Trade Liberalization and Industry Wage Structure: Evidence from Brazil*

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Abstract

We study the impact of the 1988-1994 trade liberalization in Brazil on the industry wage structure. Industry affiliation potentially provides an important channel through which trade liberalization affects worker earnings and wage inequality between skilled and unskilled workers. Our empirical results suggest that while industry affiliation is in fact an important component of worker earnings, the structure of industry wage premiums is relatively stable over time. We thus find no statistical association between changes in industry wage premiums and changes in trade policy. Furthermore, we do not find any relationship between industry-specific premiums to university graduates and trade policy. We conclude that trade liberalization in Brazil did not significantly contribute to increased wage inequality between the skilled and unskilled workers through changes in industry wage premiums. The difference between these results and those obtained for other countries (e.g., Mexico, Colombia) provides fruitful ground for studying the conditions under which trade reforms do not have an adverse effect on industry wage differentials.

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1. Introduction

Policy makers often promote trade liberalization and openness as a way to increase living standards and welfare in developing countries.[1] Brazil, like many other Latin American economies, followed these policy recommendations and experienced drastic trade liberalization from 1988 to 1994. The reforms not only reduced the average tariff level from about 60 percent in 1987 to 15 percent in 1998, but also changed the structure of protection across the industries. These drastic tariff reductions were mirrored in increased import penetration in most manufacturing sectors.

While empirical studies have documented that the Brazilian trade reforms have increased efficiency and growth (see Hay (2001), Muendler (2002)), trade liberalization might have also contributed to the growing wage inequality. In fact, several studies have documented growing returns to educated workers in Brazil that coincide with the timing of trade liberalization (see Blom, Holm-Nielsen, and Verner (2001), Green, Arbache, and Dickerson (2001), Behrman, Birdsall, Szekely (2000), Sánchez-Páramo and Schady (2003)).[2] Most of this literature has concentrated on the effects of trade on the returns to particular worker characteristics (such as skill) in the long run, where labor can move across sectors and industry affiliation does not matter.

In this paper, we take a different approach and instead investigate the relationship between trade liberalization and industry wage premiums. Wage premiums represent the portion

[1] The theoretical relationship between free trade and welfare is ambiguous; furthermore, careful empirical work based on cross-country data by Frankel and Romer (1999) confirms that countries with higher exposure to trade have higher living standards as measured by per capita GNP.

[2] Growing skill premium has been documented in Mexico and many other liberalizing Latin American economies (see Robbins (1996), Cragg and Epelbaum (1996), Hanson and Harrison (1999), Robertson (2000), Behrman, Birdsall, and Szekely (2000), Attanasio, Goldberg, and Pavcnik (2002)).

of worker wages that cannot be explained through worker or firm characteristics, but are attributed to worker industry affiliation.

We explore how trade reforms impacted industry wage premiums for several reasons. First, worker industry affiliation is crucial in predicting the impact of trade reforms on worker wages in short- and medium-run models of trade, and in trade models with imperfect competition and rent sharing. Studies that abstract from industry affiliation may thus miss an important channel through which trade policy affects wage distribution. These models seem a priori particularly relevant in Latin America where markets are often characterized by labor market restrictions that potentially obstruct labor mobility across sectors (Heckman and Pages (2000)), and where domestic industries are often shielded from foreign competition so that market power and industry rents are likely to be present.

Second, the effect of trade policy on industry wage premiums has two important implications for the wage inequality between skilled and unskilled workers. Since different industries employ different proportions of educated and skilled workers, changes in industry wage premiums translate to changes in the relative incomes of skilled and unskilled workers. If tariff reductions are proportionately larger in sectors employing less-skilled workers, and if these sectors experience a decline in their relative wages as a result of trade liberalization, these less-skilled workers will experience a decline in their relative incomes. This effect is distinct from the potential effect of trade liberalization on the economy-wide skill premium. Moreover, industry wage premiums might vary across workers with different levels of skill or education. For example, the more educated workers may be more (or less) mobile in the labor market, have accumulated more sector-specific human capital, or have more bargaining power over industry rents. If wage premiums differ across workers with different levels of education, and trade

liberalization increases the industry specific skill premiums, this could provide an additional channel through which the reforms affect wage inequality.

Interestingly, very few studies focus on the relationship between trade policy and industry wage premiums.[3] These studies yield mixed conclusions, and, with the exception of Goldberg and Pavcnik (2001), abstract from the implications of industry wage premiums for wage inequality between skilled and unskilled workers.

In this paper, we empirically address the relationship between trade policy and industry wage premiums by combining detailed micro level worker level information from Brazilian labor force survey *Pesquisa Mensal de Emprego* (PME) with industry level data on tariffs, import penetration, and export exposure. The data cover 14 years surrounding the Brazilian trade liberalization episode. Our analysis yields several interesting findings. First, we find no association between trade reforms and industry wage premiums. While industry affiliation plays an important role in determining workers earnings, i.e., it explains 4 to 6 percent of the variation in log hourly wages between 1986 to 1998, and industry wage premiums vary widely across industries, the structure of industry wage differentials is very stable through time and is not affected by the changing structure of trade protection. Moreover, we also find no statistical relationship between sector specific skill premiums (measured by the return to complete university education) and tariff reductions. Overall, we conclude that the trade reform in Brazil did not contribute to wage inequality between the skilled and unskilled through differential changes in industry wage premiums in industries that differ in the skilled-labor intensity or through increases in industry specific skill premiums.

[3]Revenga (1997), Gaston and Trefler (1994), Feliciano (2001), Robertson (2000), Pavcnik and Goldberg (2001), and Arbache and Menezes-Filho (2000) are some examples of related work. Arbache and Menezes-Filho (2000) find significant evidence of rent-sharing during trade liberalization in Brazilian manufacturing from 1989 to 1995 after they instrument for the value-added with the effective tariffs.

The paper proceeds as follows. Section 2 of the paper discusses theoretical motivation for the relationship between industry wage premiums and tariffs and empirical methodology. Section 3 provides background on Brazil's trade regime and describes the labor force data. Section 4 presents the results. Section 5 discusses policy implications of our findings and concludes.

2. Theoretical Background and Methodology

2.1 Theoretical Background

In this section, we briefly summarize trade theory that provides predictions on how trade policy might affect industry wage premiums. Perhaps the most natural point of departure for thinking about relative wages and trade is the specific factors model. This model is short-run by nature as it considers factors of production immobile across sectors. The model predicts a positive relationship between protection and industry wages; in the context of our trade liberalization experiment this implies that sectors that experienced proportionately larger tariff reductions should be associated with a decrease of wage premiums.[4] The popular notion that trade reform is going to make workers poorer in the previously protected sectors is consistent with this model.

The above trade model assumes perfectly competitive product and factor markets. Introducing imperfect competition opens up additional channels through which trade policy may impact wages. For example, in the presence of unionization and imperfect competition, it is possible that unions extract the rents associated with protection in the form of employment guarantees rather than wages. Grossman (1984) develops this idea in the context of a model in which seniority-based layoff rules are important; these induce senior workers to push for higher wages while younger

[4] In contrast, the long-run Hecksher-Ohlin model predicts that trade reform should affect only economy-wide returns to the factors of production, but not industry specific returns, since all factors of productions are mobile across uses.

workers are more interested in preventing layoffs. Such rules may imply a different relationship between protection and wages than the one implied by the specific factors model.

Liberalization induced productivity changes may further impact industry wages. There is by now a voluminous literature on the effects of trade reform on firm productivity. While in theory the effects of liberalization on productivity are ambiguous (see Rodrik (1991) and Roberts and Tybout (1991, 1996) for a discussion), most empirical work to date has established a positive link between liberalization and productivity (Harrison for Cote d' Ivoire (1994), Krishna and Mitra for India (1998), Kim for Korea (2000), Pavcnik for Chile (2002), Fernandes for Colombia (2001)). Hay (2001) and Muendler (2002) estimate that the 1988-1995 trade reforms had a significant impact on plant level productivity in Brazil. As tariffs declined, firms had to become more productive in order to remain competitive. To the extent that productivity enhancements are passed through onto industry wages, we would expect wages to increase in the industries with the highest productivity gains. If these occur in the industries with the highest trade barrier reductions, relative wages would be positively correlated with trade liberalization.

The above discussion suggests that, while industry affiliation potentially provides an important channel through which trade policy affects worker wages, these models do not yield unambiguously predictions about the sign of the expected trade liberalization effect on wages. The question is one that needs to be resolved empirically.

2.2 Empirical Methodology

To empirically investigate the effect of trade exposure to wage premiums, we employ the two-stage estimation framework familiar from the labor literature on industry wages. In the first stage we regress the log of worker i's wages ($\ln(w_{ijt})$) on a vector of worker i's characteristics (H_{ijt}) such as education, age, age squared, gender, geographic location, an indicator for whether

the person is self-employed, an indicator for whether the person works in the informal sector, and a set of industry indicators (I_{ijt}) reflecting worker i's industry affiliation:

$$\ln(w_{ijt}) = H_{ijt}\beta_{Ht} + I_{ijt} * wp_{jt} + \varepsilon_{ijt} \quad (1)$$

The coefficient on the industry dummy, the wage premium, captures the part of the variation in wages that cannot be explained by worker characteristics, but can be explained by the workers' industry affiliation. Following Krueger and Summers (1988) we express the estimated wage premiums as deviations from the employment-weighted average wage premium.[5] This normalized wage premium can be interpreted as the proportional difference in wages for a worker in a given industry relative to an average worker in all industries with the same observable characteristics. The normalized wage differentials and their exact standard errors are calculated using the Haisken-DeNew and Schmidt (1997) two-step restricted least squares procedure provided to us by John P. Haisken-DeNew and Christoph M. Schmidt.[6] The first stage regressions are estimated separately for each year in our sample as the subscript t in equation (1) indicates. In the second stage, we pool the industry wage premiums wp_{jt} over time and regress them on trade related industry characteristics in first differenced form:

$$\Delta wp_{jt} = \Delta T_{jt}\beta_T + D_t\beta_D + u_{jt} \quad (2)$$

The primary variable we include in T_{jt}, the vector of trade related industry characteristics, is tariffs. In addition, we also experiment with other controls in T_{jt}, such as lagged import penetration, lagged export to output share, and interactions of the above variables with exchange rates. The vector D_t consists of a set of year indicators. Since the dependent variable in the second stage is estimated, we estimate (2) with weighted least squares (WLS), using the inverse

[5] The sum of the employment weighted normalized wage premiums is zero.
[6] Haisken DeNew and Schmidt (1997) adjust the variance covariance matrix of the normalized industry indicators to yield an exact standard error for the normalized coefficients.

of the variance of the wage premium estimates from the first stage as weights. This procedure puts more weight on industries with smaller variance in industry premiums. We also account for general forms of heteroskedasticity and serial correlation in the error term in (2) by computing robust (Huber-White) standard errors clustered by industry.

3. Data and Country Background

3.1 Trade Policy in Brazil

Like many other Latin American countries, Brazil pursued an import substitution policy to shield domestic firms from foreign competition until the 1980s. The high level of tariffs and large number of non-tariff barriers (NTBs) severely hindered the access of foreign good to the Brazilian market and provided high levels of protection to Brazilian firms. The level of protection varied widely across industries. For example, imports from the most protected sector, clothing, faced tariffs exceeding 100 percent, followed by sectors such as textiles and rubber that were subject to tariffs exceeding 80 percent in 1987. This suggests that Brazil protected relatively unskilled, labor-intensive sectors, which conforms to a finding by Hanson and Harrison (1999) for Mexico and Goldberg and Pavcnik for Colombia (2001).

From 1988 to 1994, however, Brazil underwent a significant trade liberalization that gradually reduced its tariffs and NTBs. The liberalization proceeded in several stages. In 1988 and 1989, the reforms reduced the average tariff levels from about 60 in 1987 to 39 percent in 1989. Kume (2000) and Hay (2001) argue that the initial 1988-1989 tariff reduction had no significant bearing on the exposure of domestic industries to increased foreign competition due to continuous reliance on substantial NTBs. The NTBs such as import licenses, special import programs, and administrative barriers to trade were eliminated in the second stage of the reforms that started in 1990 as the Collor government endeavored to instigate productivity improvements

by domestic firms through increased foreign competition.[7] The gradual tariff reductions implemented from 1990 to 1994 lowered the average tariff from 34 percent in 1990 to 11 percent tariff in 1995. The government partially reversed these trade reforms in 1995 following the real appreciation of the *real* that lowered the competitiveness of the manufacturing sector and widened the current account deficit. Nevertheless, the average tariff climbed only slightly between 1995 and 1998.

Note that in addition to the unilateral trade liberalization that took place from 1988 to 1994, Brazil also joined Mercosur, a regional trade block comprised of Argentina, Brazil, Paraguay, and Uruguay, in 1991. Starting in 1991, Mercosur members began to reduce tariffs on intra-Mercosur trade. Yeats (1998) suggests that most of the intra-Mercosur trade was duty free by 1995, and that the declines in tariffs in Brazil's Mercosur partners may be reflected in increased Brazilian exports to Mercosur. Because we do not have information on Mercosur-related tariff reductions undertaken by Brazilian trading partners, our analysis abstracts from the potential effect of tariff reductions in large Brazilian trade partners on Brazilian industry wages. Nevertheless, in our analysis of the relationship between industry wage premiums and Brazilian import tariffs, we partially control for the impact of declines in Mercosur trade barriers on industry wages by including export-to-output ratios in our specifications.

The trade liberalization episode in Brazil provides an excellent setting to study the relationship between wages and trade for several reasons. Table 1 reports the average tariff

[7] Unfortunately, the information on NTBs is not available. This might not be very problematic. First, unlike in many developed countries, tariffs were an important policy instruments in countries such as Brazil. Second, NTBs are inherently hard if not impossible to measure. The common wisdom in the field is that the agencies collecting NTB data take great care in making the data comparable across sectors in a given year, but are less concerned with consistency of the numbers across years. This makes the use of time series data on NTBs troublesome. Finally, we control for import penetration, which partially accounts for the effect of NTBs on various labor market outcomes.

across 20 manufacturing industries from 1987 to 1998, the period of our study.[8] The average tariff declined from 60 percent in 1987 to 15.4 percent in 1998. Second, the reforms changed the structure of protection across industries, as different industries experienced different rates of tariff changes. Figure 1 plots tariffs in 1986 and 1998 in various industries. It shows that declines in tariffs differed across industries, and that the dispersion of tariffs was significantly reduced. The changing structure of protection is also reflected in relatively low year-to-year correlations of industry tariffs from 1987 to 1998. For example, the correlation coefficient between tariffs in 1987, a year preceding the trade reforms, and tariffs in 1989 is .81. The correlation between tariffs in 1987 and 1995, the year after the large reforms were completed, drops to .6. This vast variation in Brazilian tariffs across industries in a given time period and across time provides an excellent setting to study the relationship between trade and wages.

The above shifts in Brazil's trading environment are mirrored in the increase in the import penetration (defined as imports/(output+net imports)) and export exposure (defined as exports/output) reported in table 1.[9] The average import penetration increased from 5.7 % in 1987 to 11.6 % in 1998. The export to output ratio increased from 9.7% to 11.2% in 1998. While the import penetration has almost doubled during this period, it is worthwhile to note that the import penetration in Brazil continues to be relatively low when compared to a country such

[8] Tariff data was obtained from Muendler (2002) at http://socrates.berkeley.edu/~muendler/ and are based on Kume, et. al. (2000). The original data provide the tariff levels for 53 sectors at the nivel 80 industrial classification. We have aggregated the data to nivel 50 and made some additional adjustments so that the tariff information corresponds to the level of industry aggregation in the labor force data. The reported tariffs are simple averages of more disaggregated data. When constructing our tariff series, we have also experimented with using nivel 80 import penetration as weights, which yielded similar aggregate means. The correlation between the two series was .98. We thus use the tariffs constructed as simple averages throughout the paper.

[9] Data on import penetration and export to output ratio was obtained from Muendler (2002) at http://socrates.berkeley.edu/~muendler/. We made adjustments similar to those for tariffs explained in previous footnote so that the trade exposure information corresponds to the level of industry aggregation in the labor force data. We use industry level trade exposure measures that are weighted by the import penetration of the less disaggregated nivel 80 industry data. However, the correlation between the weighted import penetration series and the import penetration series based on simple averages is .99. Similarly, the correlation between the weighted export to output series and the export to output series based on simple averages is .99.

as Colombia that liberalized during the same period. Colombian manufacturing import penetration was about 21% in 1984 and significantly exceeded 30% after the 1990 tariff reductions (Pavcnik and Goldberg (2001)). This difference could potentially be attributed to a large size of Brazil relative to a country such a Colombia. Moreover, the import penetration increases in Brazil varied significantly across sectors. Figure 2 shows the evolution of industry import penetration and tariffs from 1987 to 1998. Industries with the largest surges in import penetration are clothing (industry 23), transport (industry 12), textiles (industry 22), machinery (industry 8) electronics (industry 10), and pharmaceuticals (industry 20). These are also industries that experienced large tariff declines. Moreover, table 2 lists the correlation between import penetration and tariffs (as well as lagged tariffs) in various industries. Unsurprisingly, imports and tariffs are negatively correlated (oil extraction is an exception). The correlation between industry imports and industry tariffs ranges from -.4 in steel to -.9 in electrical and electronic equipment. The correlation between import penetration and lagged tariffs in general increases in absolute value when one considers lagged tariffs.

3.2 Labor Force Data

We combine the trade exposure measures with labor market data *Pesquisa Mensal de Emprego* (PME) from *Instituto Brasileiro de Geografia e Estatística* (IBGE), the Brazilian Statistical Bureau from 1987 to 1998. The data set covers the 6 largest metropolitan areas in Brazil: São Paulo, Rio de Janeiro, Porto Alegre, Belo Horizonte, Recife, and Salvador. These metropolitan areas account for about 31.9 million people of the economic active age out of a total of 79 million. Moreover, in 1997, the states of the 6 surveyed metropolitan areas produced

72 percent of the Brazilian GNP.[10] Our findings are thus representative of the large and modern parts of the Brazilian labor market, but do not necessarily carry over to the rural economy. Because we focus on manufacturing industries, this might not be very problematic.

The data used in this paper consists of people affiliated with any of the 20 manufacturing industries. We include workers or self employed working full-time (defined as working more than 25 hours per week) between ages 15 and 65. We use the data to create several variables that capture worker demographic characteristics such as wage, age, education, geographical location, informal sector of employment, self-employment, and industry affiliation. Our wage measure is hourly wage based on monthly wage divided by 4 times the reported number of hours worked per week. We deflate the hourly wage with the monthly national price index, IPCA. All wages are thus expressed in 1997 September *reals*. The main indicator for education is completed years of schooling, which is computed using an algorithm based on three survey questions on education.[11] Based on completed years of schooling, we classify workers into those with no complete education, complete elementary education, complete lower secondary education, complete secondary education, and complete tertiary education.[12] We also distinguish whether a worker has formal or informal employment on the basis of "*carteira assinada*", a signed workcard. A signed workcard entitles a worker to several rights and benefits regulated by the labor market legislations, which enables us to classify whether or not a person works for a formal establishment that complies with labor market regulation. The variable informal is an indicator that is one if the worker is employed in the informal sector of the economy.

[10] Source: IBGE accounts of gross regional products in current market prices. Brazilian GNP was R$ 864,112 mil and the six states (São Paulo, Rio de Janeiro, Rio Grande do Sul, Minais Gerais, Pernambuco, and Bahia) together accounted for R$ 618,728 mil.

[11] The algorithm follows the standard conversion used elsewhere (see Lam and Schonie (1993) and Barros and Ramos (1996)).

[12] Elementary education in Brazil consists of four years of schooling. Secondary education, ensino medio, is comprised of two parts, 4-8 years of schooling and 9-11 years of schooling. Tertiary education runs from 12 to 15/17 years of schooling.

4. Industry Wage Premiums and Trade Policy: Results

4.1 First Stage Results

Prior to exploring whether trade liberalization affected industry wage premiums, we summarize the first stage results that are presented in table 3. Note that in addition to the independent variables presented in the table, all regressions include industry indicators and geographic indicators. First, like in previous work, we find that the following characteristics are associated with higher wages: age, being male, education, being self-employed, working in the formal sector. Second, workers experience changes in the returns to education over time. Perhaps the most noteworthy change is the decline in the wages of workers with secondary education relative both to the less-skilled (workers with no education or complete elementary) and the more skilled (workers with complete tertiary education).[13] Third, the bottom part of the table lists R2 from the regressions that estimate equation (1) with and without industry fixed effects. Note that industry affiliation plays an important role in explaining the variation in log hourly earnings. For example, in 1987 worker characteristics and regional indicators alone account for 50 percent of the total variation in log hourly wages. The addition of industry indicators to this regression increases R2 to .52, which suggests that conditional on other worker characteristics, industry indicators account for 4 percent of the total variation in log hourly wages in 1987. In general, industry indicators account for 4 to 6 percent of the total variation in log hourly wages between 1987 and 1998.

[13] Some of this, presumably, is related to the increasing abundance of workers with secondary education relative to both those with primary and university education—see Sánchez-Páramo and Schady (2003). The increases in the returns to tertiary education are not confined to workers in manufacturing industries or to urban areas. Blom, Holm-Nielsen, and Verner (2001) find similar patterns in the returns to education for workers in traded and nontraded industries. Green, Arbache, and Dickerson (2001) also document rising skill premium using data that covers rural and urban areas (PNAD).

The estimates of industry wage premiums from these regressions are reported in table 4. The industry wage premiums vary widely across industries. The estimates in 1987, for example, range from .55 in petrochemical industry to -.20 in foods. The reported estimates imply that a worker with the same observable characteristics switching from textile industry (with wage premium of -.079) to chemical industries (with wage premium of .168) in 1987 would observe a 25% (i.e. .168-(-.079)) increase in hourly wages. The standard deviation of the industry wage differentials reported at the bottom of table 4 summarizes the overall variability of the industry wage premiums. The variation in industry wage differentials in a given year ranges between 13 and 16 percent, which implies that changing between industries has a large impact on worker earnings. The variation is the largest in the period from 1992 to 1994.

The industry wage premiums tend to be highest in industries that employ a low share of unskilled workers (as measured by the share of workers without complete university degree), such as petrochemical industry, tobacco, and chemicals, while industry wage premiums tend to be lowest in industries that employ a large share of unskilled workers such food products, textiles, and clothing. In fact, the correlation of industry wage premiums with the share of unskilled workers in the industry in 1987 is always highly negative and ranges from -.89 in 1987 to -.8 in 1998.[14]

Finally, our results suggest that the structure of Brazilian industry wages does not change substantially between 1987 and 1998 even though the structure of protection has changed substantially. The year-to-year correlations in industry wage premiums are very high, with the correlation coefficient usually exceeding .9. This finding is surprising given the results from

[14] The positive correlation between industry wage premia and the share of skilled workers in an industry may be related to the fact that in Brazil unions tend to be concentrated in industries with the highest shares of skilled workers. Arbache (2001), writes that "unionization (in Brazil) is a clear characteristic of managers, skilled production workers, office workers and, in particular, professionals", and shows that unions are able to extract a large union wage premium—about 18 percent.

previous studies on Mexico and Colombia during trade liberalization episodes (see Robertson (2000), Goldberg and Pavcnik (2001)). Those studies found low year-to-year correlations of industry wages, which suggested that the trade reforms changed the structure of industry wages. The magnitude of the correlation in Brazil is in line with the evidence on wage premiums in the U.S., where wage premiums are very stable across years (year-to-year correlations are always estimated to be above 0.9).[15] The resemblance of Brazil to the U.S. could be attributed to the fact that despite the large tariff reductions, most Brazilian industries continue to face relatively low import penetration rates, which is also the case for the U.S.. The stable structure of industry wage premiums suggests that changes in trade policy are unlikely to be associated with changes in industry wage premiums. We explore this relationship in more detail in the next subsection.

4.2 Industry Wage Premiums and Tariffs

We next relate wage premiums to tariffs in the regression framework described in section 2.2. The results are reported in table 5. First, note that because we control for worker characteristics in the first stage regression, the relationship between industry wage premiums and tariffs does not simply reflect industry differences in worker composition that also affect political economy of protection. Similarly, because we allow the returns to all worker characteristics to differ from year to year in the first stage, these first stage coefficients capture changes in the economy-wide returns to various worker characteristics associated with changes in labor supply over time. Second, all second stage regressions are estimated in first differences and include year indicators; they thus account for unobserved time-invariant industry-specific variables (such as lobbying power) and macroeconomic shocks that could influence wages concurrently with tariffs.

[15] See Krueger and Summers (1988) and Gaston and Trefler (1994).

All columns of table 5 suggest no relationship between tariffs and industry wage premiums. While industry wage premiums are an important component of worker earnings, they do not seem associated with trade policy. Given that Brazil's tariff changes might overstate the extent of trade liberalization (due to its size and NTBs), we next explore whether wage premiums are affected by the alternative trade exposure measures. In addition, the inclusion of the export to output ratios in the analysis might partially control for declines in tariffs faced by Brazilian exports in Mercosur countries. We first estimate a specification in which, in addition to tariffs, we include industry measures of lagged import penetration and lagged export to output ratio.[16] The results presented in column 2 suggest that high export to output ratio is associated with higher industry wages. This result is intuitive since higher industry exports likely increase the demand for workers in that particular industry. However, we find no statistically significant effect of lagged import penetration on wage premiums. In column 3 we add the interaction of tariffs with import penetration to the specification in column 2. This captures the idea that the effects of tariffs might differ across sectors with different degree of import competition (as measured by import penetration). The insignificant interaction coefficient suggests that import penetration does not impact wage premiums differentially in industries with lower tariffs. Finally, exchange rate fluctuation might also affect wages. Although year effects capture the exchange rate fluctuation over time, one would expect that the effect of exchange rates might vary depending on trade exposure of the sector. We thus also estimate specifications in which we interact the exchange rate with lagged trade flows. As our results in column 4 indicate, however, the inclusion of exchange rates does not affect any of our previous findings.

[16] Because trade flows are likely endogenous (they depend on factor costs), we include the first lags of import and export measures in the estimation rather than their current values. Of course, to the extent that these variables are serially correlated, this approach might yield biased results, especially in industry fixed effects specifications with relatively small number of observations. Nevertheless, the inclusion of these lagged variables does not change our conclusions about the relationship between tariffs and industry wages.

Our discussion of industry wage premiums has so far abstracted from the potential role of labor market institutions such as minimum wages and union power. We believe that these factors are unlikely to affect our findings. First, the minimum wage is set at the national level and does not vary across industries. As a result, its effects are captured by the year effects in the second stage regressions, and the coefficients on education indicators in the first stage (in the case where the minimum wage is only binding for people with lower earnings). Moreover, note that any effects minimum wage changes may have had on industry wages through compositional channels, for example because some industries employ more unskilled workers than others, are already controlled for in our approach, since the first-stage regressions control for industry composition in each year, and allow the returns to various educational categories to change from year to year.

Second, regarding unionization, unfortunately our individual level data do not provide information on the union membership of each worker. If industry changes in union strength vary through time in the same manner as industry changes in tariffs and the change in unionization impacts industry wages *independently* of tariff changes, our results could potentially be biased.[17] While in the absence of union data we cannot formally address this issue, we believe that changes in unionization are unlikely to be driving our industry wage premiums results. To the extent that union power in each industry has not changed over time in Brazil, first differencing of data would capture union effects. This may in fact be a realistic assumption. While about 37% of manufacturing workers nationwide belong to the union, Arbache and Carneiro (2000) report the shares of unionized workers in various manufacturing industries in 1992 and 1995, and show

[17] Note that we are not concerned about the situation where lower tariffs reduce union power and this leads to lower wage premium, since in this case, unions simply provide a potential mechanism through which tariffs affect wages.

that the shares are relatively stable over time.[18] Moreover, we were not able to find any study that suggests that changes in union power were industry specific and were correlated with (or led to) changes in tariffs.

Finally, given that the structure of protection has changed in Brazil during our sample period, one could object that unobserved time-varying shocks, which may simultaneously affect tariff changes and sector specific skill premium, drive our results. As a result, we also account for the potential endogeneity of trade policy *changes* by instrumenting for changes in trade policy with presample tariffs and presample tariffs interacted with the exchange rate.

Our choice of instruments is guided by the institutional details of Brazilian trade liberalization. Kume (2000) suggests that at the macroeconomic level Brazil changed trade policy in response to exchange rate fluctuations. Moreover, as we discuss in section 3.1 of the paper some sectors experienced larger tariff reductions than others. This is due to the fact that tariffs were widely dispersed across sectors prior to trade reforms and that Brazil was committed to economy-wide liberalization. As a result, trade reform led to proportionately larger tariff reductions in sectors with historically higher tariff levels. Figure 3 relates the industry decline in tariffs between 1987 and 1998 to the pre-reform levels of protection in 1986 (a year prior to our sample) and illustrates a strong positive correlation between tariff declines and the 1986 tariff level. Moreover, the regression of the 1998-1987 tariff decline on 1986 tariffs yields the coefficient on 1986 tariffs of .8 (t-statistic 16.77) and R^2 of .94. This discussion suggests that the 1986 industry tariff levels, and their interaction with exchange rates, are highly correlated with the industry tariff reductions and may provide good instruments for the tariff changes. Because coffee is a major Brazilian export and coffee prices likely affect the exchange rate, we

[18] The correlation between industry union membership in 1992 and 1995 is .82. They use data from PNAD. During the trade liberalization of the early 1990s, these data are not available for 1991 and 1994; moreover, the surveys for 1989 and 1990 do not contain information on union status.

have also experimented with the interaction of coffee prices rather than exchange rates with presample tariffs as an instrument. We estimate the relationship between sector specific skill premiums and tariffs in first differences using 2SLS. In particular, in columns 5-7 we instrument for tariff changes with presample tariffs, and their interaction with the exchange rate (column 5) and presample tariffs and their interactions with coffee prices (column 6 and 7).[19] While the magnitude of the negative coefficient on tariffs becomes increases in absolute value, the coefficients are imprecisely estimated. Thus we continue to find no statistical relationship between trade policy and industry wage premiums.

Overall, there is no statistically significant evidence that Brazilian trade liberalization affected the industry wage structure and thus wage inequality between skilled and unskilled workers via industry affiliation. This finding is consistent with the evidence from Mexico by Feliciano (2001), who finds no relationship between industry wages and tariffs, but is inconsistent with the evidence from Colombia by Goldberg and Pavcnik (2001) and Mexico by Revenga (1997), who find that tariff reductions are associated with declines in industry wages.

4.3. Industry Wage Premiums for University Educated Workers

Although we find no relationship between trade exposure and industry wage premiums, trade policy could still account for part of the increase in the return to university-educated workers if tariff reductions are associated with increases in sector specific skill premiums. Industry wage premiums could differ across workers with differing degrees of education for several reasons. For example, the more educated workers might be more or less mobile in the labor market. Or, workers with different amounts of education might differ in the accumulation of their sector specific skills or ability to bargain over wages. In fact, Revenga (1997) finds that

[19] The first-stage F-statistics in these 2SLS regressions are F(12, 207)=30.5, F(12,207)=25.5, and F(16,203)=19.3, respectively.

the greater the proportion of unskilled workers in an industry, the lower the ability of workers in an industry to capture part of industry rents in Mexico. Finally, industry specific skill premiums might reflect efficiency wages paid to skilled workers to prevent them from shirking if industries face different monitoring costs. Robbins and Minowa (1996), for example, find substantial variation in returns to schooling across industries for manufacturing workers in Sao Paolo, Brazil in 1977. They attribute these differences to efficiency wages that firms pay to skilled workers in capital intensive industries to avoid shirking.

To investigate the relationship between industry specific skill premiums and trade policy in our data, we compute skill specific industry wage premiums by employing a modified version of equation (1) that allows industry wage premiums to differ for skilled and unskilled workers:

$$\ln(w_{ijt}) = H_{ijt}\beta_H + I_{ijt} * wp_{jt} + I_{ijt} * S_{ijt} * wp_{Sjt} + \varepsilon_{ijt}$$

The variable S_{it} is an indicator for whether worker i in industry j is skilled (i.e. has complete university degree). The coefficients wp_{jtS} represent the incremental wage premium skilled workers earn in industry j *in addition* to the base wage premium in industry j wp_{jt}, which is received by unskilled and skilled workers. By relating these industry specific returns to skill to trade policy measures in the second stage of the estimation along the lines discussed in section 2.2, we investigate the differential impact of trade policy on industry wages of skilled and unskilled workers, respectively.

Our first-stage results suggest that sector specific skill premiums are potentially important. Table 6 reports industry specific skill premiums—the coefficients on the interaction term I_{ijt}*S_{ijt} above--for all industries and years in our sample.[20] While the inclusion of industry

[20] As in the case of industry wage premiums, the reported coefficients and standard errors are computed using Haisken DeNew and Schmidt (1997) procedure.

specific skill premiums does not increase the explanatory power of the regression by much, the premiums vary widely across industries.[21] University educated workers in tobacco industry and oil extraction have largest skill premiums, while university educated workers in paper and clothing have the lowest skill premiums. For example, estimates for 1987 suggest that a university educated worker that switches from textile to chemical industry would observe an almost 14 percent increase in wages through the channel of industry specific skill premium. We summarize the overall variability of industry specific skill premiums with the standard deviation of the industry specific skill premiums reported at the bottom of table 6. The variable ranges between 10 and 20 percent in various years.

We next investigate whether changes in sector-specific skill premiums are associated with changes in trade policy. The regression results reported in column 1 of table 7 reveal no statistical association between tariff changes and changes in industry specific skill-premiums. In columns 2-4 we consider whether other trade exposure measures are also related to sector-specific skill premiums. Two findings emerge. First, the relationship between tariffs and sector specific skill premiums is robust to the inclusion of other trade exposure measures. Second, while we find no relationship between sector specific skill premium and import penetration, increases in export to output ratio within an industry are associated with increases in skill premium in that industry. Finally, in columns 5-7 we instrument for tariff changes with presample tariffs, and their interaction with the exchange rate (column 5) and presample tariffs and their interactions with coffee prices (column 6 and 7).[22] We continue to find negative, but

[21] R2 in these regressions are basically identical to those in regressions with industry fixed effects reported at the bottom of table 3 (i.e row R-squared) at two decimal points.
[22] The first-stage F-statistics in these 2SLS regressions are F(12, 207)=26.8, F(12,207)=22.3 and F(16,203)=17.5, respectively.

statistically insignificant relationship between tariff changes and changes in industry specific skill premiums.

In sum, our evidence suggests that changes in sector specific skill premiums are not statistically associated with changes in trade policy in Brazil. As a result, we find no statistically significant evidence that trade liberalization was associated with increases in wage inequality between skilled and unskilled workers through changes in industry specific skill premiums.

5. Conclusions

This paper explores the relationship between trade policy and industry wage premiums in Brazil during the 1980s and 1990s. Our empirical results suggest that while industry wage premiums are in fact an important component of worker earnings, their structure is relatively stable over time. We find no statistical association between changes in industry wage premiums and changes in trade policy. We also find no relationship between tariff declines and changes in industry specific skill premiums. In sum, for the case of Brazil we find no evidence that tariff reductions affected worker wages through their industry affiliation, or that tariff reductions contributed to wage inequality between skilled and unskilled workers through this channel.

The analysis in this paper was in part motivated by the current policy discussion on the benefits and costs of trade reforms. Many have recently questioned whether the potential benefits of trade liberalization (i.e., increased efficiency and welfare) outweigh the potential costs of trade reforms (i.e., increased inequality, potential "race to the bottom" in wages). Moreover, several studies have recently debated the use of labor market policies, such as minimum wages and government social protection programs, to offset the potential increase in inequality associated with trade liberalization (Rama (2001), Rama and Ravalion (2001), Rama

(2003)). Against this background, our work contributes to the policy debate in the following ways.

First, our study is one of a few that focuses on trade *policy* variables (such as tariffs) rather than *outcome* variables (such as openness) when examining the implications of trade reforms for labor markets. We view the use of trade policy variables as an advantage. Rodriguez and Rodrik (1999) have recently pointed out the difficulties in assessing the impact of trade liberalization if trade reforms are measured using outcome variables such as openness, which reflect not only a country's trade policy, but also factors such as transport costs, technology, demand, and most importantly, changes in factor prices.[23]

Second, globalization opponents often claim that trade reforms make workers in previously protected sectors poorer, and that trade liberalizations leads to a "race to the bottom" in wages. In fact, some studies report results that are potentially consistent with this claim. For example, Goldberg and Pavcnik (2001) and Revenga (1997) find that tariff reductions are associated with declines in industry wage premiums in Colombia and Mexico. This within country evidence is also supported by cross-country studies such as Rama (2001), and Freeman, Oostendrop, and Rama (2001), who find some evidence of a negative association between openness and wages in the short run. Rama (2001, 2003) has suggested that trade liberalization could potentially be accompanied by increases in minimum wages to compensate the potential losers. The evidence from Brazil suggests that trade liberalization does not necessarily lead to lower industry wages in the short run. Exploring the differences in country characteristics or

[23]One disadvantage of the tariff measures is that changes in tariffs may have little effect if there continue to be large non-tariff barriers. While detailed information on non-tariff barriers is not available, as we discuss in section 3.1, trade liberalization also significantly reduced non-tariff barriers. Moreover, our findings are essentially unaffected by the inclusion of measures of openness, such as (lagged) import penetration and the export to output ratio that partially accounts for the effects of non-tariff barriers.

policies that determine how trade reform impacts worker wages may thus provide a fruitful ground for future research.

Finally, while we do not find any evidence that drastic tariff declines worsened inequality through changes in the structure of wage premiums, we do find that industry wage premiums vary widely across Brazilian manufacturing sectors, accounting for 4 to 6% of variation in log hourly wages. In addition, industry wage premiums are smallest in sectors with high shares of unskilled workers. This seems to suggest that unskilled workers earn relatively low wages not only because of the growing economy-wide skill premium, but also because they are employed disproportionately more in industries with low wage premiums. This latter source of inequality between skilled and unskilled persists throughout our sample and has been undetected in previous studies. As is the case with the rising skill premium, this source of inequality could potentially be addressed through labor market policies such as changes in minimum wages and social security programs like the ones promoted by Rama (2001), in addition to improved access to education.

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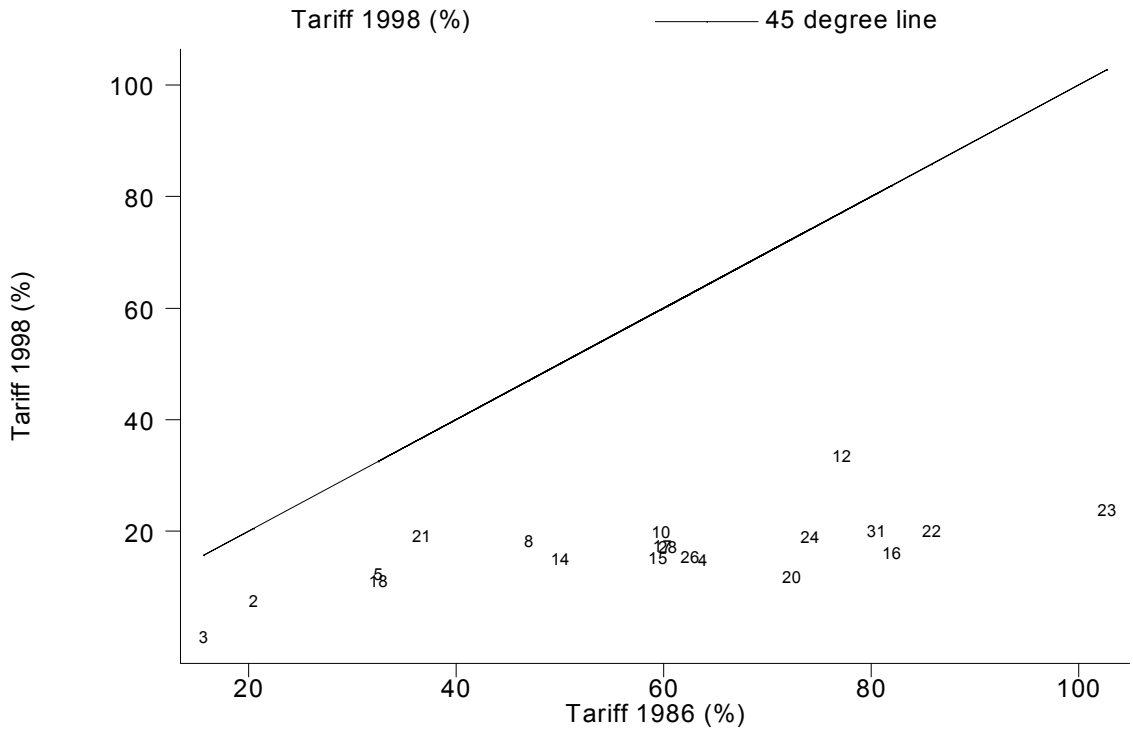
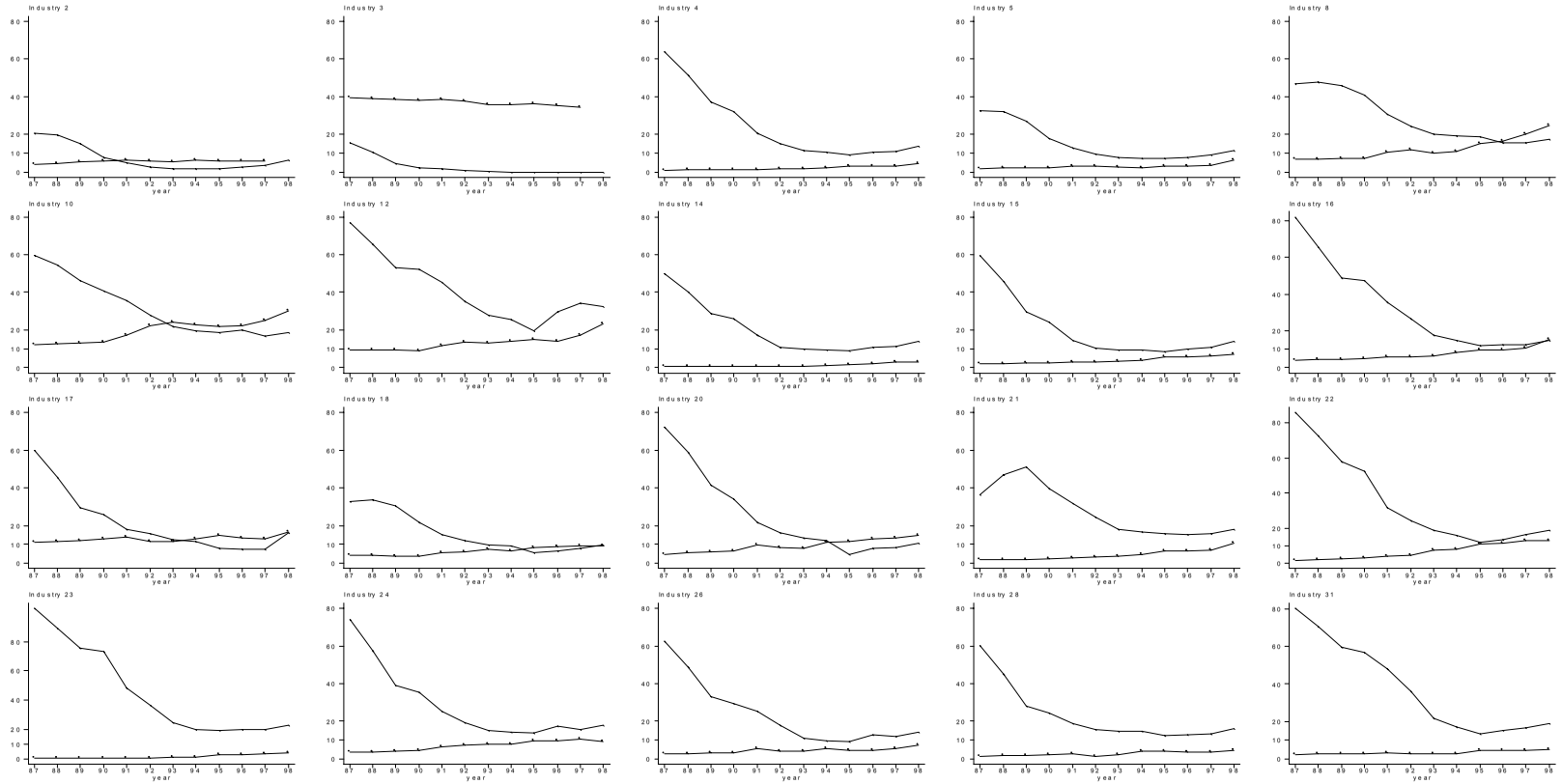
Figure 1—Tariffs in 1986 and 1998



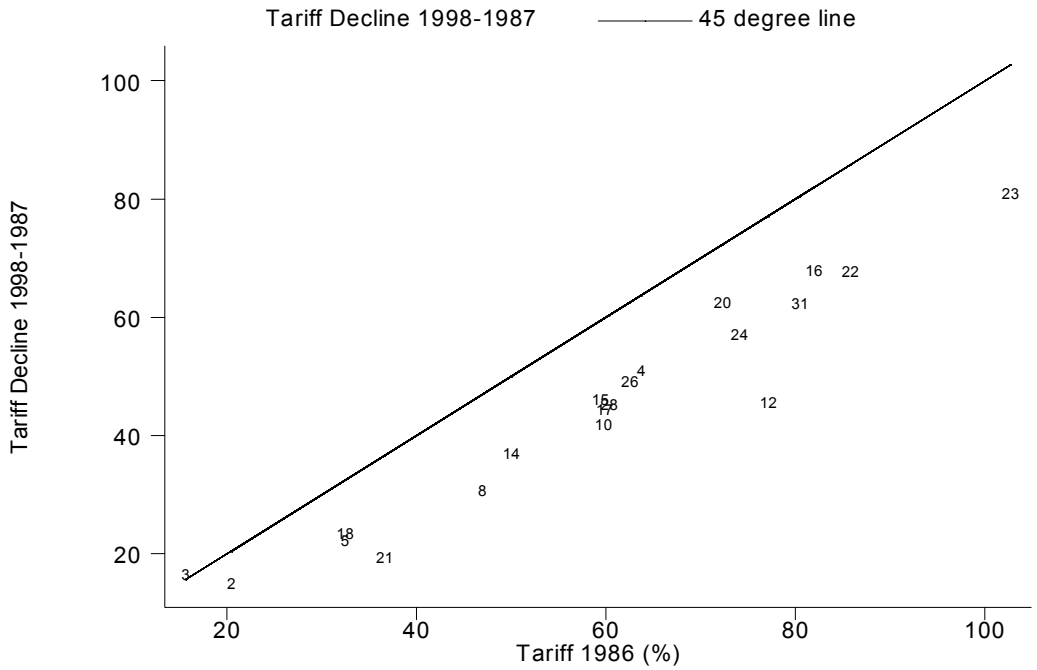
Note: Symbols are industry codes.

Figure 2—Industry Import Penetration and Tariffs



Note: import penetration (circles), tariff (line)

Figure 3—Tariff Decline 1998-1987 and Tariffs in 1986



Note: Symbols are industry codes.

Table 1--Trade Policy and Trade Exposure 1987-1998

Year	Tariffs		Import Penetration		Export to Output	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
1987	58.8	22.8	.057	.086	.097	.112
1988	50.1	18.3	.059	.085	.095	.113
1989	39.1	16.4	.061	.084	.094	.115
1990	34.1	17.0	.064	.084	.092	.116
1991	25.2	13.3	.076	.086	.109	.124
1992	19.1	10.3	.077	.088	.134	.136
1993	14.4	7.2	.080	.084	.130	.132
1994	12.9	6.2	.086	.083	.115	.112
1995	10.9	5.7	.098	.081	.110	.108
1996	12.5	6.6	.098	.081	.114	.118
1997	12.8	7.0	.106	.083	.117	.122
1998	15.4	6.5	.116	.078	.112	.101

Note: There are 20 industries in each year except in 1998 in the case of import penetration and export to output variable, where we are missing the information on two industries.

Table 2--Correlation of Industry Import Penetration and Tariffs

Industry Name	Industry Code	Correlation	
		current tariff	lagged tarriff
Mineral Extraction	2	-.88	-.69
Oil Extraction	3	.73	.75
Non-metalic Mineral Trasformation	4	-.66	-.73
Metalic Products and Steel	5	-.44	-.46
Machinery and Equipment	8	-.80	-.83
Electrical and Electronic Equipment	10	-.91	-.91
Transportation Vehicles	12	-.65	-.66
Wood and Furniture	14	-.51	-.62
Paper, Pulp and Cardboard	15	-.61	-.68
Rubber products	16	-.74	-.79
Chemicals	17	-.53	-.52
Petrochemicals	18	-.87	-.95
Pharmaceuticals	20	-.83	-.85
Plastics	21	-.74	-.82
Textiles	22	-.83	-.89
Clothing	23	-.71	-.79
Footwear	24	-.85	-.89
Tobacco	26	-.71	-.74
Foods	28	-.60	-.63
Beverages	31	-.69	-.78

Table 3--First Stage Regression Results

	87	88	89	90	91	92	93	94	95	96	97	98
age	0.067**	0.065**	0.064**	0.063**	0.059**	0.052**	0.054**	0.061**	0.056**	0.059**	0.059**	0.058**
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.003]
age squared	-0.001**	-0.001**	-0.001**	-0.001**	-0.001**	-0.001**	-0.001**	-0.001**	-0.001**	-0.001**	-0.001**	-0.001**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
female	-0.452**	-0.440**	-0.462**	-0.450**	-0.424**	-0.458**	-0.430**	-0.442**	-0.438**	-0.392**	-0.384**	-0.387**
	[0.010]	[0.010]	[0.011]	[0.012]	[0.011]	[0.013]	[0.013]	[0.013]	[0.012]	[0.012]	[0.012]	[0.018]
elementary education	0.268**	0.258**	0.252**	0.251**	0.227**	0.220**	0.219**	0.183**	0.190**	0.183**	0.202**	0.187**
	[0.006]	[0.006]	[0.007]	[0.008]	[0.007]	[0.008]	[0.009]	[0.009]	[0.008]	[0.008]	[0.009]	[0.013]
lower secondary education	0.572**	0.551**	0.542**	0.523**	0.484**	0.452**	0.442**	0.430**	0.425**	0.421**	0.436**	0.421**
	[0.008]	[0.008]	[0.009]	[0.009]	[0.009]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.015]
upper secondary education	1.079**	1.047**	1.051**	1.035**	0.951**	0.931**	0.922**	0.933**	0.906**	0.868**	0.867**	0.843**
	[0.008]	[0.008]	[0.009]	[0.010]	[0.009]	[0.010]	[0.011]	[0.011]	[0.010]	[0.010]	[0.010]	[0.015]
tertiary education	1.823**	1.862**	1.880**	1.897**	1.831**	1.762**	1.795**	1.806**	1.778**	1.804**	1.766**	1.725**
	[0.010]	[0.011]	[0.012]	[0.013]	[0.012]	[0.014]	[0.014]	[0.015]	[0.014]	[0.014]	[0.014]	[0.021]
self-employed	0.091**	0.099**	0.119**	0.148**	0.097**	0.021	0.044**	0.078**	0.137**	0.072**	0.069**	0.074**
	[0.016]	[0.016]	[0.018]	[0.018]	[0.016]	[0.017]	[0.017]	[0.017]	[0.016]	[0.015]	[0.015]	[0.022]
informal	-0.162**	-0.238**	-0.220**	-0.162**	-0.158**	-0.265**	-0.254**	-0.205**	-0.136**	-0.124**	-0.130**	-0.165**
	[0.010]	[0.010]	[0.012]	[0.012]	[0.011]	[0.012]	[0.011]	[0.011]	[0.011]	[0.010]	[0.010]	[0.015]
R-squared	0.52	0.54	0.52	0.52	0.53	0.51	0.51	0.5	0.52	0.53	0.53	0.52
R-squared without industry indicators	0.50	0.52	0.50	0.50	0.51	0.48	0.48	0.47	0.50	0.51	0.50	0.49
Variation attributed to industry indicators	.04	.04	.04	.04	.04	.06	.06	.06	.04	.04	.06	.06
Observations	65455	58659	48881	47983	44818	38447	36720	38080	37159	34933	34122	16307

Note: ** indicates significance at 5% level. All regressions also include industry indicators and regional indicators.

Table 4--Industry Wage Premiums

	87	88	89	90	91	92	93	94	95	96	97	98
Mineral Extraction	.238	.216	.115	.109	.142	.189	.166	.164	.037	.178	.269	.146
	(.023)	(.024)	(.027)	(.028)	(.026)	(.029)	(.030)	(.031)	(.032)	(.029)	(.030)	(.042)
Oil Extraction	.092	.003	.036	.071	.102	.085	.089	.048	.014	.079	.094	.124
	(.019)	(.020)	(.025)	(.026)	(.026)	(.026)	(.030)	(.030)	(.030)	(.031)	(.029)	(.044)
Non-metalic Mineral Trasformation	-.137	-.096	-.083	-.155	-.135	-.090	-.118	-.128	-.115	-.106	-.077	-.135
	(.010)	(.011)	(.012)	(.012)	(.012)	(.013)	(.014)	(.014)	(.014)	(.014)	(.015)	(.021)
Metalic Products and Steel	.021	.021	.027	.022	.012	.022	.001	.010	.016	-.010	-.009	.001
	(.005)	(.006)	(.006)	(.007)	(.006)	(.007)	(.007)	(.007)	(.007)	(.007)	(.007)	(.010)
Machinery and Equipment	.129	.114	.083	.141	.110	.111	.093	.095	.103	.136	.091	.149
	(.008)	(.009)	(.010)	(.011)	(.011)	(.012)	(.013)	(.014)	(.012)	(.013)	(.013)	(.019)
Electrical and Electronic Equipment	.051	.095	.105	.062	.085	.089	.104	.147	.088	.109	.079	.089
	(.009)	(.010)	(.011)	(.011)	(.011)	(.014)	(.015)	(.015)	(.015)	(.015)	(.015)	(.022)
Transportation Vehicles	.085	.133	.125	.098	.139	.227	.231	.215	.202	.198	.170	.183
	(.007)	(.007)	(.008)	(.009)	(.009)	(.010)	(.009)	(.010)	(.009)	(.010)	(.010)	(.014)
Wood and Furniture	-.097	-.147	-.114	-.107	-.098	-.141	-.117	-.155	-.087	-.056	-.095	-.078
	(.010)	(.011)	(.012)	(.012)	(.012)	(.013)	(.013)	(.013)	(.012)	(.012)	(.012)	(.017)
Paper, Pulp and Cardboard	-.031	-.048	-.019	.013	-.002	-.029	-.025	.029	.041	.030	.062	.070
	(.009)	(.010)	(.011)	(.010)	(.010)	(.011)	(.012)	(.012)	(.011)	(.011)	(.011)	(.016)
Rubber products	.057	.060	-.019	-.021	-.011	.002	.030	.062	.089	-.032	.019	.014
	(.018)	(.018)	(.021)	(.022)	(.019)	(.023)	(.023)	(.023)	(.023)	(.024)	(.025)	(.034)
Chemicals	.168	.172	.155	.200	.174	.178	.136	.168	.111	.088	.131	.085
	(.010)	(.010)	(.011)	(.012)	(.012)	(.014)	(.014)	(.015)	(.015)	(.015)	(.016)	(.025)
Petrochemicals	.550	.446	.426	.510	.396	.449	.440	.558	.468	.450	.468	.421
	(.016)	(.017)	(.019)	(.021)	(.019)	(.021)	(.024)	(.026)	(.024)	(.024)	(.022)	(.033)
Pharmaceuticals	.012	.015	.034	.053	.094	.018	.041	.046	.079	.089	.090	.162
	(.016)	(.017)	(.020)	(.020)	(.019)	(.022)	(.021)	(.022)	(.022)	(.020)	(.020)	(.030)
Plastics	-.081	-.071	-.082	-.070	-.025	-.086	-.057	-.051	-.092	-.098	-.091	-.101
	(.014)	(.015)	(.016)	(.016)	(.016)	(.018)	(.019)	(.019)	(.017)	(.017)	(.017)	(.025)
Textiles	-.079	-.095	-.037	-.060	-.077	-.089	-.065	-.124	-.117	-.073	-.080	-.120
	(.011)	(.011)	(.013)	(.014)	(.013)	(.015)	(.016)	(.016)	(.016)	(.018)	(.019)	(.029)
Clothing	-.141	-.177	-.133	-.155	-.144	-.196	-.180	-.210	-.146	-.145	-.178	-.159
	(.013)	(.013)	(.015)	(.015)	(.015)	(.017)	(.016)	(.016)	(.015)	(.016)	(.016)	(.024)
Footwear	-.118	-.187	-.165	-.150	-.169	-.194	-.117	-.084	-.131	-.172	-.161	-.193
	(.011)	(.012)	(.013)	(.014)	(.013)	(.016)	(.015)	(.014)	(.013)	(.014)	(.014)	(.021)
Tobacco	.232	.332	.201	.116	.275	.395	.441	.288	.198	.047	.001	.277
	(.041)	(.042)	(.048)	(.051)	(.053)	(.055)	(.058)	(.056)	(.056)	(.065)	(.064)	(.100)
Foods	-.197	-.190	-.210	-.185	-.167	-.199	-.199	-.219	-.190	-.149	-.146	-.177
	(.008)	(.008)	(.009)	(.009)	(.008)	(.009)	(.009)	(.009)	(.009)	(.009)	(.009)	(.013)
Beverages	-.110	-.070	-.122	-.138	-.135	-.132	-.074	-.023	-.026	-.062	-.064	-.060
	(.015)	(.016)	(.018)	(.019)	(.018)	(.020)	(.021)	(.021)	(.020)	(.021)	(.023)	(.032)
Standard Deviation of Industry Premiums	.135	.138	.128	.135	.127	.154	.143	.156	.133	.128	.131	.137

Note: Industry Wage premiums and their standard errors are calculated using Haisken-Denew procedure.

Table 5-- Industry Wage Premiums and Trade Exposure

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tariff	-.0686	-.0560	-.0483	-.0575	-.1594	-.1547	-.1461
	[0.0599]	[0.0543]	[0.0506]	[0.0558]	[0.1130]	[0.1099]	[0.1118]
Lagged Import Penetration		.1508	.1747	.2059			.1323
		[0.2134]	[0.2403]	[0.2305]			[0.2136]
Lagged Export to output		0.2642*	0.2627*	0.2618**			0.2605**
		[0.1298]	[0.1291]	[0.1174]			[0.1173]
Tariff*Lagged Imp. Penetration			-.2276				
			[0.6633]				
Lagged Imports*Ex.Rate				-.1154			-.1252
				[0.0972]			[0.1028]
Lagged Exports*Ex. Rate				-.0233			-.0250
				[0.0824]			[0.0844]
2SLS	no	no	no	no	yes	yes	yes
First Differences	yes	yes	yes	yes	yes	yes	yes
Year Indicators	yes	yes	yes	yes	yes	yes	yes

Note: ** and * indicate 5 and 10 % significance, respectively. Reported standard errors are robust and clustered by industry. N is 240. In column 5, tariff changes are instrumented for by exchange rate interacted with presample tariffs and presample tariffs. In column 6 and 7, tariff changes are instrumented for by coffee prices interacted with presample tariffs and presample tariffs.

Table 6--Industry Specific College Skill Premiums

	87	88	89	90	91	92	93	94	95	96	97	98
Mineral Extraction	.220	.242	.311	.389	.181	-.029	.088	.383	.370	.283	.153	.426
	(.058)	(.057)	(.068)	(.074)	(.084)	(.074)	(.074)	(.099)	(.089)	(.079)	(.082)	(.121)
Oil Extraction	.242	.639	.374	.429	.382	.275	.611	.719	.555	.412	.298	.246
	(.068)	(.068)	(.087)	(.081)	(.074)	(.094)	(.108)	(.124)	(.109)	(.105)	(.110)	(.142)
Non-metalic Mineral Trasformation	.092	.259	.135	.218	.297	.248	.201	.358	.335	.459	.187	-.006
	(.042)	(.049)	(.063)	(.070)	(.064)	(.064)	(.058)	(.062)	(.063)	(.052)	(.066)	(.090)
Metalic Products and Steel	.143	.055	.152	.133	.124	.110	.102	.136	.097	.147	.150	.048
	(.023)	(.023)	(.027)	(.028)	(.028)	(.030)	(.030)	(.033)	(.032)	(.031)	(.032)	(.052)
Machinery and Equipment	-.032	-.088	-.117	-.172	-.067	-.119	-.035	-.211	-.166	-.108	-.004	-.055
	(.033)	(.031)	(.035)	(.037)	(.035)	(.044)	(.047)	(.051)	(.048)	(.043)	(.043)	(.064)
Electrical and Electronic Equipment	-.001	.019	.016	-.043	-.110	-.001	-.061	.062	.046	.051	.021	.005
	(.028)	(.028)	(.033)	(.032)	(.032)	(.039)	(.041)	(.042)	(.040)	(.039)	(.040)	(.062)
Transportation Vehicles	-.089	-.158	-.232	-.134	-.121	-.010	-.027	-.063	-.104	-.205	-.128	.029
	(.030)	(.030)	(.035)	(.033)	(.034)	(.039)	(.035)	(.042)	(.039)	(.040)	(.037)	(.053)
Wood and Furniture	-.145	-.009	.072	.077	-.096	-.525	-.662	-.353	-.367	-.641	-.439	-.061
	(.084)	(.079)	(.081)	(.082)	(.092)	(.112)	(.122)	(.108)	(.085)	(.095)	(.096)	(.116)
Paper, Pulp and Cardboard	-.322	-.197	-.086	-.223	-.287	-.147	-.104	-.081	-.136	-.149	-.212	-.086
	(.032)	(.035)	(.037)	(.039)	(.036)	(.038)	(.039)	(.041)	(.036)	(.037)	(.036)	(.050)
Rubber products	-.036	-.278	-.182	-.010	.002	-.055	.269	-.067	.026	.047	-.095	.012
	(.069)	(.072)	(.083)	(.084)	(.078)	(.098)	(.104)	(.115)	(.119)	(.099)	(.098)	(.173)
Chemicals	.124	.013	.028	-.024	.036	-.037	.006	-.094	-.038	.000	.089	.173
	(.027)	(.027)	(.031)	(.029)	(.030)	(.038)	(.040)	(.043)	(.042)	(.039)	(.040)	(.066)
Petrochemicals	-.063	-.086	-.113	-.139	-.056	.042	-.128	-.117	-.021	-.259	-.170	-.219
	(.034)	(.035)	(.043)	(.042)	(.040)	(.046)	(.047)	(.054)	(.052)	(.054)	(.047)	(.067)
Pharmaceuticals	-.120	-.110	-.181	.139	.140	-.153	-.082	-.221	.031	-.080	.041	.009
	(.044)	(.045)	(.054)	(.058)	(.054)	(.067)	(.062)	(.065)	(.064)	(.054)	(.056)	(.080)
Plastics	-.077	.033	-.122	.042	.110	-.065	-.007	.176	.029	.123	.194	-.111
	(.060)	(.067)	(.072)	(.074)	(.079)	(.097)	(.087)	(.094)	(.073)	(.076)	(.067)	(.095)
Textiles	-.014	.085	.196	.156	-.025	.063	-.048	-.030	-.169	.006	.030	.021
	(.050)	(.056)	(.059)	(.067)	(.057)	(.070)	(.074)	(.073)	(.072)	(.085)	(.082)	(.104)
Clothing	-.358	-.441	-.355	-.124	-.299	-.384	-.424	-.599	-.404	-.378	-.248	-.001
	(.072)	(.070)	(.083)	(.083)	(.077)	(.088)	(.095)	(.126)	(.113)	(.095)	(.082)	(.144)
Footwear	-.041	.079	-.352	-.174	-.397	.280	.159	.013	-.107	-.120	.115	.301
	(.089)	(.099)	(.124)	(.112)	(.088)	(.104)	(.184)	(.111)	(.094)	(.109)	(.108)	(.264)
Tobacco	.040	.630	.687	.424	.237	-.054	.164	-.060	-.157	-.465	-.223	.456
	(.133)	(.150)	(.192)	(.182)	(.157)	(.149)	(.193)	(.207)	(.268)	(.204)	(.151)	(.313)
Foods	.082	.173	.215	.262	.238	.121	.071	.024	.104	.140	.038	.050
	(.037)	(.038)	(.043)	(.044)	(.041)	(.047)	(.047)	(.049)	(.050)	(.046)	(.042)	(.059)
Beverages	.258	.255	.046	-.030	.321	.140	.330	.299	.370	.220	.413	-.204
	(.073)	(.073)	(.087)	(.084)	(.073)	(.079)	(.104)	(.090)	(.094)	(.092)	(.085)	(.117)
Standard Deviation	.139	.163	.157	.156	.163	.122	.138	.175	.156	.198	.147	.098

Note: Industry Wage premiums and their standard errors are calculated using Haisken-Denew procedure.

Table 7-- Industry Specific Skill Premiums for University Graduates and Trade Exposure

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tariff	-.1948	-.1334	-.2211	-.1296	-.0091	-.1667	-.1427
	[0.1678]	[0.1810]	[0.2003]	[0.1833]	[0.1663]	[0.1104]	[0.1388]
Lagged Import Penetration		-.1567	-.3449	-.2708			-.2819
		[0.5131]	[0.5667]	[0.5346]			[0.5456]
Lagged Export to output		1.3691**	1.3740**	1.2357**			1.2342**
		[0.3443]	[0.3509]	[0.4161]			[0.4137]
Tariff*Lagged Imp. Penetration			2.0329				
			[1.9014]				
Lagged Imports*Ex.Rate				.2845			.2834
				[0.3351]			[0.3383]
Lagged Exports*Ex. Rate				.4136			.4134
				[0.2934]			[0.2928]
2SLS	no	no	no	no	yes	yes	yes
First Differences	yes	yes	yes	yes	yes	yes	yes
Year Indicators	yes	yes	yes	yes	yes	yes	yes

Note: ** and * indicate 5 and 10 % significance, respectively. Reported standard errors are robust and clustered by industry. N is 240. In column 5, tariff changes are instrumented for by exchange rate interacted with presample tariffs and presample tariffs. In column 6 and 7, tariff changes are instrumented for by coffee prices interacted with presample tariffs and presample tariffs.