition from manuf. to			
	Hire	Dspl.	Informal	Self empl.	Unempl.	Out of lbf.
	(1)	(2)	(3)	(4)	(5)	(6)
Indic.: Year 1988			*.009*	.219	-.475	*.006*
			(.116)	(.119)	(.132)	(.102)
Indic.: Year 1990			.596	1.182	*.098*	.488
			(.146)	(.150)	(.158)	(.130)
Indic.: Year 1992	.353	-.902	.406	1.070	*.124*	.564
	(.058)	(.046)	(.189)	(.195)	(.202)	(.166)
Indic.: Year 1993	.100	-.308				
	(.046)	(.036)				
Indic.: Year 1994	-.542	.433	.599	1.193	*.102*	.727
	(.027)	(.022)	(.201)	(.210)	(.220)	(.179)
Indic.: Year 1995	-1.076	1.509				
	(.021)	(.017)				
Indic.: Year 1996	-1.406	1.597	.691	1.129	*.117*	.810
	(.025)	(.021)	(.205)	(.217)	(.227)	(.182)
Indic.: Year 1997	-1.988	1.938				
	(.028)	(.022)				
Indic.: Year 1998	-2.783	2.218	.807	1.102	*.189*	.844
	(.035)	(.027)	(.197)	(.210)	(.218)	(.176)

Source: Estimates in columns 1 and 2 complete Table 4, columns 1 and 4, for male workers in *RAIS* (São Paulo state) with employment at a *PIA* firm in at least one year between 1990 and 1998 (no *PIA* information in 1991). Estimates in columns 3 through 6 complete Table 8, columns 1 through 4, for male and female workers in *PME* with displacement from formal manufacturing employment at the 4th interview and work status report at 8th interview. Standard errors in parentheses (insignificant point estimates at the five percent level in *italics*).

References

Beyer, Harald, Patricio Rojas, and Rodrigo Vergara, "Trade Liberalization and Wage Inequality," *Journal of Development Economics*, June 1999, *59* (1), 103–23.

Davis, Steven J., John C. Haltiwanger, and Scott Schuh, *Job creation and destruction*, Cambridge and London: MIT Press, 1996.

Ferreira, Pedro Cavalcanti and José Luis Rossi, "New Evidence from Brazil on Trade Liberalization and Productivity Growth," *International Economic Review*, November 2003, *44* (4), 1383–1405.

Goldberg, Pinelopi Koujianou and Nina Pavcnik, "The Response of the Informal Sector to Trade Liberalization," *Journal of Development Economics*, Special Issue December 2003, *72* (2), 463–96.

Gonzaga, Gustavo, Naércio Aquino Menezes Filho, and Maria Cristina Terra, "Trade Liberalization and the Evolution of Skill Earnings Differentials in Brazil," August 2004. Universidade de São Paulo, unpublished manuscript.

Gourinchas, Pierre Olivier, "Exchange Rates Do Matter: French Job Reallocation and Exchange Rate Turbulence, 1984-1992," *European Economic Review*, June 1999, *43* (7), 1279–1316.

Haltiwanger, John, Adriana Kugler, Maurice Kugler, Alejandro Micco, and Carmen Pagés, "Effects of Tariffs and Real Exchange Rates on Job Reallocation: Evidence from Latin America," *Journal of Policy Reform*, Special Issue December 2004, *7* (4), 191–208.

Hanson, Gordon H. and Ann Harrison, "Trade Liberalization and Wage Inequality in Mexico," *Industrial and Labor Relations Review*, January 1999, *52* (2), 271–88.

Jacobson, Louis S., Robert J. LaLonde, and Daniel G. Sullivan, "Earnings Losses of Displaced Workers," *American Economic Review*, September 1993, *83* (4), 685–709.

Kaplan, David S., Gabriel Martínez González, and Raymond Robertson, "What Happens to Wages After Displacement?," June 2005. Instituto Tecnológico Autónomo de México (ITAM), unpublished manuscript.

Klein, Michael W., Scott Schuh, and Robert K. Triest, "Job Creation, Job Destruction, and the Real Exchange Rate," *Journal of International Economics*, March 2003, *59* (2), 239–65.

Kume, Honório, Guida Piani, and Carlos Frederico Bráz de Souza, "A Política Brasileira de Importação no Período 1987-98: Descrição e Avaliação," May 2000. IPEA (Instituto de Pesquisa Econômica Aplicada), Rio de Janeiro, unpublished manuscript.

Menezes Filho, Naércio Aquino, "The Costs of Displacement in Brazil," November 2004. Universidade de São Paulo, unpublished manuscript.

Muendler, Marc-Andreas, "The Database *Pesquisa Industrial Anual* 1986-2001: A Detective's Report," November 2003. Fundação Instituto Brasileiro de Geografia e Estatística, Rio de Janeiro, unpublished manuscript.

___ , "Estimating Production Functions When Productivity Change Is Endogenous," *CESifo Working Paper*, March 2004, *1143. ssrn.com/abstract=523682.*

___ , "Trade, Technology, and Productivity: A Study of Brazilian Manufacturers, 1986-1998," *CESifo Working Paper*, March 2004, *1148. ssrn.com/abstract=525924.*

___ **, Jennifer Poole, Garey Ramey, and Tamara Wajnberg**, "Job Concordances for Brazil: Mapping the Classificação Brasileira de Ocupações (CBO) to the International Standard Classification of Occupations (ISCO-88)," April 2004. University of California, San Diego, unpublished manuscript.

Pavcnik, Nina, "Trade Liberalization, Exit, and Productivity Improvement: Evidence from Chilean Plants," *Review of Economic Studies*, January 2002, *69* (1), 245–76.

Ramos, Roberto Luís Olinto and Claudia Nessi Zonenschain, "The Performance of the Brazilian Imports and Exports Based on the System of National Accounts: 1980-1998," August 2000. IBGE Rio de Janeiro, unpublished manuscript.

Revenga, Ana L., "Exporting Jobs? The Impact of Import Competition on Employment and Wages in US Manufacturing," *Quarterly Journal of Economics*, February 1992, *107* (1), 255–84.

___ , "Employment and Wage Effects of Trade Liberalization: The Case of Mexican Manufacturing," *Journal of Labor Economics*, Part 2, July 1997, *15* (3), S20–43.

Ribeiro, Eduardo Pontual, Carlos H. Corseuil, Daniel Santos, Paulo Furtado, Brunu Amorim, Luciana Servo, and André Souza, "Trade Liberalization, the Exchange Rate and Job Flows in Brazil," *Journal of Policy Reform*, Special Issue December 2004, *7* (4), 209–23.

Roberts, Mark J., "Employment Flows and Producer Turnover," in Mark J. Roberts and James R. Tybout, eds., *Industrial evolution in developing countries: Micro patterns of turnover, productivity, and market structure*, Oxford and New York: Oxford University Press for the World Bank, 1996, pp. 18–42.

Robertson, Raymond, "Relative Prices and Wage Inequality: Evidence from Mexico," *Journal of International Economics*, December 2004, *64* (2), 387–409.