Decomposing the Effect of Trade on the Gender Wage Gap *

Felipe Benguria † Josh Ederington ‡

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Abstract

This paper utilizes variation in exposure to increased Chinese imports in Brazil to investigate the impact of trade on gender wage inequality. First, using Brazilian census data, we find that rising imports reduced the gender wage gap in Brazilian local labor markets. Next, using Oaxaca-Blinder decompositions, we show that this reduction in the wage gap was largely explained by trade increasing the share of female workers in higher-paying occupations. Finally, we utilize a matched employer-employee dataset to investigate how individual workers adjust to the trade shock. Similar to the local labor market analysis, we find that male workers exposed to increased import competition saw a larger decline in both wages and cumulative earnings relative to female workers. In addition, we uncover an interesting asymmetry in that, while male workers exhibited much higher degrees of industry mobility in response to the trade shock, female workers exhibited a higher degree of occupational mobility.

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†Department of Economics, University of Kentucky (fbe225@uky.edu).

‡Department of Economics, University of Kentucky (ederington@uky.edu).

1. Introduction

It is a well-established fact that, globally, women make less than men even after controlling for individual characteristics such as age and education. While much attention has been paid to the impacts of globalization on income inequality, only recently has there developed a literature looking at the impact of globalization on the gender wage gap.[1] In this paper we exploit variation across local labor markets in exposure to Chinese import competition and ask how trade shocks (i.e., increased foreign competition) impacts gender wage inequality.[2] We leverage a rich census of Brazil's population and decompose the gender wage gap into components related to the sorting of women and men across jobs and components related to discrimination or differences in bargaining outcomes. This allows us to provide insight into the channels through which trade impacts Brazil's gender wage gap, and quantitatively benchmark the importance of the various theories put forth to explain this link. We then take advantage of longitudinal data on formal sector workers in Brazil to study male and female mobility across industries and occupations in response to rising import competition, and how this mobility shapes the impact of the shock on wages.

During the time period under consideration (2000-2010) imports from the rest of the world to Brazil increased by 128% in real terms, while imports from China soared by an astonishing 1617%. Thus, the "China trade shock" in Brazil seems an ideal episode to study the impact of foreign competition on labor market outcomes, as the increase in import competition is driven primarily by China's productivity growth and integration into world markets. Indeed, in a recent paper Costa et al. [2016] show that trade with China has had a significant impact on the distribution of income across regions in Brazil.[3] Thus, this paper utilizes this episode to investigate how increased import competition in Brazil impacted the long-running gender wage gap in the Brazilian labor market.

We first show that more exposed Brazilian regions saw a larger decline in the gender wage gap compared to less exposed regions, with a 1.0 log point difference between regions at the 80th and 20th percentiles of trade exposure. This represents an important mitigation of the overall 10 log points gender wage gap in Brazil during this period. The question then becomes the mechanism by which foreign competition might be having a differential effect on male and female wages. A key advantage of using regional variation and worker-level data is that we can estimate Oaxaca-Blinder decompositions to divide regional gender wage gaps into their different components and see which component import competition is influencing. We use a three-fold decomposition which divides the gender wage gap into a part due to observable differences in the characteristics of workers (the *explained* component), a part due to differences in returns (the *unexplained* component) and a part which captures the interactions between the two (the *interaction* term). Estimating our regional trade exposure regressions on each of these components, we find that (when comparing regions at the 80th and 20th percentiles of trade exposure) the 1.0 log point decline in the wage gap is due almost entirely a reduction in the *explained* portion

[1] For research on globalization and inequality see survey articles by Goldberg and Pavcnik [2007] and Harrison et al. [2011]. For research on the gender wage gap see the survey article by Blau and Kahn [2008].

[2] Other papers that have taken a local labor markets approach to the impact of trade liberalization on labor market outcomes include Autor et al. [2013] Topalova [2010], Kovak [2013] and Hakobyan and McLaren [2016].

[3] See Autor et al. [2016] for a review of research using the "China trade shock" as a source of variation in exposure to foreign competition. Similar to Autor et al. [2013] we instrument for the growth in Brazilian imports from China by using Chinese import growth to other countries.

of the wage gap. More specifically, we find it is due to changes in observed occupational differences between male and female workers.

Next, we decompose this change in the occupation component of the (explained) gender wage gap into the part due to changes in the labor share of male and female workers in different occupations and the part due to changes in overall occupation returns. We find the majority of the decline in this component is coming from changes in the observed differences between male and female workers in occupational employment. Intuitively, this result suggests that exposure to Chinese imports is reducing the gender wage gap by increasing the share of female workers in higher-paying occupations (at least in the more trade-exposed regions).[4]

Next, we use an employer-employee census of Brazil's formal sector workforce which allows for a longitudinal study of how male and female worker mobility across occupations or industries responds to the import shock. The recent trade literature has started to involve more longitudinal studies of how workers respond to trade-induced job shocks (e.g., see Autor et al. [2014] and Dix-Carneiro and Kovak [2019]). We undertake a similar analysis but focusing on the differential response of male and female workers. Specifically, following workers over time, we compare the cumulative labor market outcomes of workers with similar characteristics and pre-shock labor market histories, but who are employed in industries with different degrees of exposure to rising import competition. First, consistent with the regional analysis, we show that male workers more exposed to increased import competition suffered a larger decline in both wages and cumulative earnings relative to female workers. Then, we examine how mobility shapes these differential impacts on earnings. We find that the male workers are much more likely to switch industries than female workers (indeed, estimates for cumulative hours of employment outside the initial industry are typically over 60 percent higher for male workers than female workers). Despite these high levels of industry mobility, we find no evidence of occupation switching among male workers in response to the trade shock. In contrast, we do find that female workers in more exposed industries, were more likely to switch occupations. Thus, there appear to be significant differences in how male and female workers respond to trade-induced shocks to the labor market with respect to industry vs occupational mobility.

In what follows, Section 2 provides a theoretical discussion of channels through which trade integration can impact the gender wage gap as well as a discussion of the literature on trade and gender specific labor market outcomes. Section 3 provides a brief discussion of the data while Section 4 describes important institutional features of Brazil's labor market and provides evidence on the gender wage gap in Brazil (at both the national and regional levels). Section 5 then provides our primary estimates of the impact of the China trade shock on labor market outcomes (for both male and female workers). Section 6 conducts our empirical decompositions in which we see through which channels trade is influencing the gender wage gap. Section 7 uses individual-level longitudinal data to examine the impact of the trade shock on mobility and wages. Finally, Section 8 concludes.

[4]This result is potentially consistent with either foreign competition breaking down discriminatory barriers to hiring female workers in traditionally male occupation, as in Ederington et al. [2009], or inducing technology upgrading that is more complementary to female skills as in Juhn et al. [2014].

2. Trade and the Gender Wage Gap

In this paper we investigate the impact of increased import competition on the gender wage gap. Of course this raises the question of why trade might have a differential effect on male and female wages. In a recent survey, Blau and Kahn [2017] discusses the literature on gender wage inequality, including the role of human capital, discrimination, compensating wage differentials and selection into the workforce, as well as more recent research on the role of firm pay policies. Competitive forces could influence the gender wage gap through several of these channels and the trade episode we study provides a unique opportunity to study their overall effect on the gender wage gap as well as the mechanisms through which they act.

One possibility arises from gender segregation in the labor market. Specifically, due often to cultural/social norms, their is a tendency for males and females to sort into different industries, occupations and even educational groups. Thus, to the extent that trade impacts industries, occupations or skill groups differently, then it can have also have an impact on the relative demand for female labor. For example, foreign competition could induce changes in the production process (e.g., technology upgrading as in Bustos [2011]) that impact the demand for different occupations and thus occupation wages (even within the same industry). Indeed, this is roughly the story behind a sequence of papers (Juhn et al. [2013] and Juhn et al. [2014]) that argue that trade liberalization might induce firms to acquire new technologies that are more complementary to female labor. A second possibility arises from Becker-type competitive forces: increased foreign competition reducing discriminatory behavior by firms. For example, Ederington et al. [2009] suggests that trade might reduce firm-level discrimination against female workers by increasing the cost of engaging in discriminatory behavior. A third possibility arises from potential changes in bargaining power. For example, Card et al. [2016] argues that a significant portion of the overall gender wage gap is due to the combined facts that "primarily male" occupations have greater bargaining power than "primarily female" occupations (i.e., receive a higher share of firm-wide rents) and that male workers tend to receive larger shares of firm rents than female workers even within occupational groups. They hypothesize that male and female workers might be treated differently in the firm wage-setting process due to differences in the elasticity of labor supply (e.g., as in Barth and Dale-Olsen [2009]). Thus, trade-induced changes in the labor market might impact this bargaining game between firms and workers and thus, potentially, the gender wage gap.

These differential mechanisms provide the main motivation behind our decompositions as our empirical approach aims to provide insight into the mechanism by which the China trade shock affects the gender wage gap in Brazil.[5] For example, if the trade shock was reducing the gender wage gap primarily through increasing the returns to education (since female workers in Brazil tend to have higher levels of education attainment), than we would expect to see this result in a relative decline in the "education" component of the gender wage gap in the more trade-exposed regions. Such a decomposition might be

[5]It should be noted that while our approach can provide insight into the mechanism by which the China trade shock reduced the gender wage gap in Brazil, it cannot provide definite proof of any given theory. For example, if we observe trade exposure being correlated with the movement of female workers into previously male-dominated occupations/industries, it could be due to reduced discrimination in hiring decisions, but also could be due to unobserved differences in male and female workers (even for very precisely defined occupations). Likewise, a decline in the overall *unexplained* wage gap is consistent with a change in bargaining power story as in Card et al. [2016] but is also potentially consistent with a reduced discrimination story.

particularly relevant for insight into whether or not Brazilian results are likely to be replicated in other countries as it might suggest similar results will not apply to countries where higher-education is more male-dominated.

2.1. Related Literature.

Our paper is related to a small but growing body of literature that investigates the impact of globalization on the gender wage gap. In general, these previous papers have exploited industry variation in trade exposure to import competition. Black and Brainerd [2004] find that U.S. industries facing larger increases in import competition observed declines in the gender wage gap (at least within a set of industries that were already non-competitive). Aguayo-Tellez et al. [2014] studies Mexico's trade integration in the context of NAFTA finding an increase in the relative demand for female labor, especially within industries. Motivated by this finding, Juhn et al. [2013] and Juhn et al. [2014] develop a theory featuring complementarities between technology adoption and female labor, and show that Mexican firms in industries that saw the largest foreign tariff reductions, post-NAFTA, tended to engage in technology upgrading and increase both relative female wages and employment. Finally, Ederington et al. [2009] use the Colombian trade liberalization episode of the 1980's and find that firms facing the greatest increase in foreign competition tended to increase the female share of their employment. The first key contribution of our paper relative to this literature is to quantify the various channels through which exposure to import competition impacts the gender wage gap, nesting the mechanisms explored in each paper. The second contribution is to use longitudinal individual-level data to show how mobility across industries or occupations in response to the shock shapes these differential wage losses.

Our paper is obviously complementary to the majority of the previous literature as, in Section 5, we exploit regional variation in exposure to increased import competition from China.[6] In this sense, the paper most directly related to ours is Gaddis and Pieters [2017] that exploited regional variation in exposure to the Brazilian trade liberalization episode of the 1990's to observe the impact of foreign competition on labor force participation. They find that trade liberalization did reduce participation rates, but did not find any statistically significant differences between male and female participation. In related work studying the impact of trade on employment, Yahmed and Bombarda [2020] find that the Mexico tariff liberalization episode induced highly-skilled women to transition into the formal sector. Obviously we are using a different time period (2000-2010) and different trade episode (China trade shock), but the main difference is we investigate the impact of trade on wages (as opposed to just employment) which allows us to explore and quantify the mechanisms through which trade impacts the gender wage gap through our use of the wage decomposition exercises.

Other papers that have exploited regional variation to import competition and focusing on gender differentials are Hakobyan and McLaren [2017] and Brussevich [2018] which both use U.S. data. Hakobyan and McLaren [2017] find that, following NAFTA, married blue-collar women in regions more

[6] Of course, the use of regional variation depends on assumptions about labor mobility. If labor is highly mobile across regions, then this mobility would suppress any wage differentials thus making it harder to identify the impact of trade at the regional level. However, Autor et al. [2013], provide evidence (some - Dix-Carneiro [2014]- based on Brazilian data) that regional adjustment to labor demand shocks tends to be slow and incomplete, thus making the regional approach plausible. In Section 4 we provide evidence on regional Brazilian migration rates and in Section 5 we find little evidence of a correlation between import exposure and regional population.

exposed to import competition suffered larger wage losses than other demographic groups. After exploring various competing explanations that can't fully account for this result, the authors state the result presents a puzzle. In contrast, Brussevich [2018] find that increased import competition actually increased relative female wages in the U.S. Interestingly, she traces this to labor market segregation across sectors in the U.S. with male-workers being more prevalent in traded manufacturing industries and their being significant costs to switching sectors. Similar to Brussevich [2018] we find that increased import competition reduces the gender wage gap, although our decomposition excercises point more to the importance of labor market segregation across occupations as an explanation.[7]

Finally, in Section 7, we extend our analysis by using administrative longitudinal data to consider how individual male and female workers adjust to rising Chinese import competition. Our empirical approach in this section is directly related to that of Autor et al. [2014] which focuses on the U.S. experience and Dix-Carneiro and Kovak [2019] which focuses on an earlier Brazilian trade liberalization episode. However, our analysis is focused on the differential experience of male and female workers in responding to foreign competition and how that experience is shaped by mobility across not just industries but also occupations. The only paper we know of that similarly utilizes individual-level longitudinal data and is focused on gender differences is Keller and Utar [2018].[8] Keller and Utar [2018] find that the removal of quotas on textile imports in Denmark led young women in exposed industries to shift away from the labor market towards family, becoming more likely to marry and have children. One main difference with this paper is in our goal: to quantify the extent to which sorting and returns shape the impact of the shock on male and female workers differently. A second key difference is in the context, as in Brazil (and developing countries more in general) there are wide differences in the exposure to these types of shocks, as males and females work to a large extent in different industries and occupations. Thus, our results are driven more by initial levels of gender segregation in the labor market, in comparison to Denmark where the difference across genders seems to be related to differential gender roles with respect to child-rearing.

3. Data Sources

Demographic Census Our first data source, used in the regional analysis of the impact of import competition, is the Demographic Census of 1991, 2000, and 2010, which is collected by the Instituto Brasileiro de Geografia e Estatística (IBGE).[9] We study the response to rising import competition between 2000 and 2010, and use the 1991 wave to build control variables. These data contain a wealth of demographic characteristics and labor market outcomes for all individuals, and is representative of the Brazilian population. We focus on individuals most likely to be in the labor force (ages 15-59) in each wave. We observe workers age, gender, educational attainment, municipality, employment status,

[7] Brussevich [2018] does not include occupational switching but, in her conclusion, she points to the link between gender wage differences and occupational mobility as being an important area for future work.

[8] While all of the work cited above focuses on the impact of import competition on wage or employment differences between genders, a recent paper, Bøler et al. [2018], focuses on the relationship between exporting and the gender wage gap and documents that exporting firms exhibit a higher gender wage gap than non-exporting firms for college-educated workers.

[9] IBGE provides an (approximately) 10% sample in 2000 and 2010, and a 25% sample in 1991.

industry and occupation of employment, and hourly wage.[10] The definition of formality follows the literature and is based on whether workers have a signed work card.

We approximate the concept of local labor market using microregions, as has been common in the literature [Kovak, 2013, Costa et al., 2016, Dix-Carneiro and Kovak, 2017, 2019, Dix-Carneiro et al., 2018].[11] These are regional units defined by IBGE. Following Costa et al. [2016] we aggregate the data to 412 microregions whose boundaries are consistent over time (this allows us to control for pre-trends in our specifications as some microregions had changed borders over time).

3.1. RAIS

The second data source used is a detailed administrative census of workers in Brazil denominated RAIS (Relação Anual de Informações Sociais).[12] This data is collected annually by the Brazilian government for social security purposes and covers the universe of formal-sector employment. We use RAIS for the longitudinal analysis in Section 7.

RAIS has several advantages that are key to our empirical strategy. First, these data allow us to track workers over time to analyze the long-term adjustment to the import competition shock. Second, it contains a large set of detailed variables describing labor market outcomes and worker characteristics, including educational attainment, gender, age, occupation, industry and municipality. In each job spell and year, the data reports average monthly earnings, which is our measure of earnings.[13] We also observe the identity of firms at which workers are employed. Similar to the regional analysis, we track the response of worker outcomes to trade exposure over the years 1999-2010 and use 1996-1998 data to construct controls.

Of course, the limitation of the RAIS dataset is that we do not have information on workers who are not formally employed. Thus, while we can observe a worker no longer being employed in the formal sector, we cannot observe whether they are out of the labor force, unemployed or simply informally employed. As a result our estimates, in Section 7, on the impact of import competition on formal sector earnings should be likely interpreted as an upper-bound as workers could potentially offset any losses through informal sector earnings. However, we feel this focus on the formal sector remains worthwhile as the formal sector provides a host of benefits and labor market protections not found in the informal sector and thus transitioning out of the formal sector, even if just to the informal sector, is likely correlated with a loss of welfare.[14]

[10]We follow Costa et al. [2016] in the computation of hourly wages, dividing monthly wages by the number of hours worked (equal to reported weekly wages times 4.33). We measure wages in 2010 levels using the IPCA consumer price index.

[11]Brazil is divided into 558 microregions, which are grouped into 27 states and 5 macroregions. As a point of comparison, there are 741 commuting zones in the U.S. (a country approximately 15 percent larger and 50 percent more populous).

[12]Other papers that have used RAIS include Helpman et al. [2017], Dix-Carneiro [2014], Dix-Carneiro and Kovak [2015], Krishna et al. [2014] and Alvarez et al. [2018].

[13]Following the literature (e.g., see Alvarez et al. [2018]) when workers report more than one job in a given year we choose the one with the longest duration and, if a worker has more than one job of equal duration we choose the highest paying one.

[14]For example, formal sector workers in Brazil do enjoy some protections against "unfair dismissal" such as a one-month pre-notification and an established system (the *Fundo de Garantia por Tempo de Serviçõ*-FGTS) to provide monetary compensation to any dismissed workers. In addition, we do not find any evidence that transitions between the formal and informal sector (either in aggregate or gender specific) were correlated with trade exposure (see Section 5).

3.2. Trade Data

In our analysis of local labor markets we use the measures of regional trade exposure constructed by Costa et al. [2016].They build a concordance to match trade flows to the CNAE-Domiciliar industry classification of the Demographic Census. They inflate trade flows in USD using the US GDP deflator, such that values correspond to 2010 dollars. In our worker-level longitudinal analysis we construct industry-level measures of trade exposure using a concordance provided by IBGE to assign trade flows to CNAE 3-digit industries in RAIS. We also inflate trade flows in USD using the US GDP deflator.

4. The Brazilian Labor Market and Gender Wage Gap

As mentioned, our data includes a sample of the entire population which includes formal workers (25 percent in 2000), those employed in the informal sector (30 percent), unemployed (10 percent) and out of the labor force (35 percent). Using Brazil's Demographic Census we compute the share of the population (broken down into male and female) in each of these 4 categories for both 2000 and 2010 and report the results in Table 1. As can be seen, during the time period under consideration (2000-2010) the share of workers employed in the formal sector increases from 23.9% to 30.7% with both male and female workers exhibiting similar upward shifts. In large part this increase in formal sector employment comes from a decline in overall unemployment rates (from 10.7% to 6.0%). However, also note that the men and women in our sample do exhibit different trajectories with respect to labor force participation rates with the share of men in the labor force decreasing from 79.3% in 2000 to 76.1% in 2010 while the share of women in the labor force increased from 51.6% to 56.7%.

Brazilian labor market legislation mostly dates to the establishment of the Labor Code (*Consolidação das Leis do Trabalho* - CLT) in 1943. This established a system where formal workers kept a signed work card (*cartera de trabalho*) which committed workers and firms to a system which established minimum working conditions and benefits as well as labor courts to negotiate disputes. The last major reform of the system prior to our study was the 1988 constitutional change which increased worker protections (in the formal sector), strengthened union autonomy and removed some aspects of (direct) government interference in the labor market. The current minimum wage system was also created by the 1998 constitutional change and established a nationally unified minimum wage. The Brazilian minimum wage is designed to provide a "worker's basic needs" and, as such, is adjusted regularly (for example, to account for rising prices). Indeed over the time period of our study, the minimum wage rose by 76% from 152 Reais in 2000 to 268 Reais in 2010 (measured in constant year 2000 Reais). However, the share of workers with wages equal to or less than the minimum wage declined over this time period. Specifically, 33 percent of female workers in our sample had wages equal to or below the minimum wage in 2000 compared to 27 percent of male workers. In the year 2010 the respective numbers were 15 percent (a decrease of 18 percentage points) for females and 12 percent (a decrease of 15 percentage points) for males. It should be noted that, since the minimum wage is set at the national level and our study exploits variation across regions, any uniform rise in the national minimum wage should not directly bias our estimates.[15] However, the Brazilian system does provide state governments the

[15] Although, the presence of a minimum wage could indirectly influence our results as a general downward pressure on wages generated by increased import competition could differentially reduce male wages if female worker wages are more

flexibility to set wage floors above those of the national government. Thus, all our specifications include state-level fixed effects to control for any potential differential changes in state wage floors during the time period.

The Brazilian formal labor market is also characterized by fairly common collective bargaining arrangements between employee unions and firms (which could also establish their own unions). Data from Brazil's annual household survey PNAD indicates that the share of unionized workers was almost constant during this period, ranging from 17.3% in 2001 to 18.3% in 2009. (The unionization rate is much higher in the formal sector, at 50% and 52% in 2001 and 2009). Union membership is slightly more common for male than for female workers. The unionization rate increased very slightly during this period from 16.0% to 16.9% for female workers and from 18.3% to 19.3% for male workers.

Inter-regional mobility in Brazil is fairly low, and has remained stable during the period under study. From the RAIS data of formal sector workers we can calculate that each year around 6 percent of workers were employed in a different region in the previous period. In 2000 the annual regional mobility rate for female workers (within our sample of formal workers) was 3.5 percent, while for male workers it was 6.4 percent. For the year 2010, these migration rates were 4.3 percent and 8.2 percent respectively.[16] In addition, in Section 5 we find no evidence that exposure to import competition is correlated with regional population which suggests limited regional migration in response to the trade shock.

4.1. Gender Wage Gap in Brazil

If one just looks at average wages of male and female employees in our Census sample , one finds that women are paid about 17 percent less.[17] However, this wage gap could be due to observable differences in worker characteristics between male and female workers (other than simply gender). For example, if one looks at Table 2, one finds that, in Brazil, female workers are typically younger than their male colleagues, making up 39% of workers in the age 15-19 category, but only 31% of those aged 55-59. On the other hand, women are typically more highly educated comprising 50% of workers with tertiary education and only 32% of those workers with primary education.

Likewise, male and female workers are not uniformly distributed over industries or occupations in Brazil. From Tables 3 and 4 we see that women are predominately employed in industries such as education, social work or apparel manufacturing (with a female employment share of about 84%). In contrast, men are disproportionately employed in mining, construction and the manufacture of wood and metal products (all industries where women make up less than 10% of workers). Similarly, men are overwhelmingly employed in occupations such as workers in steel plants or in machine maintenance while women are much more likely to be employed as teachers, clerks or textile workers.

Thus, to get an idea of both the size and reasons for the gender wage gap in Brazil we estimate a Oaxaca-Blinder decomposition on wages for the years 2000 and 2010 (Blinder [1973] and Oaxaca [1973]). Specifically, let W_M and W_F be the means of the natural logs of male (M) and female (F) wages.

likely to be bounded by the wage floor. Even if the minimum wage were creating relative wage changes, one would expect it's influence to appear in the *unexplained* portion of our wage decomposition (i.e., trade reducing wages of male workers relative to otherwise similar female workers). As we discuss later, we find that the China trade shock is actually impacting relative wages through changes in the *explained* portion of the gender wage gap.

[16] As a basis of comparison, Molloy et al. [2011] using IRS data reports annual migration rates for the U.S. of 5-7 percent at the county level and 2-3 percent at the state level.

[17] For more information on the gender wage gap in Brazil see Marquez Garcia et al. [2009].

Estimating a standard log wage model separately for male and female workers, one can express the log wage differential as

$$W_M - W_F = \left(\bar{X}_M - \bar{X}_F\right) \cdot \beta_M + (\beta_M - \beta_F) \cdot \bar{X}_M + \left(\bar{X}_M - \bar{X}_F\right) \cdot (\beta_F - \beta_M), \tag{1}$$

where $\bar{X}_M$ and $\bar{X}_F$ are vectors of the means of the regressors for male and female workers and β_M and β_F are the estimated coefficients. Thus, we can decompose the difference between female and male log wages into a part explained by differences in the regressors (the *explained* component), a term reflecting differences in the returns as well as the intercepts (the *unexplained* component), and a term capturing the interaction between these two components (the *interaction* term). The regressors are age, education, industry of employment and occupation. We split individuals into 4 different categories of educational attainment, 9 age groups, 59 industries (at the 2-digit level) and 43 occupational categories (at the 2-digit level).[18]

Note that our base specification is a three-fold decomposition which evaluates the explained component in terms of male wage coefficients (i.e., the expected change in average male wages if men had similar regressors as women) and the unexplained component in terms of male regressors (i.e., the expected change in average male wages if men had similar coefficients as women). It is also common in the discrimination literature to specify a "non-discriminatory" coefficients vector which can be used to create a two-fold decomposition (e.g., see Oaxaca [1973]). We also estimate our regressions using a two-fold specification and receive very similar results but find our three-fold decomposition cleaner to interpret with respect to our later trade-exposure regressions and thus present those results throughout the paper.

National Gender Wage Gap. The results of the Oaxaca-Blinder decomposition for 2000 are reported in Table 5. As can be seen, women are paid, on average, about 10.1 log points less than males overall in Brazil.[19] This wage gap of 10.1 log points is due entirely to a significant unexplained difference in returns (19.2 log points). Indeed, the portion of the wage gap that can be explained by male employees having different observable characteristics than female employees actually significantly reduces the overall wage gap in Brazil (resulting in a 8.6 log point decrease of the wage gap). Specifically, female workers in Brazil are more highly educated than male workers (as discussed in the previous section) and this tendency for female workers to have higher eduction levels reduces the overall wage gap (and the portion due to explained characteristics) by 5.4 log points.

Note that while there is little movement in the overall gender wage gap in Brazil over the decade, this disguises the fact that the explained portion of the wage gap declined by 4.6 log points (from 8.6 log points in 2000 to 4 log points in 2010). In addition, this decline is fairly consistent across industries, occupations and levels of educational attainment. Thus, the question addressed in this paper is not only how different levels of exposure to import competition is correlated with the changes in the overall wage gap, but also how exposure is correlated with changes in the different components of the wage gap.

[18] Our educational categories correspond to those i) without formal education, ii) with primary education, iii) with secondary education, and iv) with tertiary education. Age groups are 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54 and 55-59 years old.

[19] Specifically, the -0.101 coefficient in Table 5 is the difference between the mean of the log wage across women and the mean of the log wage across men.

Regional Wage Gaps. As mentioned in Section 3, the geographic unit of observation is a microregion, which is an official Brazilian geographical unit that encompasses groups of neighboring municipalities with strong commuting ties, and thus serves as a good proxy for a local labor market (see discussion in Gaddis and Pieters [2017]). Table 6 provides evidence on the regional distribution of the gender gaps in hourly wages, employment, and labor force participation. The majority of regions have wage differentials of around 15-25 percent (the median of the distribution is at .825). However, there is a large degree of variability across regions as moving from the 25th percentile to the 75th percentile increases the female/male wage ratio from .770 to .863. In addition, the female share of the labor force and employment are typically in the range of 32-44 percent (median = .406 and .382 respectively).

5. Empirical Framework and Overall Results

In a recent paper Autor et al. [2013] use the "China shock" (rising import competition from China over the past decade) to investigate the impact of foreign trade on local wages and employment in the U.S.. Basically, they assume that regional variation in industry employment will be correlated with a region's exposure to foreign competition (i.e., a region specializing in industries which are also Chinese export goods will experience a larger increase in foreign competition). In this section we utilize a similar strategy to consider the effects of the growth of Chinese exports on wages and employment in Brazilian regions and how that shock might have differentially affected male and female workers

There are several reasons to expect that the growth of Chinese exports would have a significant impact on local labor markets in Brazil. First, there was a significant rise in Brazilian imports from China due to the rapid growth in the Chinese economy. As can be seen in Figure 1, imports from China rose abruptly, especially over the period 2000-2010, relative to overall imports. Indeed, the share of imports from China rose from 2.2 percent in 2000 to 14.4 percent in 2010.

However, there is also significant regional variation in exposure to this "China Shock" due to differential industry specialization. China has a pronounced comparative advantage in certain labor-intensive industries (see Amiti and Freund [2010]), and thus, for example, textile imports from China to Brazil increased between 2000-2010 by 637 USD per worker (in real terms using 2000 figures as base). In contrast, an industry like food and beverages only saw an increase in China imports of 133 USD per worker. Thus, variation in industry specialization across Brazilian regions would lead to large differences in exposure to this "China shock".

Our measure of regional exposure to the increase in import competition from China follows Autor et al. [2013] and, even more specifically, Costa et al. [2016] in utilizing an IV strategy that is adapted to the Brazilian experience. First, we define the increase in import competition faced by region r between 2000 and 2010 as the weighted average of industry-level imports with weights given by industry-level employment shares for that region in the initial year ($\frac{L_{ir}}{L_r}$) and imports normalized by national industry employment (L_i):

$$\Delta IP_r = \sum_i \frac{L_{ir}}{L_r} \cdot \frac{\Delta M_i}{L_i}. \tag{2}$$

In this equation ΔM_i is the difference in imports from China in each industry i between 2000 and 2010. Thus, we are measuring variation in a region's exposure to the China trade shock through variation in the industry structure of Brazilian regions (i.e., regions which are more specialized in import-intensive industries are considered to be more exposed).

Summary statistics for regional exposure to growth in Chinese imports (ΔIP_r) are given in Table 7 and also summarized by Figure 2. As can be seen, there is a significant degree of variation across regions as our measure of regional exposure increases by a factor of 5 in moving from a region at the 20th percentile ($\Delta IP_r = 0.129$) to a region at the 80th percentile ($\Delta IP = 0.691$). In Figure 2, we provide a map of Brazil which demonstrates the geographic variation across regions in exposure to Chinese import shocks. One item that stands out is that there is some degree of clustering with many of the more exposed regions located on the coast. This is another reason why all our specifications include state-level fixed effects - to control for potential geographic differences across regions.

However, a concern with the above measure is that trade with China might be correlated with domestic industry demand and productivity shocks. Thus, we follow Costa et al. [2016] by constructing an instrument for ΔIP_r by using a non-Brazil measure of exposure ($\Delta IP_r^{\text{OTHER}}$) with weights according to Brazilian regional employment shares but using contemporaneous exports from China to other (non-Brazil) countries :

$$\Delta IP_r^{\text{OTHER}} = \sum_i \frac{L_{ir}}{L_r} \cdot \frac{\Delta M_i^{\text{OTHER}}}{L_i}. \tag{3}$$

Here $\Delta M_i^{\text{OTHER}}$ is the growth in imports in each industry i from China to the rest of the world. This IV strategy will assist with identification provided that increased Chinese imports are due to Chinese growth or falling trade costs and not due to correlations in productivity or demand shocks across our set of countries (e.g., a negative Brazilian productivity or demand shock correlated with shocks in other countries).[20]

A regression of the "raw" measure of trade exposure (ΔIP_r) on the "IV" measure (ΔIP_r^{OTHER}) and the controls (i.e., equivalent to the first-stage regression) results in a coefficient of 0.018 (s.e. 0.001) with a t-statistic of 34.23 and R-squared of .98.[21] This strength of the instrument reflects the fact that Chinese export growth to other countries is a strong predictor of Brazilian import growth from China.

5.1. The China Trade Shock and the Gender Wage Gap

Our baseline specification is a regression of regional exposure to increased Chinese import competition on changes in regional wages and employment in Brazil:

$$\Delta Y_r = \beta_1 \cdot \Delta IP_r + \beta_2 \cdot X_r^0 + \epsilon_r. \tag{4}$$

The dependent variable is the change in log wage, log labor force or log population (from 2000-2010) for region r while ΔIP_r is the change in region r's trade exposure (defined in the previous section - we also instrument for the change in import exposure as discussed). The geographic unit of observation is a

[20] See Autor et al. [2013] for a detailed discussion of the assumptions behind this IV strategy. We also consider an alternative instrument using a set of low and middle income countries and results are similar. In Section 5.2 we provide results for an alternate instrument suggested by Costa et al. [2016], which we describe in Appendix A.2.

[21] An F-test of the exclusion restriction suggests that we can reject the hypothesis that our instruments are weak. See discussion in Appendix A.3.

microregion and the set of controls in X_r^0 include demographic characteristics that might independently impact employment outcomes: share of employment in agriculture and mining, share of employment in manufacturing, share of employment in the public sector, share of employed population, share of informal employment, (log) total population, share of female employment and share of skilled employment (all measured for both 1991 and 2000). Along with the rapid growth in imports from China, Costa et al. [2016] also document a rapid growth in Brazilian export markets. Thus, all specifications also include measures of regional exposure to a Chinese export demand "shock" following Costa et al. [2016] as an additional control variable.[22] Finally, all specifications include state-level fixed effects.

First, consider the effect of the trade shock on the change in the average of log hourly earnings.[23] The results of this estimation are given in panel A (*Wages*) and columns 1 and 2 of Table 8. In that table, coefficients and standard errors are multiplied by 100. The first column (*All-OLS*) reports the raw coefficient estimates of β_1 for OLS estimation while the second column (*All-IV*) reports estimates for our instrumental variables approach. As can be seen, the coefficient estimates are negative (higher regional exposure to increased import competition is correlated with lower average hourly wages) but not statistically significant.[24]

Second, we reestimate (4) where the dependent variable is now the change in the gender wage gap (i.e., the change in average log male wage minus average log female wage) and report the results in columns 3 (*Male/Female Gap - OLS*) and 4 (*Male/Female Gap - IV*) of Table 8. These results suggest that increased import competition in Brazil reduced the gender wage gap. To interpret the magnitude of the estimate note that the the difference in the trade exposure measure between the 80th and 20th percentiles is 0.56. This means that in moving from the 20th percentile to the 80th percentile of regional exposure is associated with a 0.56 x 1.7 = 1 log point decrease in the gender wage gap. This can be compared to the overall gender wage gap in Brazil of around 10 log points (see Section 4). Thus, we find that exposure to increased import competition in China does appear to be leading to a statistically and economically significant decline in the gender wage gap in the more exposed regions.

Next, consider the effect of the trade shock on regional population and labor force. The results, when the dependent variable is the change in the (log) regional population, are given in Panel B (*Population*) and columns 1 and 2 of Table 8. As can be seen there is little evidence that exposure to increased import competition is appreciably impacting regional migration patterns as estimates are small and statistically insignificant. In columns 3 and 4 we consider the differential in male and female population counts (i.e., log male population minus log female population). In this case the estimate is marginally statistically significant but quite small.[25] Thus, at least at the local labor market level, we fail to find evidence that foreign competition appears to be having a noticeable impact on aggregate population. However,

[22] Details of the construction of export demand exposure are provided in Appendix A.3. While export demand exposure was correlated with general changes in labor market outcomes, we found no evidence that the export demand shock had a differential impact on male and female workers.

[23] Note that these results should be treated with caution as the dependent variable is mean regional wages and thus if less-skilled (lower wage) workers are more likely to lose their employment as a result of the negative trade shock, our estimates will be biased towards zero. However, this is part of the justification for our later decomposition exercises in Section 6.

[24] The negative but statistically insignificant estimates are not surprising as we are following the Costa et al. [2016] approach to measuring regional exposure and they also estimate negative but statistically insignificant effects on log hourly wages.

[25] The magnitude of the estimated coefficient is such that moving from the 20to 80th percentile of trade exposure is associated with a 0.2 log point decline in the male population relative to the female population. This estimate becomes statistically insignificant in some of our robustness exercises.

this is fortunate for our wage decomposition exercise as is suggests large changes in population (due, for example, to regional migration) are not suppressing our identification of differential wage changes across regions.

Finally, Panel C (*Labor Force*) of Table 8 provides estimates when the dependent variable is the change in the log of the count of people in the labor force (i.e., formal workers plus informal workers plus unemployed). As before columns 1 and 2 provide estimates for the effect of import exposure on overall labor force participation while columns 3 and 4 provide estimates on the differential impact across male and female workers (i.e., the dependent variable is the log labor force count of male workers minus the log count of female workers). As can be seen in columns 1 and 2, there is little evidence that import exposure is affecting overall labor force participation as the estimates are small and statistically insignificant. However, this lack of change in overall labor force participation is masking some interesting difference across male and female workers. Specifically, in columns 3 and 4, we observe a decline in the *relative* labor force participation of female workers. In terms of magnitude, moving from the 20th to 80th percentile of trade exposure is associated with a 0.56 x 2.9 = 1.6 log point decrease (i.e., approximately a 1.6% decrease) in the female to male labor force gap. While this result, that increased import competition reduced female participation (in relative terms) in the labor force, differs from that of Gaddis and Pieters [2017] (which found little evidence of gender differences in labor force participation arising from the Brazilian trade liberalization episode of the 1990's), it is consistent with Keller and Utar [2018] which found that trade liberalization in Denmark led to decreased female participation in the labor market.

5.2. Robustness

In this section we consider several robustness checks to our main result: that increased import competition is associated with a reduction in the gender wage gap. Results of the various specifications are provided in Table 9.

First, Costa et al. [2016] express a concern that correlated world-level shocks might invalidate the traditional IV design and suggests a second IV which utilizes a regression approach to attempt to remove global changes in prices and quantities from the IV measure. Thus, in Column 1, we provide estimates using this second suggested instrument as a robustness check (details of it's construction are provided in the Appendix A.3).

Another concern is that the correlation between import exposure and the gender wage gap is simply a continuation of pre-existing regional labor market trends. In this respect, the primary concern would be the Brazilian trade liberalization episode of the early 1990s. This episode has been shown to have had a significant impact on local labor markets (see e.g. Dix-Carneiro and Kovak [2017]) and could have had delayed impacts on the regional labor markets in our sample. Thus, in order to account for such pre-sample-period trends, we undertake two robustness checks. First, in column 2, we include a lag of the dependent variable (i.e., the 1991-2000 change in the regional gender wage gap). Second, in column 3, we control for a regional measure of exposure to the tariff cuts of the early 1990's.[26] In column 4, we include both the pretrends and the measure of tariff cuts. As can be seen, results remain statistically significant and are of similar magnitude.

[26]The definition of this variable is provided in Appendix A.4.

Finally, in column 5 we use the change in the gender wage gap from 1991 to 2000 instead of the difference from 2000 to 2010 as the dependent variable in our base IV specification. The estimates show no statistically significant relationship between the growth in import exposure between 2000 and 2010 and pretrends in the gender wage gap which is consistent with our results of column 2 (in which the addition of the pretrends as a control variable did not appreciably change our estimates).

5.3. Additional Results

Finally, we consider some additional mechanisms by which import competition might be influencing labor market outcomes (and, potentially, the gender wage gap). First, we previously mentioned the fairly significant differences between the formal and informal sectors of the Brazilian economy. Thus, in Panel A of Table 10, we provide the results for our log wage regressions where the sample is restricted to formal sector workers. Columns 1 and 2 (*All*) are the results for the change in the average (log) wage of formal sector workers in the region and the dependent variable in Columns 3 and 4 (*Male/Female Gap*) is the regional gender wage gap for the formal sector (i.e., average log wages of male formal workers minus average log wages of female formal workers). Estimates are quite consistent with the full sample results of Table 8 with a negative (and statistically insignificant) effect of import exposure on formal sector wages and a negative (and statistically significant) affect of import exposure on the gender wage gap. In this case, the estimated impact of import exposure on the gender wage gap is even greater when one restricts the sample to the formal sector.

Second, in Panel B of Table 10, we provide results for regressions whose dependent variable is the change in the regional employment rates between 2000 and 2010 (i.e., percent of the labor force that is employed). As before, Columns 1 and 2 provide an estimate for the impact of import competition on the overall employment rate while Columns 3 and 4 provide an estimate of the differential impact on male and female workers (i.e., the change in the male employment rate minus the change in the female employment rate). As can be seen, we see no evidence that increased competition from China is affecting employment rates. Thus, while import exposure might be decreasing the relative number of female workers in the labor force (see Table 8) it does not appear to be having an appreciable effect on rates of employment across male and female workers.

Third, several papers have documented a tendency for trade liberalization to induce a transition between the formal and informal sectors of the economy (e.g., see Gaddis and Pieters [2017] and Yahmed and Bombarda [2020]). Being employed in the formal sector brings many non-wage benefits including increased job security, as well as access to paid medical leave and unemployment insurance. Thus, increased foreign competition might impact the utility of workers not only through wages but also through employment in the formal sector. Thus in panel C of Table 10, our dependent variable is the 2000 to 2010 change in the percent of workers that are employed in the formal sector of the economy. As can be seen, we find no evidence that increased import exposure is affecting formal sector employment rates - either the change in overall rates (Columns 1 and 2) or in differential changes across genders (Columns 3 and 4).

To sum up, our results suggest that increased foreign competition from China reduced the overall gender wage gap in more exposed regions with little impact on employment rates with the exception of a relative shift towards male workers in the overall labor force. The question then becomes the mechanism by which trade is reducing the wage gap. For example, suppose foreign competition is reducing the wage gap through selection effects - for example by inducing less-educated (lower wage) females to leave the labor force. In that case, one would expect to find a correlation between regional trade exposure and the portion of the wage gap that is "explained" by educational differences across male and female workers. It is these types of questions we address in the following section (6) where we decompose the effect of the trade shock on the gender wage gap.

6. Inspecting the Mechanism

One of the advantages of using regional variation in trade exposure is that it allows us insight, not only into the direction and magnitude of the overall effect of trade on wages, but also the mechanism by which trade is affecting the gender wage gap. Since we estimate Oaxaca-Blinder wage regressions for each region that decompose the gender wage gap into its various components (both before and after the trade shock), we can examine the impact of the China trade shock on those various components. Specifically, we can estimate (4) where, once again, ΔIP_r is the change in region $r's$ trade exposure over the time period (2000-2010) but now the dependent variable is the change in a particular component of the gender wage gap for region r (e.g., that portion of the wage gap due to male and female workers having different labor shares across the occupational categories).

Thus, in the following sections we do progressively more detailed decompositions to see how variations in trade exposure across regions are correlated with different components of the wage gap.

6.1. Is it sorting?

First, for each region we decompose the wage gap into its threefold components (explained, unexplained and interaction) and re-estimate (4) where ΔY_r is now the change in a particular component of the gender wage gap for region r. Results are provided in Table 11 where column 1 provides OLS estimates (*OLS*), column 2 provides estimates using our IV strategy (*IV*) and column 3 is an additional specification which controls for pretrends and the 1990's change in tariffs (*IV-Robust*).

To interpret these results, recall from (1) that the change in the explained component of the wage gap for region r will be given by $\Delta[(\overline{X}_{Mr} - \overline{X}_{Fr}) \cdot \beta_{Mr}]$ where $\bar{X}_{Mr}, \bar{X}_{Fr}$ are the observable characteristics of male and female workers in the region, while β_{Mr} are the regional returns to those characteristics (using male workers as a reference point). Thus, to the extent that the China trade shock is reducing the explained portion of the gender wage gap within regions, it would do so by either a reduction in observable differences between male and female workers (i.e., men moving into lower-paying occupations/industries) or a reduction in the returns to those observable differences (i.e., traditionally male occupations/industries paying less).

In contrast, the change in the unexplained component of the wage gap is given by $\Delta[(\beta_{Mr} - \beta_{Fr}) \cdot \overline{X}_{Mr}]$. Thus, trade would reduce the unexplained portion of the gender wage gap within regions by either reducing the (unexplained) difference in returns between similar workers (i.e., female workers being paid relatively more within the *same* industry/occupation) or by a change in the composition of the workforce to minimize these (unexplained) differences (i.e., a reduction in employment in those industries with high wage disparities).[27]

As can be seen in Table 11, trade appears to be reducing the gender wage gap almost entirely through the explained portion of the gap. Panel A (*Overall*) reproduces the results of Section 5 where the first row (*Predicted-Difference*) reports the raw coefficient estimates of β_1 while the second row (*p80-p20*) reports the difference in the dependent variable when one moves between the 80th and 20th percentiles of changes in regional trade exposure. Panel B (*Explained, Unexplained and Interaction*) then reports results where the dependent variable is the change in the corresponding portion of the wage gap. In what follows, we discuss magnitudes of our preferred specification (column 3) although results are consistent across specifications. As before, a more exposed region (80th percentile) had about a 1.2 log point larger decline in the gender wage gap than a less exposed region (20th percentile). However, as can be seen from Panel B, this is almost entirely a reduction in the *explained* wage gap, as the more exposed region saw a 1.1 log point larger decline in the explained part of the wage gap with statistically insignificant changes in the other portions of the wage gap. Thus, our results are more consistent with a sorting story with trade either decreasing overall wages in male-dominated occupations/industries/demographics or female workers being more represented in those higher-paid male-dominated occupations/industries/demographics.

6.2. Occupations Matter Most

Next, recall that within our baseline Oaxaca-Blinder wage regressions the explained portion of the wage gap is based on four observable worker characteristics: industry of employment, occupation, education and age. Thus, we can implement a more detailed decomposition and test the extent to which trade exposure is correlated with a decline in each of these components of the explained wage gap.[28]

Thus, for each region we decompose the explained portion of the wage gap into its four observable components (industry, occupation, eduction and age) and re-estimate (4) where ΔY_r is now the change in that particular component of the explained part of the gender wage gap. For example, the change in the *Occupation* component of the explained wage gap for region r is given by:

$$\Delta\text{OCCUPATION}_r = \Delta[(\bar{X}^{OCC}_{Mr} - \bar{X}^{OCC}_{Fr}) \cdot \beta^{OCC}_{Mr}], \tag{5}$$

where β^{OCC}_{Mr} is a vector of the (male) returns to the various occupations in region r and $\bar{X}^{OCC}_{Mr}, \bar{X}^{OCC}_{Fr}$ are the means of the occupation dummy regressors (basically the share of male and female workers, respectively, in each occupation in each region). The change in the industry, age and education components are defined similarly.

Results are provided in Panel C of Table 11. While each of the four components are contributing to the reduction in the wage gap, changes in observed occupational differences between male and female workers appear to be the primary contributor to the reduction. Recall that the more exposed regions saw a 1.1 log point decline in the explained part of the wage gap relative to less exposed regions. The

[27] Likewise, $\Delta Interaction$ is the change in the third component of (1). However, the interaction results are of less concrete interest and fail to be statistically significant in our specifications.

[28] In this and the following section we focus on the explained portion of the wage gap for two reasons. First, as can be seen in Table 11, trade exposure only seems to be significantly correlated with a reduction in the explained portion of the wage gap. Second, as discussed in Jann [2008], more detailed decompositions of the unexplained portion of the wage gap can be impacted by arbitrary decisions with respect to scaling and the choice of the base category.

final set of rows (*Explained - Occupation*) of Table 11 shows that roughly all of the decline is coming from the occupation component of the wage gap. Thus, our results are most consistent with a story of trade either decreasing overall wages in male-dominated occupations or a (relative) shift among female workers towards higher paying occupations.

6.3. Occupational Mobility vs Occupation Returns

Finally, we can employ one more decomposition. Note from (5) that we can breakdown the change in any component of the explained wage gap into the changes in the employment shares ($\Delta[X_{Mr} - X_{Fr}]$) and changes in the associated returns ($\Delta\beta_{Mr}$):

$$\Delta\left[\left(\bar{X}_{Mr} - \bar{X}_{Fr}\right)\cdot\beta_{Mr}\right] = \beta_{Mr}^{AV}\cdot\Delta\left(\bar{X}_{Mr} - \bar{X}_{Fr}\right) + \left(\bar{X}_{Mr} - \bar{X}_{Fr}\right)^{AV}\cdot\Delta\beta_{Mr}. \tag{6}$$

In this expression $\beta_{Mr}^{AV} = \frac{\beta_{Mr}^{2000}+\beta_{Mr}^{2010}}{2}$ is the "average" return over the time period (2000-2010) and $\left(\bar{X}_{Mr} - \bar{X}_{Fr}\right)^{AV} = \frac{\left(\left(\bar{X}_{Mr}-\bar{X}_{Fr}\right)^{2000}+\left(\bar{X}_{Mr}-\bar{X}_{Fr}\right)^{2010}\right)}{2}$ is the "average" difference in employment shares.

For example, in decomposing the occupation component, the first part of the right-hand side of (6) would represent the effects on the wage gap of changes in the observed differences between male and female workers in employment across occupations (i.e., what we will refer to as changes in the X's) . If trade is reducing gender wage gaps by having women move into traditionally male dominated (higher paying) occupations it would be captured by this term. In contrast, the second part of the right-hand side of (6) are changes in the returns to the different occupations (which we refer to as changes in the β's). Thus, if trade is reducing gender wage gaps by increasing the pay of traditionally female-dominated occupations it would be captured by this term. Similar decompositions between quantities and returns can be done for the other components of the explained wage gap (industry, age and education).

Thus, for each region we decompose the explained portion of the wage gap (and its different components) into these two parts (changes in the X's and β*'s*) and re-estimate (4) where ΔY_r is now the change in that particular component of the gender wage gap. Since the majority of the decline of the explained wage gap is coming from the occupation component, we will focus on that part (i.e., final set of rows (*Explained - Occupation*) of Table 12). Results are provided in Table 12 for both the IV specification (columns 1 and 2) and the robust IV specification which controls for pre-trends (columns 3 and 4).

Recall that roughly all of the decline in the wage gap (1.2 log points) is coming from the occupation component. As can be seen from columns 3 and 4 in Table 12, this decline is coming mostly occupation transitions (i.e., *Change in the X's*). Specifically, about 0.8 log points is coming from changes in the observed differences between male and female workers in occupational employment. Intuitively, this result suggests that exposure to Chinese imports is reducing the gender wage gap by increasing the share of female workers in higher-paying occupations (at least in the more trade-exposed regions).

There are several possible explanations for this result. One possibility is a story similar to Ederington et al. [2009] where foreign competition increases the female share of workers by increasing the cost to discriminatory behavior by firms. They provide evidence (using the Colombian trade liberalization episode of the 1980's) that firms facing greater foreign competition increased their share of female workers. Another possibility is a situation similar to Juhn et al. [2014] where foreign competition increases female wages by inducing technology upgrading that is more complementary with female skills.

They provide evidence (using the NAFTA agreement) that tariff reductions induced Mexican firms to upgrade their technology and replace male workers with female workers. Although we are investigating a different country (Brazil), trade episode (China trade shock) and exploiting a different source of variation (regional), our result that regions facing greater competition saw an increase in the share of female workers employed in higher-paying occupations is similarly suggestive that foreign competition might be breaking down (occupational) labor-market barriers to women.

7. Worker-Level Evidence

In the previous sections we used Brazilian Demographic Census data to describe the impact of trade exposure on regional labor-market outcomes. The main finding was a decline in the gender wage gap which appeared primarily related to a reallocation of male and female workers across occupational categories. However, Brazil also has individual-level longitudinal data on formal-sector workers through the Relação Anual de Informações Sociais (RAIS). One of the advantages of using RAIS data is that it allows us to estimate the impact of increased exposure to import competition from China on employment and earnings trajectories of individual workers. However, as discussed in Section 3, it is limited to formal-sector workers and thus our estimates in this section are with respect to formal-sector earnings and employment. In Appendix A.5 we provide summary statistics of our RAIS data including the distribution of formal-sector workers across industries and occupations.

7.1. Empirical Framework

The analysis in this section follows that of Autor et al. [2014] but applied to the Brazilian labor market and focusing on the differential impact of the China trade shock on male and female workers. Specifically, we measure the effect of trade exposure on cumulative labor market outcomes (earnings and time of employment) of workers with high labor-force attachment originally employed in the manufacturing sector. The empirical strategy captures exposure to rising Chinese import competition during the period 1998-2010 based on workers' initial industry of employment to avoid selection issues associated with the post-shock resorting of workers.

The baseline regression of cumulative earnings on industry-level growth in import competition is:

$$E_{ijro}^{1999-2010} = \beta_1 \cdot \Delta IP_j^{1998-2010} + X_{ijro}^{'} \cdot \beta_2 + \epsilon_{ijro} \tag{7}$$

Each observation represents a worker i initially employed in industry j, working in microregion r, and performing occupation o. The dependent variable $E_{ijro}^{1999-2010}$ represents cumulative earnings over the period 1999-2010:

$$E_{ijro}^{1999-2010} = \frac{\sum_{t=1999}^{2010} E_{ijrot}}{\bar{E}_{ijrot_0}} \tag{8}$$

It is expressed as a multiple of average annual pre-shock earnings, which are calculated over the period 1996-1998.

Industry-level exposure to growth in Chinese imports is defined as the change in Brazil's imports from China between 1998 and 2010 ($\Delta M_{j\,1998-2010}^{CHINA\rightarrow BRA}$) normalized by domestic consumption (production plus exports minus imports) in the initial year (1998).

$$\Delta IP_j^{1998-2010} = \frac{\Delta M_{j\,1998-2010}^{CHINA\to BRA}}{Y_{j\,1998}^{BRA} + M_{j\,1998}^{BRA} - E_{j\,1998}^{BRA}} \tag{9}$$

It captures trade exposure based on a worker's industry of employment in 1998. Summary statistics for industry exposure to growth in Chinese imports ($\Delta IP_j^{1998-2010}$) are given in Table 13.

Following Autor et al. [2014], we instrument for the growth in Chinese imports to Brazil by using contemporaneous Chinese imports to other countries. The underlying assumption is that Chinese exports to this set of countries is not driven by unobservable shocks to Brazilian industries. We construct two such instruments. First, we use the growth in Chinese imports to a set of 9 South American countries ($\Delta M_{j\,1998-2010}^{CHINA\to BRA}$), normalized by domestic consumption in Brazil.[29] Second, we construct an alternative instrument using Chinese export growth to all (non-Brazil) countries (similar to that used in Section 5).

$$\Delta IP_j^{1998-2010,OTHER} = \frac{\Delta M_{j\,1998-2010}^{CHINA\to OTHER}}{Y_{j\,1998}^{BRA} + M_{j\,1998}^{BRA} - E_{j\,1998}^{BRA}} \tag{10}$$

A regression of the "raw" measure of trade exposure (ΔIP_j^{BRA}) on the "IV" measure using trade with all non-Brazilian countries (ΔIP_j^{OTHER}) and the controls (i.e., equivalent to the first-stage regression) results in a coefficient of 0.010 (s.e. 0.002) with a t-statistic of 4.41 and R-squared of 0.75 (the first-stage F-statistic is 1.9 e+06 which easily rejects the null hypothesis of a weak instrument).

Finally, we control for a large set of worker, industry, region, and occupation-level variables, represented in equation (7) by the term X_{ijro}. Worker-level controls include workers' age, educational attainment, and tenure in 1998, as well as average annual pre-shock labor market outcomes during 1996-1998. Educational attainment is captured by nine categorical variables, ranging from absence of formal education to tertiary education. We compare workers within age cohorts by including fixed effects for workers' year of birth. We also include fixed effects for workers' tenure at their 1998 employer and 2-digit occupation fixed effects.[30] To control for differences in regional exposure to Chinese import competition we also include microregion fixed effects. While the industry-level trade-exposure variable varies at the three-digit level, we include fixed effects for two-digit sectors, such that we compare industries within narrow sectors.[31] Finally, we control for the initial level of import competition from China and from the rest of the world. Thus, to summarize, the empirical strategy compares workers of similar characteristics and pre-shock labor market histories employed in different industries (but in the same two-digit sector) in 1998.

[29]The set of countries is Argentina, Bolivia, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay and Venezuela.

[30]We group workers by tenure at their 1998 employer into the following bins: less than a year of tenure, 1 to 2 years, 2 to 5 years, 5 to 10 years, 10 to 20, and 20 or more years.

[31]This also helps us control for pre-sample trends (e.g., such as might be generated by the 1990s trade liberalization episode).

7.2. Base Results

We first study the effect of import competition on cumulative formal sector earnings of Brazilian manufacturing workers over the period 1999-2010.[32] The results of estimating (7) are shown in panel A (*Cumulative Earnings*) and columns 1 and 2 of Table 14. Column 1 (labeled *IV1*) provides results when using Chinese exports to other South American countries as the instrument, while column 2 (labeled *IV2*) uses all countries except Brazil. As can be seen, there is a negative and statistically significant relationship between initial exposure to increased import competition from China and cumulative worker earnings over the subsequent 12 year period. To interpret the magnitude of the estimate note that the difference in the trade exposure measure between the 80th and 20th percentiles is 0.066. Multiplying this by the -1.612 coefficient in column 1, this means that workers at the 80th percentile of exposure lose 10.7% of annual pre-shock earnings relative to workers at the 20th percentile of exposure over this 12 year period. Estimates from the alternative instrument are very consistent with more exposed workers losing 11.5% of annual pre-shock earnings.[33]

Next, we estimate (7) separately for each gender and report the results for male workers in columns 3 and 4 and for female workers in columns 5 and 6. As can be seen, both male and female workers who were more exposed to import competition see a decline in cumulative earnings, with a larger (relative) decline among male workers. Interpreting the magnitude of column 3, male workers at the 80th percentile of exposure lose 10.4% of annual pre-shock earnings relative to male workers at the 20th percentile of exposure. In contrast, according to column 5, female workers at the 80th percentile of exposure only lose 9.1% of their annual pre-shock earnings. Results are quite similar for the alternate instrument. Thus, consistent with the local labor markets approach of Section 5, the longitudinal analysis also finds that increased import competition from China appears to be impacting male workers to a greater extent in Brazil.

However, these estimates raise the question of whether the decline in earnings is due to the extensive margin (workers working fewer days) or the intensive margin (workers earning less per day worked). Thus we next consider two new labor outcomes: cumulative days of employment and cumulative earnings per days of employment. First, Panel B (*Cumulative Employment*) of Table 14 reestimates (7) where the dependent variable is the number of days between 1999-2010 where the worker has positive labor market earnings in the formal sector. As can be seen in column 1, import competition leads to reduced employment with workers at the 80th percentile of exposure losing 4.9% (=0.066 $\times$ -0.744) of annual pre-shock days of employment (relative to workers at the 20th percentile of exposure) over this 12-year period. Thus, at least a portion of the decline in cumulative formal sector earnings is due to import exposure leading to fewer days of employment in the formal sector. However, in this case, the estimates of columns 3-6 suggest some ambiguity about whether male or female workers lose more days of employment from import exposure. Thus, we don't see strong evidence that the larger decline in male earnings is due simply to less formal-sector work.

Finally, Panel C (*Wages*) of Table 14 reestimates (7) where the dependent variable is the earnings per

[32]We focus on import competition in this section since the growth in export demand from China mainly affected commodities and not manufacturing industries (see Costa et al. [2016]).

[33]Interestingly, while this is a significant loss of earnings, it is less than that estimated by Autor et al. [2014] for the case of the U.S. (they estimate lost earnings for U.S. manufacturing workers during a 16 year period as 46% percent of annual pre-shock earnings).

day of employment over the 12 year period (i.e., a measure of wages). Once again, we find evidence that import competition is negatively correlated with wages as workers at the 80th percentile of exposure lose 0.5% of annual pre-shock earnings per day of employment relative to workers at the 20th percentile of exposure. In addition, similar to Section 5 where greater exposure to increased import competition was correlated with a decline in the gender wage gap, our estimates of the decline in wages due to import competition exposure are larger for male workers relative to female workers. For example, column 3 suggests that while male workers at the 80th percentile of exposure lose 0.6% of annual per-day wages (relative to male workers at the 20th percentile) the estimate for female workers (column 5) is about half that (and no longer statistically significant).

Thus, similar to the Autor et al. [2014] findings for U.S. manufacturing workers, we find that increased import competition from China resulted in a subsequent loss in earnings among Brazilian manufacturing workers more exposed to China due to both a decline in the number of days worked (extensive margin) and average wages over the period (intensive margin). However, we also find that this import shock impacted male workers in Brazil to a greater extent, with male earnings declining by a greater extent despite a similar fall in the number of days worked. Indeed the relative decline in male earnings appears primarily driven by a a relative decline in average male wages over the time period (intensive margin). These results parallel the regional analysis of Section 5 which also found a decline in the gender wage gap in more exposed regions.

7.3. Trade and Mobility Across Industries and Occupations

Given labor market segregation in Brazil, differences across genders in the impact of the trade shock on mean wages and earnings could be the consequence of the shock generating different sorting patterns between males and females (i.e., mobility). Indeed, there are several recent papers that have begun to explore how exposure to foreign competition is leading to re-sorting of workers across industries (e.g. [Autor et al., 2014, Dix-Carneiro and Kovak, 2019]). With respect to the specifics of the impact of increased import competition on male and female workers, our regional analysis of Section 5 also points to the potential importance of re-sorting across occupational categories.

Thus, similar to [Autor et al., 2014] we first look for evidence of whether workers displaced by increased import competition in their initial industry of employment, can offset these losses by finding employment in alternate industries. In Panels A and B of Table 15 the dependent variable is cumulative earnings (Panel A) and cumulative employment (Panel B) within the initial industry. Then, in Panels C and D it is cumulative earnings (Panel C) and cumulative employment (Panel D) obtained in a two-digit industry different than the one held in 1998. In columns 1 and 2 we report results on male workers for our two instruments, while estimates for female workers are reported in columns 3 and 4. Not surprisingly, we see evidence of labor market adjustment across industries, as workers in industries more exposed to import competition from China saw declines in earnings and employment in their initial industry (statistically significant negative coefficients in Panels A and B) which are partly offset by increased earnings and employment in alternate industries (positive, and statistically significant, coefficients in Panels C and D). The magnitude in Table 15 in column 1 (for men) is such that, over the 12 year period, workers at the 80th percentile of exposure lose 31.9% (4.816×0.066) of annual pre-shock earnings and 23.0% (3.473×0.066) of annual pre-shock days of employment relative to workers at the 20th percentile of exposure in the initial industry. However, over the same period, they gain back 21.5% (3.240×0.066) of pre-shock earnings and 18.6% (2.806×0.066) of pre-shock days in employment outside the initial industry. In contrast, female workers exhibit much lower rates of industry mobility in response to the increased import competition from China. Results suggest that female workers (column 3) initially employed in the more exposed industries lose a comparatively smaller 21.6% of pre-shock earnings and 16.6% of pre-shock days in the initial industry, while only gaining back 12.6% of earnings and 11.4% of days in employment in alternate industries. Thus, we see that the similar employment losses for male worker and female workers in Panel B of Table 15 are actually masking a much higher degree of industry mobility among male workers in response to the import shock.

While previous papers (e.g. [Autor et al., 2014, Dix-Carneiro and Kovak, 2019]) have focused on reallocation of workers across industries, the results from our regional analysis in Section 5 also point to the importance of occupational shifts. Thus, in Table 16 we extend the decomposition to investigate how increased import competition reallocated workers across occupations. In Panels A and B of Table 16 the dependent variables are cumulative earnings (Panel A) and employment (Panel B) within the initial occupation while in Panels C and D it is cumulative earnings (Panel C) and employment (Panel D) in two-digit occupations different than the one held in 1998. Once again, we see evidence of labor market adjustments, this time across occupational categories. Specifically, workers in industries more exposed to import competition from China saw larger declines in earnings and employment in their initial occupation (statistically significant negative coefficients in Panels A and B) and larger increases in earnings and employment in alternate occupations (positive, and sometimes statistically significant, coefficients in Panels C and D). The estimates in column 1 suggest that a male worker at the 80th percentile of exposure loses 11.5% of annual pre-shock earnings and 5.4% of annual pre-shock days of employment in their initial occupation (relative to workers at the 20th percentile of exposure). Similarly, female workers (column 3) lose 10.5% of annual pre-shock earnings and 6.4% of days of employment in their initial occupation. However, we do not find any statistically significant evidence of increased earnings or employment among male workers in alternate occupations (despite their demonstrated high rates of industry mobility). In contrast, we find that female workers in the more exposed industries gain a statistically significant 1.4% of annual pre-shock earnings and 1.2% of pre-shock days in employment in 2-digit occupations outside their initial occupation.

A couple of items stand out when comparing Tables 15 and 16. First, and perhaps not surprisingly, job mobility in response to the trade shock across 2-digit industries is much higher than mobility across 2-digit occupations. Second, women in Brazil exhibit much lower rates of industry mobility in response to the trade shock than men with the coefficient estimates for female workers in Table 15 consistently around 60 percent the size of the coefficient estimates for male workers. Third, in contrast to industry mobility, rates of occupational mobility arising from trade exposure are equal if not slightly higher for female workers. This is consistent with the results of Section 5 which found occupational sorting to be a primary explanation for the decline in the gender wage gap.

8. Conclusions

This paper complements a growing theoretical and empirical literature that examines the impact of globalization on gender income inequality. Such research has taken on increased importance over the years, especially for developing countries, as several papers have documented a correlation between female earnings and childhood outcomes such as education and health (e.g., see Thomas [1990], Duflo [2003] and Qian [2008]). Thus, gender wage inequality has become an important issue in the development community. Combined with the fact that many developing countries have turned to trade liberalization as a development strategy (either through unilateral trade liberalization or through the joining of regional and multilateral trade agreements), the question of how trade impacts gender specific wages might have important implications for the future.

A new technique in investigating the effects of globalization on income inequality is to utilize regional variation in trade exposure across local labor markets. In this paper, we apply these techniques to the question of how trade might affect wage inequality between male and female workers using Brazilian census data and the rapid expansion of Chinese imports in the years 2000-2010. This allows us to decompose the gender wage gap across regions using Oxaca-Blinder decompositions and thus observe which component of the wage gap increased trade exposure appears to be influencing. Our results indicate that the China trade shock primarily reduced the *explained* portion of the wage gap by increasing the share of female workers in higher-paying occupations.

In addition, we use a longitudinal dataset on Brazilian formal sector workers to complement the regional regressions with individual-level regressions that follow the same workers over time. Previous longitudinal studies on individual worker adjustments to trade shocks (e.g., see Autor et al. [2014] and Dix-Carneiro and Kovak [2019]) have focused on mobility across industries or sectors of the economy. Consistent with this focus, Brussevich [2018] finds, in a regional study of import competition and wages, that a trade-induced decline in the gender wage gap in the U.S. was primarily traced to high-levels of labor market segregation across sectors combined with low levels of sectoral mobility. However, our extension of the traditional longitudinal analysis to occupation mobility uncovers an interesting difference in how male and female workers adjust to a trade-induced shock to the labor market. Specifically, while we find that male workers more exposed to import competition exhibit higher rates of industry mobility (relative to female workers), the opposite is true for occupational mobility. Thus, a main takeaway, to both the regional and longitudinal analysis in this paper, is the potential importance of occupational mobility (in addition to the traditional focus on industry mobility) in understanding the differential impacts of trade shocks on male and female workers.

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10. Tables and Figures

Table 1: Summary Statistics: Employment Status

	2000			2010		
	Total	Female	Male	Total	Female	Male
Total Employment	54.5%	40.5%	69.1%	60.2%	71.0%	49.9%
Formal Employment	23.9%	17.8%	30.1%	30.7%	37.0%	24.8%
Informal Employment	30.6%	22.7%	38.9%	29.4%	34.0%	25.1%
Unemployment	10.7%	11.0%	10.3%	6.0%	5.0%	6.8%
Not in the labor force	34.8%	48.4%	20.7%	33.9%	23.9%	43.3%

Notes: This table reports the share of individuals that are employed, employed in the formal sector, employed in the informal sector, unemployed, and out of the labor force in 2000 and 2010, overall and by gender. Source: Demographic Census.

Table 2: Descriptive Statistics; Employment and Wages by Gender, Age, and Educational Attainment.

		Employment			Wage		
		Female	Male	Share Female	Female	Male	Ratio F/M
All		21.6	35.2	0.38	6.04	7.30	0.83
Education							
	No formal ed.	4.19	6.48	0.39	4.34	4.38	0.99
	Primary	8.87	18.98	0.32	3.27	4.59	0.71
	Secondary	5.78	7.05	0.45	5.92	8.98	0.66
	Tertiary	2.72	2.74	0.50	17.85	28.58	0.62
Age							
	15 to 19	1.92	3.03	0.39	2.33	2.37	0.98
	20 to 24	3.35	5.39	0.38	3.85	3.93	0.98
	25 to 29	3.27	5.36	0.38	5.47	5.69	0.96
	30 to 34	3.25	5.21	0.38	6.38	7.15	0.89
	35 to 39	3.16	4.90	0.39	7.12	8.64	0.82
	40 to 44	2.67	4.14	0.39	7.68	9.84	0.78
	45 to 49	1.97	3.26	0.38	8.12	10.88	0.75
	50 to 54	1.27	2.38	0.35	7.81	10.98	0.71
	55 to 59	0.71	1.57	0.31	7.39	10.42	0.71

Notes: This table reports employment and the mean hourly wagefor male and female workers by groups according to age and educational attainment in year 2000. Employment is in millions. Wages are expressed in Reais of 2000.

Table 3: Industries with the Highest and Lowest Female Employment Share

Industry Code	Industry Name	Male	Female	Share Female
Panel A: Lowest Female Employment Share				
10	Mining of coal and lignite	4.76	0.16	0.032
45	Construction	4149.45	153.75	0.036
5	Fishing	240.57	13.80	0.054
13	Mining of metal ores	21.55	1.41	0.062
14	Other mining and quarrying	158.38	11.22	0.066
60	Land transport	2133.09	153.85	0.067
27	Manufacture of basic metals	145.62	13.77	0.086
20	Manufacture of wood and wood products	349.65	34.82	0.091
28	Manufacture of fabricated metal products, except machinery and equipment	718.31	76.67	0.096
26	Manufacture of other non-metallic mineral products	428.43	50.62	0.106
Panel B: Highest Female Employment Share				
95	Domestic staff in households	332.00	4428.87	0.930
18	Manufacture of wearing apparel	183.26	987.28	0.843
80	Education	783.91	2870.16	0.785
93	Other service activities	204.53	695.56	0.773
85	Health and social work	543.03	1481.00	0.732
66	Insurance and pension funding	36.00	36.15	0.501
17	Manufacture of textiles	271.40	261.92	0.491
91	Activities of membership organizations not elsewhere classified	136.85	122.98	0.473
55	Hotels and restaurants	1454.07	1294.97	0.471
65	Financial intermediation, except insurance and pension funding	309.08	253.73	0.451

Notes: This table reports male and female employment by two-digit industries in 2000. Panels A and B correspond to the ten industries with the highest and lowest female employment shares respectively. Employment is in thousands. Source: Demographic Census.

Table 4: Occupations with the Highest and Lowest Female Employment Share

Occupation	Occupation Name	Male	Female	Share Female
Panel A: Lowest Female Employment Share				
71	Workers in extractive industries and construction	4179.53	34.14	0.008
91	Repair and mechanic maintenance workers	965.47	8.54	0.009
99	Other repair and mechanic maintenance workers	252.40	2.96	0.012
64	Agricultural and forestry mechanization worker	189.86	2.49	0.013
95	Electronic and electromechanic maintenance workers	206.64	3.19	0.015
78	Cross-functions workers	3124.29	130.98	0.040
86	Water and energy utilities operators	75.64	3.31	0.042
77	Workers in the wood and furniture industries	558.85	25.88	0.044
72	Metal transformation workers	1290.60	66.95	0.049
82	Workers in steel facilities	187.73	10.36	0.052
Panel B: Highest Female Employment Share				
33	Teachers	171.65	1317.51	0.885
32	Mid-level technicias in biology, biochemistry, health, etc.	157.91	421.18	0.727
23	Higher-education teachers	310.23	794.64	0.719
42	Public-service clerks	408.60	1031.29	0.716
76	Textile, leather, and apparel workers	681.95	1315.75	0.659
51	Service workers	4255.46	7857.83	0.649
22	Professionals in biology, biochemistry, health, etc.	250.31	306.23	0.550
41	Clerks	1647.88	2002.43	0.549
25	Professional in social and human sicences	309.75	309.92	0.500
52	Salesperson	3213.87	2402.11	0.428

Notes: This table reports male and female employment by two-digit occupations in 2000. Panels A and B correspond to the ten occupations with the highest and lowest female employment shares respectively. Employment is in thousands. Source: Demographic Census.

Table 5: Oaxaca-Blinder Decomposition of the Gender Wage Gap

	2000	2010	Change	Change (%)
Predicted - Female	1.194	1.501	0.308	
Predicted - Male	1.294	1.600	0.306	
Predicted - Difference	0.101	0.099	-0.002	1.000
Explained - Age	0.004	-0.001	-0.006	3.283
Explained - Educ. Att.	-0.054	-0.047	0.007	-4.004
Explained - Industry	0.026	0.044	0.017	-10.150
Explained - Occupation	-0.063	-0.035	0.028	-16.177
Explained - Total	-0.086	-0.040	0.046	-27.048
Interaction - Age	-0.000	-0.001	-0.001	0.410
Interaction - Educ. Att.	-0.016	-0.010	0.006	-3.287
Interaction - Industry	-0.015	-0.031	-0.016	9.676
Interaction - Occupation	0.026	-0.009	-0.035	20.638
Interaction - Total	-0.005	-0.052	-0.047	27.437
Unexplained - Intercept	0.260	0.190	-0.070	40.951
Unexplained - Age	-0.002	0.002	0.003	-2.010
Unexplained - Educ. Att.	-0.009	0.003	0.012	-6.937
Unexplained - Industry	-0.017	0.003	0.020	-11.936
Unexplained - Occupation	-0.041	-0.008	0.033	-19.457
Unexplained - Total	0.192	0.191	-0.001	0.611

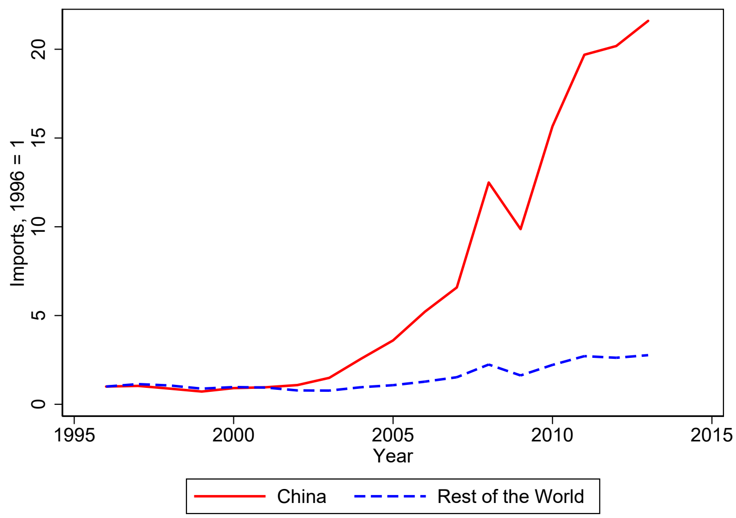
Notes: This table reports the results of the Oaxaca-Blinder decomposition in equation (1), which decomposes the gender wage gap into "explained", "unexplained", and "interaction" terms. The first two columns correspond to the cross-sections in years 2000 and 2010. The third column corresponds to the difference between the first two columns. The last column indicates the fraction of the change over time in the gender wage gap (the difference in row 3) accounted for by each component.

Table 6: Regional Distribution of Wage, Employment and Labor Force Gaps

	Mean	St. Dev.	10th pct.	25th pct.	50th pct.	75th pct.	90th pct.
Female / Male Wage ratio	0.835	0.103	0.737	0.770	0.825	0.863	0.984
Female Employment Share	0.377	0.041	0.321	0350	0.382	0.414	0.423
Female Labor Force Share	0.401	0.039	0.345	0.375	0.406	0.435	0.445

Notes: This table reports summary statistics of the distribution (weighed by population in 2000) of the female employment share, labor force employment share and female to male hourly wage ratio across microregions. Source: Demographic Census.

Figure 1: Brazilian Imports from China and from the World.



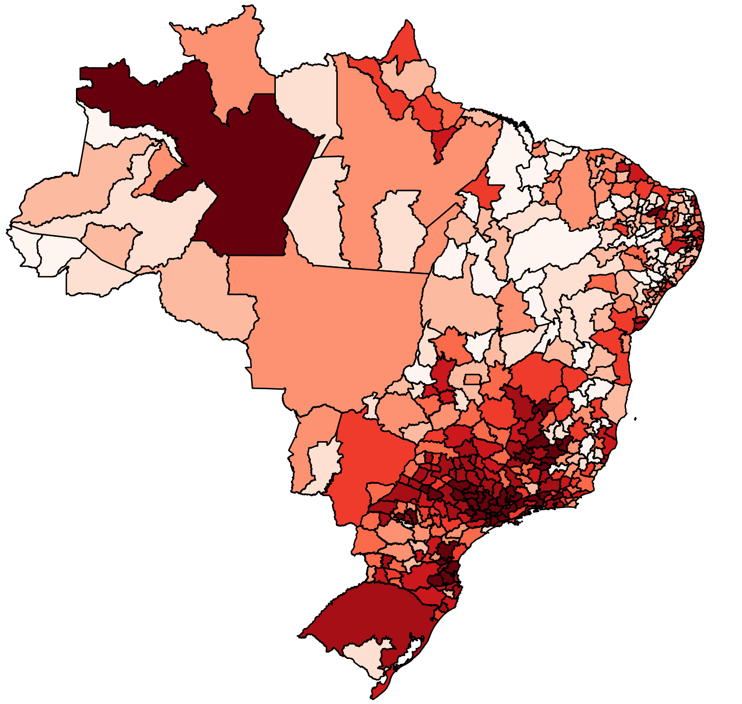
Notes: This figure shows the evolution over time of Brazil's imports from China (red) and from the rest of the world (blue) from 1996 to 2013 in real USD. Both series are normalized to 1 in 1996.

Table 7: Summary Statistics: Regional Measure of Growth in Chinese Import Competition and Export Demand

	Mean	St. Dev.	10th pct.	20th pct.	25th pct.	50th pct	75th pct.	80th pct.	90th pct.
Import Competition	0.441	0.414	0.089	0.129	0.138	0.332	0.495	0.691	0.881
Export Demand	0.472	0.669	0.048	0.095	0.103	0.243	0.544	0.684	1.13

Notes: This table reports summary statistics of the distribution (weighed by population in 2000) across microregions of the measure of growth in regional exposure to Chinese import competition defined in equation (2).

Figure 2: Regional Variation in Trade Exposure



Notes: This figure shows the regional variation in growth in Chinese import competition as defined in equation (2). Darker shades indicate larger values.

Table 8: Growth in Import Competition and Regional Wages, Population and Labor Force

	(1)	(2)	(3)	(4)
	All		Male / Female Gap	
	OLS	IV	OLS	IV
PANEL A: WAGES				
ΔIP_r	-2.699	-2.511	-1.573***	-1.720***
	(3.267)	(2.984)	(0.525)	(0.512)
p80 - p20	-1.517	-1.411	-0.884	-0.967
PANEL B: POPULATION				
ΔIP_r	1.437	0.680	-0.702***	-0.439*
	(1.103)	(1.125)	(0.263)	(0.214)
p80 - p20	0.808	0.382	-0.247	-0.395
PANEL C: LABOR FORCE				
ΔIP_r	1.544	0.105	1.592	2.938***
	(1.216)	(1.203)	(1.230)	(1.011)
p80 - p20	0.868	0.059	0.895	1.651
Observations	412	412	412	412

Notes: This table reports the results of the estimation of equation (4). The dependent variable is (100 ×) the change between 2000 and 2010 in the mean log wage (panel A), log total population (panel B) or log total labor force (panel C). Male/Female gap in columns 3 and 4 refers to the difference between the outcome compute among male workers minus the outcome computed among female workers. Control variables include the following, all measured in both 2000 and 1991: share of employment in agriculture and mining, share of employment in manufacturing, share of employment in the public sector, share of employed population, share of informal employment, (log) total population, share of female employment, share of skilled employment, and state-level fixed effects. We also control for growth in export demand from China, and use the instrument for it described in Appendix A.2. Regressions are weighted by microregion population in 2000. We report coefficients and standard errors followed by normalized coefficients reflecting the difference in the dependent variable associated with moving from the 20th to the 80th percentiles of trade exposure. Standard errors are clustered by state. ***, **, and * denote statistical significance at a 1, 5 and 10 percent confidence level.

Table 9: Growth in Import Competition and Regional Wages: Robustness

	(1)	(2)	(3)	(4)	(5)
	Alt. Instr.	Pre-trend	Tariff	Pre-trend + tariff	Placebo
ΔIP_r	-1.483***	-2.251***	-1.578***	-2.114***	-1.962
	(0.440)	(0.648)	(0.575)	(0.708)	(1.440)
p80 - p20	-0.833	-1.265	-0.887	-1.188	-1.103

Notes: This table reports the results of the estimation of equation (4). The dependent variable in columns 1 through 4 is (100 ×) the difference in the change between 2000 and 2010 in the regional mean log wage of male workers minus the change between 2000 and 2010 in the regional mean log wage of male workers. Control variables in columns 1 through 4 include the following, all measured in both 2000 and 1991: share of employment in agriculture and mining, share of employment in manufacturing, share of employment in the public sector, share of employed population, share of informal employment, (log) total population, share of female employment, share of skilled employment, and state-level fixed effects. In addition, columns 1 through 4 control for growth in export demand from China, and use the instrument for it described in Appendix A.2. Column 2 also controls for the lagged dependent variable computed between 1991-2000 instead of 2000-2010. Column 3 also controls for a measure of regional exposure to changes in tariffs during 1990-1995 defined in Appendix A.4. Column 4 controls for the lagged dependent variable and exposure to tariff liberalization. The dependent variable in column 5 is the difference in the change between 2000 and 2010 in the regional mean log wage of male workers minus the change between 2000 and 2010 in the regional mean log wage of male workers. Column 5 controls for state fixed effects. Regressions are weighted by microregion population in 2000. We report coefficients and standard errors followed by normalized coefficients reflecting the difference in the dependent variable associated with moving from the 20th to the 80th percentiles of trade exposure. Standard errors are clustered by state. ***, **, and * denote statistical significance at a 1, 5 and 10 percent confidence level.

Table 10: Growth in Import Competition and Regional Wages and Employment

	(1)	(2)	(3)	(4)
	All		Male / Female Gap	
	OLS	IV	OLS	IV
Panel A: Wages: Formal Sector				
ΔIP_r	-7.660	-6.242	-3.366***	-3.442***
	(5.508)	(6.521)	(1.203)	(1.055)
p80 - p20	-4.361	-3.508	-1.892	-1.934
Panel B: Employment Rate				
ΔIP_r	0.120	0.283	0.579*	0.364
	(0.402)	(0.394)	(0.304)	(0.336)
p80 - p20	0.067	0.159	0.325	0.205
Panel C: Share of Formal Employment				
ΔIP_r	0.101	0.065	-0.231	-0.158
	(1.052)	(0.805)	(0.568)	(0.421)
p80 - p20	0.057	0.037	-0.130	-0.089
Observations	412	412	412	412

Notes: This table reports the results of the estimation of equation (4). The dependent variable is (100 ×) the change between 2000 and 2010 in the mean log wage in the formal sector (panel A), employment to labor force ratio (panel B) or formal employment to total employment ratio (panel C). Male/Female gap in columns 3 and 4 refers to the difference between the outcome compute among male workers minus the outcome computed among female workers. Control variables include the following, all measured in both 2000 and 1991: share of employment in agriculture and mining, share of employment in manufacturing, share of employment in the public sector, share of employed population, share of informal employment, (log) total population, share of female employment, share of skilled employment, and state-level fixed effects. We also control for growth in export demand from China, and use the instrument for it described in Appendix A.2. In addition, we control for the lagged dependent variable computed between 1991-2000 instead of 2000-2010 as well as a measure of regional exposure to changes in tariffs during 1990-1995 defined in Appendix A.4. Regressions are weighted by microregion population in 2000. We report coefficients and standard errors followed by normalized coefficients reflecting the difference in the dependent variable associated with moving from the 20th to the 80th percentiles of trade exposure. Standard errors are clustered by state. ***, **, and * denote statistical significance at a 1, 5 and 10 percent confidence level.

Table 11: Impact of Trade Exposure on the Components of the Oaxaca-Blinder Decomposition of the Gender Wage Gap

	(1) OLS	(2) IV	(3) IV-Robust
Panel A: Overall			
Predicted - Difference	-1.6***	-1.7***	-2.1***
	(0.5)	(0.5)	(0.7)
p80-p20	-0.9	-1.0	-1.2
Panel B: Explained, Unexplained and Interaction Components			
Explained	-0.9*	-1.2**	-1.9***
	(0.5)	(0.5)	(0.6)
p80-p20	-0.5	-0.6	-1.1
Unexplained	0.5	0.3	0.1
	(1.6)	(1.8)	(2.2)
p80-p20	0.3	0.2	0.1
Interaction	-1.2	-0.9	-0.3
	(1.5)	(1.6)	(1.8)
p80-p20	-0.7	-0.5	-0.2
Panel C: Explained Component Breakdown			
Explained - Educ. Att.	-0.1	-0.1	-0.0
	(0.2)	(0.2)	(0.3)
p80-p20	-0.0	-0.0	-0.0
Explained - Age	-0.3*	-0.3*	-0.3**
	(0.1)	(0.2)	(0.2)
p80-p20	-0.1	-0.1	-0.2
Explained - Industry	0.7	0.7	0.5
	(0.6)	(0.6)	(0.6)
p80-p20	0.4	0.4	0.3
Explained - Occupation	-1.2	-1.5*	-2.1**
	(1.0)	(0.9)	(1.0)
p80-p20	-0.7	-0.9	-1.2

Notes: This table reports the results of the OLS and 2SLS estimation of equation (4). The dependent variables in each panel are (100 ×) the following components of the Oaxaca-Blinder decomposition in equation (1). Panel A corresponds to the left-hand side of the decomposition. Panel B corresponds to the change in the "explained", "unexplained", and "interaction" terms. Panel C corresponds to the change in each component of the "explained term". Control variables include the following, all measured in both 2000 and 1991: share of employment in agriculture and mining, share of employment in manufacturing, share of employment in the public sector, share of employed population, share of informal employment, (log) total population, share of female employment, share of skilled employment, and state-level fixed effects. We also control for growth in export demand from China, and use the instrument for it described in Appendix A.2. In addition, in column 3 we control for the lagged 1991-2000 difference in the change in the mean log wage among male and female workers as well as a measure of regional exposure to changes in tariffs during 1990-1995 defined in Appendix A.4. Regressions are weighted by microregion population in 2000. We report coefficients and standard errors followed by normalized coefficients reflecting the difference in the dependent variable associated with moving from the 20th to the 80th percentiles of trade exposure. The number of observations is N = 412 corresponding to the number of microregions. Standard errors are clustered by states. ***, **, and * denote statistical signficance at a 1, 5 and 10 percent confidence level.

Table 12: Impact of Trade Exposure on the Components of the "Explained" Term in the Oaxaca - Blinder Decomposition of the Gender Wage Gap: Change in Quantities vs. Change in Returns

	(1)	(2)	(3)	(4)
	IV		IV-Robust	
	Change in Xs	Change in βs	Change in Xs	Change in βs
Explained - Educ. Att.	-0.3	0.3	-0.3	0.3
	(0.4)	(0.4)	(0.4)	(0.4)
p80-p20	-0.2	0.2	-0.2	0.2
Explained - Age	-0.2	-0.1***	-0.2	-0.1***
	(0.1)	(0.0)	(0.1)	(0.0)
p80-p20	-0.1	-0.1	-0.1	-0.1
Explained - Industry	0.5	0.2	0.4	0.1
	(0.2)	(0.7)	(0.3)	(0.8)
p80-p20	0.3	0.1	0.2	0.1
Explained - Occupation	-1.1*	-0.4	-1.4**	-0.7
	(0.6)	(0.6)	(0.6)	(0.6)
p80-p20	-0.6	-0.3	-0.8	-0.4

Notes: This table reports the results of the 2SLS estimation of equation (4). The dependent variables in each row are (100 ×) the following components of the Oaxaca-Blinder decomposition in equation (1). The first row corresponds to the change in the "explained" term of the decomposition (already reported in the second row of table 11. The second, third, fourth, and fifth rows correspond to the subset of the change in the "explained" term associated to industry, occupation, educational attainment, and age. Each of these is decomposed into changes in quantities (in columns 1 and 3, corresponding to the first term in equation (6)) and changes in "returns" or coefficients (in columns 2 and 4, coresponding to the second term in equation (6)). Control variables include the following, all measured in both 2000 and 1991: share of employment in agriculture and mining, share of employment in manufacturing, share of employment in the public sector, share of employed population, share of informal employment, (log) total population, share of female employment, share of skilled employment, and state-level fixed effects. We also control for growth in export demand from China, and use the instrument for it described in Appendix A.2. In addition, in columns 3 and 4 we control for the lagged 1991-2000 difference in the change in the mean log wage among male and female workers as well as a measure of regional exposure to changes in tariffs during 1990-1995 defined in Appendix A.4. Regressions are weighted by microregion population in 2000. We report coefficients and standard errors followed by normalized coefficients reflecting the difference in the dependent variable associated with moving from the 20th to the 80th percentiles of trade exposure. The number of observations is N = 412 corresponding to the number of microregions. Standard errors are clustered by states. ***, **, and * denote statistical significance at a 1, 5 and 10 percent confidence level.

Table 13: Summary Statistic for Industry-level Measure of Growth in Chinese Import Competition

Mean	St. Dev.	10th pct.	20th pct.	25th pct.	50th pct.	75th pct.	80th pct.	90th pct.
0.055	0.101	0.001	0.004	0.006	0.023	0.062	0.070	0.162

Notes: This table reports summary statistics of the measure of growth in industry exposure to Chinese import competition defined in equation (9).

Table 14: Growth in Import Competition and Cumulative Labor Market Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)
	All		Male		Female	
	IV1	IV2	IV1	IV2	IV1	IV2
PANEL A: CUMULATIVE EARNINGS						
ΔIP	-1.612***	-1.737***	-1.576**	-1.664**	-1.371**	-1.399***
	(0.468)	(0.488)	(0.572)	(0.650)	(0.473)	(0.412)
p80 - p20	-0.107	-0.115	-0.104	-0.110	-0.091	-0.093
PANEL B: CUMULATIVE EMPLOYMENT						
ΔIP	-0.744***	-0.853***	-0.667**	-0.814***	-0.782**	-0.763**
	(0.218)	(0.211)	(0.236)	(0.247)	(0.331)	(0.263)
p80 - p20	-0.049	-0.057	-0.044	-0.054	-0.052	-0.051
PANEL C: CUMULATIVE EARNINGS PER EMPLOYMENT						
ΔIP	-0.076**	-0.077*	-0.085*	-0.077	-0.041	-0.051**
	(0.034)	(0.037)	(0.041)	(0.050)	(0.024)	(0.023)
p80 - p20	-0.005	-0.005	-0.006	-0.005	-0.003	-0.003
Observations	1832218	1832218	1360081	1360081	472088	472088

Notes: This table reports the results of the 2SLS estimation of equation (7). In columns labeled IV1, the instrument is based on imports from China by South-American countries other than Brazil. In columns labeled IV2, the instrument is based on imports from China by all countries other than Brazil. Control variables include fixed effects for age, nine educational levels, microregion, 3-digit occupation, 2-digit broad industry, gender (except in columns 3 through 6) and tenure bins as described in the text. Control variables also include the initial level of import competition from China and from the rest of the world, and average annual pre-shock earnings and days of employment. We report coefficients and standard errors followed by normalized coefficients reflecting the difference in the dependent variable associated with moving from the 20th to the 80th percentiles of trade exposure. Standard errors are clustered by sector. ***, **, and * denote statistical significance at a 1, 5 and 10 percent confidence level.

Table 15: Growth in Import Competition and Cumulative Labor Market Outcomes by Industry

	(1)	(2)	(3)	(4)
	Male		Female	
	IV1	IV2	IV1	IV2
Panel A: Cumulative Earnings in Same Industry				
ΔIP	-4.816***	-5.223***	-3.265***	-3.443***
	(1.311)	(1.276)	(0.759)	(0.759)
p80 - p20	-0.319	-0.346	-0.216	-0.228
Panel B: Cumulative Employment in Same Industry				
ΔIP	-3.473***	-3.896***	-2.508***	-2.570***
	(0.873)	(0.959)	(0.639)	(0.682)
p80 - p20	-0.230	-0.258	-0.166	-0.170
Panel C: Cumulative Earnings in Different Industry				
ΔIP	3.240**	3.559**	1.894***	2.044***
	(1.287)	(1.248)	(0.508)	(0.625)
p80 - p20	0.215	0.236	0.126	0.136
Panel D: Cumulative Employment in Different Industry				
ΔIP	2.806***	3.083***	1.725***	1.807***
	(0.929)	(0.993)	(0.458)	(0.575)
p80 - p20	0.186	0.204	0.114	0.120
Observations	1360081	1360081	472088	472088

Notes: This table reports the results of the 2SLS estimation of equation (7). In columns labeled IV1, the instrument is based on imports from China by South-American countries other than Brazil. In columns labeled IV2, the instrument is based on imports from China by all countries other than Brazil. Control variables include fixed effects for age, nine educational levels, microregion, 3-digit occupation, 2-digit broad industry, and tenure bins as described in the text. Control variables also include the initial level of import competition from China and from the rest of the world, and average annual pre-shock earnings and days of employment. We report coefficients and standard errors followed by normalized coefficients reflecting the difference in the dependent variable associated with moving from the 20th to the 80th percentiles of trade exposure. Standard errors are clustered by sector. ***, **, and * denote statistical significance at a 1, 5 and 10 percent confidence level.

Table 16: Growth in Import Competition and Cumulative Labor Market Outcomes by Occupation

	(1)	(2)	(3)	(4)
	Male		Female	
	IV1	IV2	IV1	IV2
PANEL A: CUMULATIVE EARNINGS IN SAME OCCUPATION				
ΔIP	-1.735**	-1.724**	-1.585***	-1.590***
	(0.601)	(0.664)	(0.514)	(0.403)
p80 - p20	-0.115	-0.114	-0.105	-0.105
PANEL B: CUMULATIVE EMPLOYMENT IN SAME OCCUPATION				
ΔIP	-0.817***	-0.899***	-0.958**	-0.946***
	(0.267)	(0.254)	(0.371)	(0.281)
p80 - p20	-0.054	-0.060	-0.064	-0.063
PANEL C: CUMULATIVE EARNINGS IN DIFFERENT OCCUPATION				
ΔIP	0.159	0.060	0.214**	0.191**
	(0.104)	(0.124)	(0.091)	(0.070)
p80 - p20	0.011	0.004	0.014	0.013
PANEL D: CUMULATIVE EMPLOYMENT IN DIFFERENT OCCUPATION				
ΔIP	0.150	0.085	0.176**	0.183***
	(0.096)	(0.124)	(0.061)	(0.061)
p80 - p20	0.010	0.006	0.012	0.012
Observations	1360081	1360081	472088	472088

Notes: This table reports the results of the 2SLS estimation of equation (7). In columns labeled IV1, the instrument is based on imports from China by South-American countries other than Brazil. In columns labeled IV2, the instrument is based on imports from China by all countries other than Brazil. Control variables include fixed effects for age, nine educational levels, microregion, 3-digit occupation, 2-digit broad industry, and tenure bins as described in the text. Control variables also include the initial level of import competition from China and from the rest of the world, and average annual pre-shock earnings and days of employment. We report coefficients and standard errors followed by normalized coefficients reflecting the difference in the dependent variable associated with moving from the 20th to the 80th percentiles of trade exposure. Standard errors are clustered by sector. ***, **, and * denote statistical significance at a 1, 5 and 10 percent confidence level.

A. Appendix

A.1. Transitions between Formality and Informality

We use the *Monthly Employment Survey* (Pesquisa Mensal de Emprego - PME) to document transitions between employment status over time. This survey is restricted to six of Brazil's metropolitan areas, so it is not representative of Brazil as a whole.[34] We take advantage of the panel dimension of this survey, and compute transitions based on the employment status of workers in January 2005 and December 2005. This is the longest time frame at which we can compare two workers, given its rotation scheme. Unfortunately, there is no survey in Brazil with which we could compute these transitions over longer time frames. It is worth noting that these survey is not representative of Brazil as a whole (as it is limited to urban areas).

In Table A.1 we split workers by gender and by employment status, distinguishing between formal employment, informal employment and the combination of unemployment and out of the labor force. We restrict the sample to individuals aged 15-59. Overall, the transition patterns out of formal sector work are broadly similar between men and women.

Table A.1: Transitions between formality and informality

	Formal Emp.	Informal Emp.	Unemp. or Not in Labor Force
Panel A: Men			
Formal Emp.	78.4%	12.2%	9.5%
Informal Emp.	13.3%	74.7%	12.0%
Unemp. or Not in Labor Force	13.0%	22.0%	65.0%
Panel B: Women			
Formal Emp.	74.6%	11.8%	13.7%
Informal Emp.	11.4%	67.2%	21.4%
Unemp. or Not in Labor Force	7.5%	16.2%	76.2%

Notes: This table reports transitions across different employment status for male and female individuals between January and December 2005, based on Brazil's Monthly Employment Survey (PME).

A.2. Export Demand from China

For Brazil, increased trade with China implied not only an increase in import competition, but also an increase in export demand. Costa et al. [2016] label this as a commodities for manufacturing boom, in the sense that export demand from China is concentrated mostly in commodity industries. For this reason, we construct a measure of growth in export demand from China following Costa et al. [2016], and control for it in all regressions in Sections 5 and 6. This measure of growth in export demand is conceptually similar to the measure of growth in import competition.

[34] PME covers Belo Horizonte, Porto Alegre, Recife, Rio de Janeiro, Salvador and Sao Paulo.

First, we define the increase in Chinese export demand faced by region r between 2000 and 2010 as the weighted average of growth in industry-level exports with weights given by industry-level employment shares for that region in the initial year ($\frac{L_{ir}}{L_r}$) and growth in exports normalized by national industry employment (L_i):

$$\Delta XD_r = \sum_i \frac{L_{ir}}{L_r} \cdot \frac{\Delta X_i}{L_i}. \tag{A.1}$$

In this equation ΔX_i is the difference in exports to China in each industry i between 2000 and 2010. Summary statistics for regional exposure to growth in exports to China (ΔXD_r) are given in Table 7.

As in the case of the import competition measure, we also construct an instrument for growth in export demand from China, given that this measure might be correlated with domestic industry demand and productivity shocks. Following Costa et al. [2016], we construct an instrument for ΔXD_r by using a non-Brazil measure of exposure ($\Delta XD_r^{\text{OTHER}}$) with weights according to Brazilian regional employment shares but using contemporaneous exports to China by other (non-Brazil) countries :

$$\Delta XD_r^{\text{OTHER}} = \sum_i \frac{L_{ir}}{L_r} \cdot \frac{\Delta X_i^{\text{OTHER}}}{L_i}. \tag{A.2}$$

Here $\Delta X_i^{\text{OTHER}}$ is the growth in exports in each industry i from the rest of the world (excluding Brazil) to China. For our specifications in Section 5 which involve two endogenous regressors (i.e., ΔM_i and ΔX_i), the first-stage Cragg-Donald F-statistic is 127.52 which means we can reject the hypothesis that our instruments are weak.

A.3. Alternative Costa et al. [2016] Instrument

The robustness checks in column 1 in Table 9 use an alternative instrumental variable obtained from Costa et al. [2016]. Here we describe it in more detail.

The instrument used in the main text uses imports from China by countries other than Brazil. There is the concern that, specially in the case of commodities, changes in *world prices* might affect trade flows of all countries. Note that this is specially a concern in the case of Costa et al. [2016], who focus on the effects on Brazil's labor market of export demand from China, which is concentrated on the commodity sector. We do control for export demand from China, but it is not our main focus, so we use this alternative instrument as a robustness check.

Costa et al. [2016]'s approach follows Autor et al. [2013] but in addition removes the effect of changes in world prices and quantities using auxiliary regressions. Specifically, it generates an instrument for ΔM_i (in 2) and ΔX_i (in A.1) by taking the product of initial trade levels and China-specific fixed effects from a auxillary 2000-2010 trade growth regression. Intuitively, the China-specific fixed effects represent deviations from in the growth rates of China's trade relative to the rest of the (non-Brazilian) world. See Costa et al. [2016] for more details.

A.4. Regional Exposure to Tariff Cuts

We construct a measure of regional exposure to tariff cuts which were part of Brazil's unilateral trade liberalization in the early 1990s. This is defined as:

$$\Delta\tau_r = \sum_i \frac{L_{ir}}{L_r} \cdot \Delta\tau_i\,, \tag{A.3}$$

where r represents microregions and i represents industries. L_{ir} and L_r are employment in industry i and region r and employment in region r respectively. $\Delta\tau_i$ is the change in the tariff in industry i between years 1990 and 1995. Tariff data is obtained from Kovak [2013]. Tariffs are originally defined at the *nivel 50* level which is similar to SIC 2-digit industries, and are aggregated to 20 industry categories which can be matched to the Demographic Census following Kovak [2013], using value-added weights.

A.5. Summary Statistics: RAIS

The Relação Anual de Informações Sociais (RAIS) provides individual longitudinal data on formal sector workers in Brazil. Our empirical approach focuses on the set of workers employed during the 1996-1998 period and follows their employment and earnings trajectories over the 1999-2000 period. In Table A.2 we provide a basic description of the data and then break-down the distribution of male and female workers across major sectors (Table A.3) and occupations (Table A.4).

Table A.2: Employment in RAIS over time

	Total	Male	Female	Share Female
1996	29.208	18.755	10.453	35.8%
2000	31.309	19.634	11.675	37.3%
2005	39.885	24.363	15.522	38.9%
2010	53.060	31.524	21.536	40.6%

Notes: This table reports annual male and female employment in RAIS, in millions.

Table A.3: Employment in RAIS by broad sectors in 2000

Sector	Sector Name	Total	Male	Female	Share Female
A	Agriculture, Livestock, Forestry	1.75	1.50	0.26	0.15
B	Fishing	0.02	0.02	0.00	0.12
C	Extractive Industries	0.13	0.12	0.01	0.09
D	Manufacturing	5.91	4.24	1.67	0.28
E	Utilities	0.21	0.18	0.03	0.15
F	Construction	1.77	1.67	0.11	0.06
G	Commerce	5.43	3.40	2.02	0.37
H	Hotels and restaurants	1.09	0.56	0.53	0.48
I	Transportation and communication	1.60	1.36	0.24	0.15
J	Financial Intermediation	0.59	0.32	0.27	0.46
K	Real Estate and Business Services	3.92	2.49	1.43	0.36
L	Public Adminsitration	5.69	2.52	3.17	0.56
M	Education	0.86	0.32	0.54	0.63
N	Health and Social Services	1.09	0.28	0.82	0.75
O	Other collective, personal and social services	1.22	0.65	0.57	0.47
P	Domestic Services	0.01	0.00	0.00	0.59
Q	International Organizations	0.00	0.00	0.00	0.47

Notes: This table reports male and female employment in RAIS by sectors according to Brazil's CNAE classification in 2000, expressed in millions. (These 17 sectors are the broadest sectors available in this classification).

Table A.4: Employment in RAIS by broad occupation groups in 2000

Occupation group	Name	Total	Male	Female	Share Female
0/1	Scientific, technical, artistic, etc.	3.56	1.39	2.17	0.61
2	Legislative, executive, judicial, company directors, etc.	1.47	1.05	0.42	0.29
3	Administrative service workers	6.72	3.16	3.56	0.53
4	Commerce workers	3.05	1.74	1.31	0.43
5	Tourism, hospitality, and health workers	5.14	2.78	2.35	0.46
6	Agricultural, forestry, fishing workers	1.73	1.51	0.22	0.13
7/8/9	Industrial production workers, etc.	9.65	8.00	1.64	0.17

Notes: This table reports male and female employment in RAIS by broad occupational groups according to Brazil's CBO classification in 2000, expressed in millions. These 7 groups are the broadest occupational groups available in this classification.