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The Gendered Labor Market Impacts of Trade Liberalization

Evidence from Brazil

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Abstract

This paper investigates gender differences in the impact of Brazil's trade liberalization on labor market outcomes. To identify the causal effect of trade reforms, the paper uses difference-in-difference estimation exploiting variation across microregions in pre-liberalization industry composition. The analysis finds that trade liberalization reduced male and female labor force participation and employment rates, but the effects on men were significantly larger. Thereby, tariff reductions contributed to gender convergence in labor force participation and employment rates. Gender differences are concentrated among the low-skilled population and in the tradable sector, where male and female workers are most likely to be imperfect substitutes.

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The Gendered Labor Market Impacts of Trade Liberalization: Evidence from Brazil*

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1. Introduction

Women's rising economic activity is an ongoing phenomenon across advanced and many developing countries, particularly in Latin America. At the same time, men's labor force participation, which has traditionally been much higher than female labor force participation, is declining in all regions of the world, further contributing to a convergence of male and female labor force participation rates in almost every region. Over the past three decades, gender convergence in labor force participation occurred against the backdrop of globalization, one of its most notable features being rapid trade liberalization and the increasing integration of world product markets. The sharp decline in international tariff barriers in developing countries since the 1980s has motivated a rich literature to analyze the distributional impacts of trade reforms, typically across the income or skill distribution (see Goldberg and Pavcnik 2007 for an overview). However, so far there is only very limited empirical evidence on the gender-specific effects of trade liberalization in developing countries. This is the focus of the present paper, which investigates the impact of Brazil's trade liberalization in the early 1990s on gender-specific labor force participation rates and other labor market outcomes.

Recent empirical work at the cross-country level on the gendered effects of globalization and trade has been inconclusive. Some authors have analyzed the empirical relationship between trade flows and female labor force participation across countries (e.g. Wood 1991; Bussman 2009; Cooray et al. 2012). These studies often find heterogeneous effects of trade on women's economic activity, contingent on the country's income level and economic structure and the time period considered. However, these analyses also face significant methodological challenges – particularly regarding the quality and international comparability of labor force data, and the difficulty to establish causality in a cross-country framework, where trade flows may be correlated with other factors determining female economic activity. Using micro data from household, labor force and establishment surveys, several studies have documented a positive association between export-orientation and female employment at the establishment level (e.g. Ozler 2000; Ederington et al. 2009; Aguayo-Tellez et al. 2013). But based on simple OLS regressions, these studies also lack a meaningful causal interpretation. An exception is the recent paper by Juhn et al. (2014), who show that new export opportunities in Mexican manufacturing reduced gender inequality in blue-collar manufacturing jobs, through technology upgrading by exporting firms.

While studies based on micro data provide more scope for uncovering the relevant mechanisms through which trade affects gender inequality, they are typically confined to the

formal manufacturing sector, focusing on impacts within an industry or firm directly affected by tariff reductions. This paper, instead, presents empirical evidence on the economy-wide labor market impacts of trade liberalization, analyzing Brazil's trade liberalization in the 1990s. Studying impacts beyond the formal manufacturing sector is important, we believe, to better understand how aggregate outcomes such as labor force participation rates are affected. Furthermore, previous research on Brazil has demonstrated that trade liberalization led to labor reallocation across industries (Ferreira et al. 2010), and in particular out of formal manufacturing, into informal jobs, the non-tradable sector, unemployment or inactivity (Meñezes-Filho and Muendler 2011). This means an analysis of the formal tradable sector can only draw a very partial picture of the impacts of trade liberalization.

To analyze the local economy-wide impacts across all sectors we use a local labor market approach pioneered by Topalova (2007), which exploits variation across microregions in exposure to tariff reductions that stems from differences in microregions' pre-liberalization industry composition. By comparing the change in trade protection across microregions we can identify the relative impact of trade liberalization on men's and women's labor market outcomes, whilst controlling for secular trends and time-invariant regional unobservable factors. The strategy we use in this paper has been previously applied to estimate the impact of trade policy changes on poverty, child labor, human capital, and unemployment in India, Vietnam, and Indonesia (Topalova 2007, 2010; Edmonds et al. 2010; McCaig 2011; Kis-Katos and Sparrow 2011; Hasan et al., 2012) and inequality and regional wages in Brazil (Castilho et al. 2012; Kovak 2013). However, this is to our knowledge its first application to estimate the impact of trade reforms on gender-specific labor market outcomes.

A second contribution of the paper is that we not only estimate the effect of trade liberalization on female labor force participation and employment, but examine a wider range of labor market outcomes for both men and women, including unemployment and employment in different sectors. We further disaggregate outcomes by education level, to make sure any gender differences not merely reflect differences in education, and to allow different impacts across the skills distribution. We are thus able to draw a complete picture of the gender-specific local labor market impacts of Brazil's trade liberalization. We thereby contribute to the empirical literature on trade and female labor force participation discussed above, as well as to the broader literature on the distributional effects of trade liberalization (e.g. Goldberg and Pavcnik 2007; Topalova 2010).

We should emphasize from the outset that we analyze medium- to long-term differences in outcomes (over a nine-year period). Liberalization-induced opportunities and incentives can

cause equalizing cross-regional migration, dampening the immediate regional labor market effects of the reforms. This is important to keep in mind when interpreting the results. Focusing on the medium- to long-term effects of trade liberalization also has advantages, however. Our approach is essentially a two-period difference-in-difference estimation, which means we do not face problems due to serial correlation in our outcome and independent variables, while the large number of microregions gives enough power to detect the impacts of liberalization (see Bertrand et al. 2004).

Our results show that trade liberalization in Brazil contributed to a convergence of male and female labor force participation and employment rates. Though microregions more exposed to trade liberalization experienced faster reductions (or slower growth) in labor force participation and employment of men as well as women, the effects on men are roughly twice as large. The negative employment impacts are mostly concentrated in the tradable sector, where gender differences appear only in the low-skilled population. High-skilled men and women are affected similarly, and reallocate from the tradable sector to the non-tradable sector, without any net impacts on labor force participation. Both for low-skilled and high-skilled workers, male workers were much more concentrated in the tradable sector at the start of the period. But only among low-skilled workers do we find that tariff reductions affected men more negatively than women. Because low-skilled tradable sector jobs are most likely to require physical strength, the overrepresentation of men in this segment of the labor force is most likely to reflect imperfect substitutability of male and female workers. Our results therefore suggest that the substitutability of men and women plays a key role in determining and explaining gender differences in the impact of trade liberalization.

This paper is structured as follows. Section 2 briefly discusses related theoretical and empirical literature. Section 3 describes the data sources used in this study, presents a short narrative of the Brazilian trade liberalization and shows descriptive trends in men's and women's labor market outcomes. Section 4 describes our trade protection measure and the empirical framework. Estimation results and robustness checks are discussed in section 5. Section 6 concludes.

2. Theory and Existing Empirical Evidence

Trade liberalization can influence gender differences in the labor market outcomes through three main channels.[1] The first two channels are related to the so-called pro-competitive effects of trade. First, increased competition induced by trade liberalization should reduce the

[1] The focus lies here on demand-side effects; labor supply might also be directly affected via income effects.

scope for taste-based discrimination, a potentially important source of gender inequality in employment and wages (Becker, 1957). Black and Brainerd (2004) provide empirical evidence supporting this channel using data for US manufacturing industries in the 1980s.[2] Second, increased competition (but also access to imported inputs and improved export opportunities) can induce technical change.[3] If technical change is skill-biased (Wood 1995; Acemoglu 2003; Thoenig and Verdier 2003) and men and women differ in terms of their education levels, this will have an effect on gender inequality. Moreover, technical change can be gender-biased due to male-female differences in endowments of brain versus brawn (see e.g. Galor and Weil 1996; Weinberg 2000; Juhn et al. 2014). Analyzing tariff reductions that came about with the creation of the NAFTA trade bloc, Juhn et al. (2014) show that liberalization-induced technical change reduced gender gaps in wages and employment of blue-collar workers in Mexican exporting firms, because these firms adopted new technologies that reduced the physical strength required in blue-collar occupations.

The third channel is the sectoral reallocation of labor, often combined with factor-intensity differences between sectors. Standard Heckscher-Ohlin trade theory predicts that trade liberalization induces a structural change in production and reallocation of factors from import-competing to exporting (comparative advantage) sectors. Sectoral reallocation of production factors has gender implications if male and female workers are imperfect substitutes in the production process, such as in the models of Galor and Weil (1996), Sauré and Zoabi (2014), and Do et al. (2014). Even if male and female workers are perfectly substitutable, however, sectoral changes in the structure of production may have gender implications if there are frictions that exhibit women from entering certain sectors. Goldin (1995) argues that society often stigmatizes female industrial workers, especially if they work in heavy industries (see also Boserup 1970). Similarly, gender differences in social and competitive preferences (Croson and Gneezy 2009) or in care-giving responsibilities (Becker 1985) can lead to a situation where female labor force participation depends on the sectoral structure of production. It has indeed been widely observed that in virtually all countries women are clustered in particular occupations and sectors of the economy, often with little changes over time (Anker et al. 2003; World Bank 2011). Given this type of gender segregation, trade liberalization is expected to improve women's labor market outcomes

[2] Ederington et al. (2009) find supporting evidence for Colombian manufacturing firms, exploiting import tariff reductions between 1984 and 1991.
[3] See Topalova and Khandelwal (2011) for evidence from Indian manufacturing.

relative to men's if a country has a comparative advantage in relatively female-intensive sectors, and vice versa.[4]

Few studies have explored the gender effects of trade-induced labor reallocation empirically. What evidence there is comes from Mexico under NAFTA. Aguayo-Tellez et al. (2013) explore the role of between- and within-industry changes for female employment and wages. They argue that between-industry shifts, consistent with trade liberalization-induced structural change, account for up to 40 percent of the growth in women's wage bill share between 1990 and 2000. While these results suggest that Mexican women benefitted from NAFTA-induced employment growth in female-intensive sectors, the descriptive nature of the decomposition techniques does not allow for a firm causal interpretation of the results.

In general, the empirical evidence on sectoral labor reallocations in response to trade liberalization is mixed. Goldberg and Pavcnik (2007), citing evidence from Mexico, Colombia, Morocco and India, argue that contrary to the predictions of neoclassical trade theory, most studies find little evidence of a substantial reallocation of labor across sectors after trade reforms.[5] On the other hand, studies for Brazil demonstrate that trade liberalization has been associated with significant employment flows across sectors. Ferreira et al. (2010), for example, show that the main impact of liberalization on income inequality was through employment shifts across industries and formality status. However, the nature of labor reallocations following Brazil's liberalization does not seem to correspond to neoclassical trade theory. Using matched employer-employee panel data for the formal sector, Meñezes-Filho and Muendler (2011) find that trade liberalization led to employment shifts out of formal manufacturing with neither exporting firms nor comparative advantage industries absorbing displaced workers. Displaced workers instead ended up in informal manufacturing, the non-tradable sector, unemployment or inactivity. Their findings are in line with McMillan and Rodrik (2011), who show that sectoral labor reallocation in Brazil was growth-reducing in the period 1990-2005, when employment expanded most rapidly in relatively unproductive non-tradable sectors.

What implications can this have for gender-specific labor market outcomes? Rather than the female-intensity of comparative advantage sectors, the difference between tradable and non-tradable sector seems to be more relevant in the Brazilian case. Women in Brazil – as in most other countries – are disproportionately represented in the non-tradable services sectors.

[4] This is the prediction Do et al. (2014) derive in a specific-factors model. Sauré and Zoabi (2014) arrive at the exact opposite conclusion, in a model with capital-skill complementarity: as men move into female-intensive exporting sectors, the capital-labor ratio declines and this increases the gender wage gap.
[5] Also see Wacziarg and Wallack (2004).

It is thus likely that liberalization-induced displacement of workers from the tradable sector disproportionately affected men, though the direction of the overall impact is not clear a priori. If displaced workers move into the non-tradable sector, this might result in a crowding-out of women in traditionally female-intensive activities, reducing or slowing down growth of female employment rates. On the other hand, if displaced workers end up unemployed or inactive, liberalization affects male employment more negatively than female employment, thus contributing to feminization of Brazil's workforce - albeit in a rather negative way.

Uncovering the gendered labor market impact of trade liberalization when workers move from tradable to non-tradable activities, or from work to inactivity and unemployment, requires analysis beyond the manufacturing sector. A number of studies have analyzed the economy-wide relationship between trade and female economic activity on the basis of cross-country data, mostly focusing on trade flows, rather than trade policy changes. This literature (e.g. Bussman 2009; Cooray et al. 2012) suggests that aggregate analyses hide significant heterogeneity across countries, age cohorts and time spells, which is consistent with the notion that the effects of trade liberalization on women's labor market outcomes depend on the pattern of structural change and other country-specific factors.[6] This highlights the need for micro-oriented analyses to better understand the various factors at work in the context of a specific country, yet focusing on impacts beyond the exporting firm or tradable sector. To the best of our knowledge, we are the first to apply this type of analysis to the link between trade and gender-specific labor market outcomes. We furthermore not only focus on female labor market outcomes, but also consider male labor market outcomes, to be able to directly compare the impacts of trade liberalization between men and women. Before describing our empirical approach in detail, we now turn to a description of Brazil's trade liberalization and labor market developments in the 1990s.

3. Data and Descriptive Evidence

3.1 Data Sources

The data for the analysis are drawn from two different data sources. First, we use the Demographic Census for 1991 and 2000, fielded by the Brazilian Census Bureau (Instituto Brasileiro de Geografia e Estatística, IBGE). The census includes a labor market module that collects data on employment status, industry, informality, and wages, for all individuals aged 10 years or above. Our measure of employment includes paid and unpaid work, formal as well as informal. In all of our analyses we focus on the population age 25 to 55.

[6] See also Gaddis and Klasen (2014) on the effects of sectoral growth on female labor force participation.

Our second data source consists of data on nominal tariffs and effective rates of protection by industry based on Kume et al. (2003) and tabulated in Abreu (2004) for the period 1987 to 1998. Compared to nominal tariffs, the effective rate of protection considers both tariffs on output products and imported intermediate goods and is thus a better measure of sectoral protection induced by the overall tariff structure (see Goldberg and Pavcnik 2007 for a discussion). However, nominal tariffs are the most commonly used indicator to measure changes in trade policy (Kovak 2013; Kis-Katos and Sparrow 2011; Topalova 2007). We therefore use nominal tariffs as our main indicator of trade policy, but test whether our results hold when using the effective rate of protection instead. We use concordance tables developed by Ferreira et al. (2010) to match the census activity codes with the tariff data.

3.2 The Brazilian Trade Liberalization

Until the late 1980s, Brazil was one of the most heavily protected economies in the world. Despite the fact that the country was among the founding members of the General Agreement on Trade and Tariffs (GATT) in 1947, it made extensive use of GATT article XVIII:B, which allowed developing countries to impose trade restrictions to address balance of payment difficulties (Abreu 2004). In 1987, just before the onset of trade liberalization, average nominal tariffs stood at 54.9 percent, with significant variations between industries. Apparel, automobiles, and textiles were the most heavily protected sectors, with tariffs between 87 and 102 percent. The lowest tariffs were between 15 and 25 percent, for oil, gas and coal; mining products; and chemicals. Due to the structure of tariffs, effective rates of protection showed even greater dispersion – varying between 308.1 percent in the automobile sector and just 8.3 percent for oil, gas and coal (Abreu 2004).

In the late 1980s, after the transition from military rule to a civilian government, Brazil embarked on an ambitious liberal reform agenda, whose central elements were a comprehensive trade liberalization program and macroeconomic stabilization to curb inflation. Between 1987 and 1994 average nominal tariffs were unilaterally lowered from 54.9 to 10.5 percent and most non-tariff trade barriers were lifted. Because binding non-tariff barriers were not abolished until 1990, tariff reductions became effective only from 1990 onwards, whereas the tariff cuts before 1990 effectively served to eliminate tariff redundancy (see Carvalho 1992 for Brazil; see Goldberg and Pavcnik 2007 for a more general discussion).

Figure A1 documents tariff levels between 1987 and 1999 for 20 industries and shows that, besides tariff levels, tariff dispersion across industries was reduced as well. After 1994, the Brazilian government partially slid back on trade reforms, particularly in the automobile

sector, where tariffs rebounded from 18.7 percent in 1994 to 32.9 percent in 1997. Across industries, the average tariff increased from 10.5 percent in 1994 to 14.8 percent in 1997, after which tariff levels remain stable. Given this pattern and the fact that non-tariff barriers were binding until 1990, we use tariff changes between 1990 and 1998 in our analysis.[7] The Brazilian trade reforms of the late 1980s and 1990s did not include special or new incentives for export promotion. On the contrary, the mounting public deficit had already forced the Brazilian administration to abolish several exports subsidy schemes in the mid-1980s, prior to import tariff liberalization reforms (GATT 1993a, b; Pereira 2006).

Brazil's move to a more liberal trade policy stance was triggered by a series of external and internal events. Even though trade reforms were implemented unilaterally, they were embedded in multilateral trade negotiations under the Uruguay Round (Castilho et al. 2012). Trade policy changes were also designed to have tariff levels converge towards the Mercosur Common External Tariff (CET), which came into effect with the establishment of Mercosur customs union in January 1995 (Abreu 2004). Yet the fundamental reversal in trade policy also had deeper causes. After the experiences of the 1970s oil crises as well as macroeconomic and debt crises in many Latin American economies during the 1980s, elites in Brazil, as in other countries in the region, felt disaffected with the protectionist import-substitution policies of the past. As described in Abreu (2004) and Kovak (2013) trade liberalization became an explicit objective of the Brazilian government, which also managed to curb protectionist interests. The implications of this for the present analysis are that tariff reductions during the early 1990s can be considered reasonably exogenous to industry performance and labor market outcomes, which is an important element of the identification strategy in this paper.

Although the exogeneity of trade policy changes to private sector interests is difficult to test formally, the pattern and magnitude of tariff reductions over this phase of trade liberalization is consistent with the stated policy objective of systematically reducing the level and spread of import tariffs. Figure A2 in the appendix plots the reduction in tariffs between 1990 and 1998 against the initial (1990) level for 20 industries, illustrating that tariff cuts are strongly predicted by the initial levels in tariffs.

Trade liberalization was not the only macroeconomic change taking place in the Brazilian economy in the 1990s. The country was hit by a recession and record inflation in 1990-1992, which may have affected employment and unemployment. In 1994, after several failed attempts to curb inflation, the government of Brazil launched the Real Plan that introduced a

[7] We do test for the robustness of our results using tariff changes between 1990 and 1995, as in Kovak (2013).

new currency and brought prices under control, which again could have triggered labor market responses. The government's series of steps towards capital account convertibility and liberalization further included the creation of foreign capital investment companies and funds, stock and bond portfolios (Goldfajn and Minella 2005). As a result, the stock of FDI in Brazilian industry, which was rather constant in the early 1990s, picked up significantly after 1992 (Muendler 2003a; see also Appendix figure A5). Section 4 sets out to isolate the causal impact of trade reforms on labor market outcomes, exploiting the fact that the Brazilian microregions were differentially exposed to tariff changes. The potentially confounding effect of FDI is further discussed in section 5.3.

3.3 Labor Market Outcomes

This section turns to the evolution of economic activity and other labor market outcomes among Brazilian men and women aged 25-55. Table 1 summarizes labor force participation, employment and unemployment in 1991 and 2000. We view these three measures as important and complementary indicators of labor market engagement. However, employment is arguably measured more reliably than the other two variables because of the empirical difficulty to distinguish unemployed (who per definition must be actively searching for employment) from non-participating individuals, where the latter includes discouraged workers no longer actively searching for a job.[8] Because male-female differences are much smaller in the highly educated population, all measures (and later on, all estimation results) are also presented separately by education group. In this table and throughout the paper, high-skilled is defined as having completed high-school education or higher.[9] In 1991, high-skilled men and women accounted for 21 percent of the population age 25-55. Their share increased to 27 percent in 2000.

[8] Note that all labor market participation rates in this paper are normalized on the total population age 25-55. Hence the employment rate is the share of the population working and the unemployment rate is the share of the population unemployed. This differs from the usual concept of unemployment rates, which are normalized on the economically active population.

[9] The same definition of high-skilled is used by Ferreira et al. (2010).

Table 1: Male and female labor force participation, employment, and unemployment

	All				Low-skilled				High-skilled			
	women		men		women		men		women		men	
	1991	2000	1991	2000	1991	2000	1991	2000	1991	2000	1991	2000
Labor force	43.6	57.9	94.0	88.4	36.8	51.0	93.3	86.9	71.5	77.1	96.1	94.0
Employed	41.5	49.0	91.5	80.7	34.7	41.6	90.7	78.1	69.1	69.2	94.0	88.8
Tradable	8.3	9.4	39.2	27.1	8.7	10.4	41.5	29.0	5.5	5.9	21.9	16.9
Non-tradable	33.0	39.0	51.9	52.5	25.9	30.7	48.7	48.1	63.4	62.5	71.7	70.7
Unemployed	2.1	8.9	2.4	7.7	2.1	9.4	2.6	8.8	2.4	7.9	2.1	5.2

Note: Numbers are in percentage of the population age 25-55. Tradable and non-tradable may not add up to total employment because the sector of employment is missing for some observations. *Source*: Brazil Demographic Census

Though part of a longer-term trend, Brazil's trade liberalization period is characterized by a sharp increase in female labor force participation, while the male labor force participation rate, which started out more than twice as high as for women, declined.[10] The gender gap in labor force participation is largest for the low-skilled population, but shows a strong decline from 57 to 36 percentage points. Gender convergence is much less pronounced in the high-skilled population, where the female labor force participation was already more than 70 percent in 1991. Unemployment accounts for a substantial part of the increase in female labor force participation, in fact for the entire increase among high-skilled women. Employment rates by sector show the typical pattern of gender segregation by sector, as female workers are much more concentrated in the non-tradable sector than men. Table 2 summarizes the distribution of male and female of workers across sectors, showing there has been a sizeable shift of the male workforce into non-tradable employment between 1991 and 2000. Overall, we thus see gender convergence in labor force participation and employment rates, as well as in the sectoral distribution of male and female workers.

Table 2: Share of male and female workers in tradable and non-tradable sector

	All				Low-skilled				High-skilled			
	women		men		women		men		women		men	
	1991	2000	1991	2000	1991	2000	1991	2000	1991	2000	1991	2000
Tradable	20.1	19.5	43.1	34.0	25.1	25.3	46.0	37.7	8.0	8.6	23.4	19.3
Non-tradable	79.9	80.5	56.9	66.0	74.9	74.7	54.0	62.3	92.0	91.4	76.6	80.7
Total	100	100	100	100	100	100	100	100	100	100	100	100

Note: Numbers are for the workforce age 25-55. *Source*: Brazil Demographic Census

[10] The trend of increasing female labor force participation in Brazil is consistent with secular patterns in many developing countries in Latin America, the Middle East and parts of Asia (Gaddis and Klasen 2014).

4. Empirical Approach

The key econometric challenge in identifying the causal effect of trade liberalization is that national tariff reforms affect the whole country, leaving the analyst without a control group that could be suitably compared to workers exposed to trade liberalization. However, geographic variation in the pre-liberalization industry structure and variation across industries in tariff reductions in Brazil suggest that there is variation in the intensity with which microregions were exposed to the reforms. Hence by comparing microregions more or less exposed to trade reforms we can identify the relative impact of trade liberalization on labor market outcomes. This identification strategy was pioneered by Topalova (2007, 2010).

4.1 Measuring Trade Protection at the Microregion Level

Following Topalova (2007, 2010) we construct a region-level time-varying measure of trade protection (*TP*), which reflects the region-specific pre-liberalization industry composition of employment and time-specific sectoral tariff rates. Throughout the analysis, the geographic unit of analysis is the microregion. Microregions are groups of neighboring municipalities with similar economic and geographic characteristics, constituting local labor markets relevant to our analysis (IBGE 1990; Kovak 2013).[11] We can distinguish 494 microregions, each of which belongs to one of Brazil's 27 states, which in turn is part of one of five macroregions. *TP* measures the level of trade protection for 494 microregions of Brazil in 1990 and 1998, the first and last year of tariff data we use. In a first step, we aggregate the Demographic Census industry codes into 21 broad sectors (20 tradable sectors and the non-tradable sector) that can be matched to the tariff data, based on the concordance table displayed in Ferreira et al. (2010), but with minor adjustments.[12] We then use the census data to calculate sector-level employment shares by microregion for the start of the liberalization period. These 'base-year' employment shares act as weights for the industry-level tariff changes and thus capture the cross-sectional variation in exposure to trade reforms.[13] In a

[11] Some of the administrative boundaries changed between the 1991 and 2000 census. We thank Brian Kovak for kindly sharing details on the aggregation required to define consistent areas over time.

[12] In particular we combine the sub-sectors 'processing of vegetal products' and 'meat packing, dairy industry, vegetal and other food products'; we also merge 'leather and skins' with 'footwear', and 'manufacturing of synthetic materials' with 'unclassified manufacturing'.

[13] Note that the employment shares are based on the Demographic Census in 1991 and refer to the year ending on August 31st 1991, which is after the start of tariff reductions in March 1990. Since earlier employment data are not available at the microregion level, we use the 1991 data assuming the regional employment structures were not affected significantly in the first year after tariff reductions.

second step, we merge these with the sectoral tariff data.[14] Finally, we compute the microregion-level trade protection measure according to the following formula:

$$TP_{r,t} = \sum_{s=1}^{S} \frac{Emp_{r,s}^{1991}}{Emp_{r}^{1991}} * Trf_{s,t} \qquad [1]$$

Where $Trf_{s,t}$ is the nominal tariff rate of sector s at time t (1990, 1998). Note that TP is scaled in such a way that a high value indicates high levels of protection.

Computing [1] requires a decision regarding the treatment of the non-tradable sector, for which two different approaches have been taken in the literature. One approach is to let non-tradables enter the trade protection measure as an additional sector, with tariffs being assigned zero over the entire period (e.g. Topalova 2007; Kis-Katos and Sparrow 2011). Denote this measure TP^{inNT}. Variation in TP^{inNT} will reflect the fact that microregions with a large share of employment in the non-tradable sector are less exposed to trade liberalization than those with a large share of the labor force employed in the tradable sectors. The second approach is to exclude the non-tradable sector from the analysis and to rescale employment shares to sum to unity over the 20 traded sectors only. From a theoretical perspective, the latter measure, which we denote TP^{exNT}, is preferable if labor market adjustments work out entirely within the tradable sector, as would be the case in a neoclassical model with perfectly mobile labor (see Kovak 2013). One could argue this is a reasonable approximation of long-term equilibrium. As discussed above, however, labor reallocations following Brazil's liberalization appeared to be dominated by a move from the tradable to the non-tradable sector. If reallocation of workers within the tradable sector fails, while the non-tradable sector is able to absorb more workers, the start-of-period employment share of the non-tradable sector should matter for the local labor market impact of liberalization reforms. TP^{exNT}, however, reflects only differences in the employment structure within the tradable sector.

While this would suggest using TP^{inNT}, there is a second empirical consideration that determines the choice between the two trade protection measures. In particular the measure including non-tradables is mechanically affected by the size of the non-tradable sector, which can potentially confound the estimates if the initial size of the non-tradable sector has an impact on subsequent changes in gender-specific labor market outcomes (or is correlated with unobserved determinants of labor market outcomes). This holds for the initial size of all tradable sectors as well, but is more likely to be a problem for the non-tradable sector, because non-tradable sector 'tariffs' do not change over time (effectively being assigned zero) so that the portion of the variation in TP^{inNT} that is due to the non-tradable sector only mirrors

[14] In cases where tariffs are measured at a finer level of disaggregation, we compute a simple average at the level of the 21 tradable sectors identified above.

differences in the initial employment shares. Initial employment in the non-tradable sector is highly correlated with initial female labor force participation and therefore likely to be correlated with subsequent changes in women's labor market outcomes if for example a process of mean reversion takes place. Furthermore, regions more specialized in the non-tradable sector are likely to have a higher level of overall development, which in itself may predict slower employment growth if there is regional convergence over time. Given these considerations, we prefer to use TP^{exNT} as an instrument for TP^{inNT}, based on the notion that TP^{exNT} is not influenced by the size of the non-tradable sector but is highly correlated to TP^{inNT}.[15] A similar approach is used in Topalova (2007 and 2010) and Edmonds et al. (2010).

4.2 Empirical Framework

To estimate the relationship between trade protection and male and female labor market outcomes, we construct a panel data set by aggregating all individual-level census data for 1991 and 2000 to the microregion level. Our two-stage least squares estimation starts with a regression of TP^{inNT} on the exogenous TP^{exNT}. The second stage estimation equation is the following:

$$y_{r,t} = \alpha_r + \delta D2000_t + \beta\, \widehat{TP}_{r,t} + \sum_k \gamma^k \left(E^k{}_{r,1991} * D2000_t\right) + \varepsilon_{r,t} \qquad [2]$$

Here, $y_{r,t}$ is a microregion-level (r) outcome in year t – i.e. the female or male labor force participation rate, employment rate, unemployed rate, as well as employment rates by sector (always as a percentage of the population aged 25-55 years). All outcomes are also analyzed for low-skilled and high-skilled men and women separately, to verify that any male-female differences in estimates are not driven by differences in education levels. We control for time-invariant unobserved regional heterogeneity through microregion fixed effects (α_r), while a "post" dummy ($D2000_t$) controls for trends affecting Brazil as a whole. TP is the predicted values of trade protection and β the parameter estimate of key interest. As explained above, we use an instrumental variable approach to make sure this estimate does not pick up the effect of start-of-period specialization in the tradable versus non-tradable sector.

We further allow for a differential trend in (fe)male labor market outcomes across regions with different initial employment shares in agriculture, industry, construction, trade, and other services ($E^k{}_{r,1991}$). While this broad employment structure is not mechanically related to the

[15] Note that within the tradable sector, tariff changes are only weakly correlated with industries' female-intensity. Figure A3 in the appendix shows that male-intensive tradable industries were not systematically more or less liberalized than female-intensive tradable industries, which means that TP^{exNT} will not be picking up the female-intensity of tradable sector employment in the microregion.

variation in *TP* (as is the case for the share of the non-tradable sector as a whole), it is included to capture other unobserved microregion characteristics that are likely to predict labor market developments. Standard errors are clustered at the microregion-level and regressions are weighted by microregions' population in 1991.

As discussed previously, an important advantage of this identification strategy is that it does not restrict the analysis to the manufacturing sector, but allows a focus on economy-wide changes across all sectors. In fact our econometric set up should reveal general equilibrium effects taking place within microregions, though not any effects operating between them. If people tend to migrate from regions more affected by liberalization to those less affected, for example, this dampens the link between changes in *TP* and changes in labor market outcomes. It is unlikely, however, that this will affect the estimates for men and women differently. Another important implication of our identification strategy is that we can only estimate the differential impact of tariff reforms on labor market outcomes across microregions, net of any country-wide 'level' effects of trade liberalization (Topalova 2007, 2010).

Before turning to the estimation results, Table 3 illustrates there is considerable variation across microregions in terms of the changes in trade protection and labor market outcomes. The first column summarizes the distribution of the 1990-1998 change in TP^{inNT}. Between the 25th and 75th percentile we see a difference of 3.21 percentage points in tariff reduction. Columns two and three summarize the 1991-2000 change in male and female labor force participation rates. With falling male participation rates and increasing female participation rates, the male-female gap has declined considerably across the whole of Brazil. The fourth column shows that the gender convergence in participation rates ranged from 13.4 percentage points in the 90th percentile to almost 30 percentage points in the 10th percentile microregion, with a 7.2 percentage point difference between the 25th and 75th percentile. Variation in the changes in employment rates is similar.

Table 3: Distribution of change in *TP* and labor market outcomes across microregions

		Labor force participation rate			Employment rate		
	TP^{inNT}	Male	Female	Male-female	Male	Female	Male-female
90th percentile	1.47	-1.76	18.6	-13.4	-5.94	2.81	-12.4
75th percentile	0.40	-1.93	16.2	-15.4	-7.71	4.90	-14.1
50th percentile	-1.58	-2.84	14.1	-18.2	-8.67	6.88	-16.0
25th percentile	-2.81	-6.30	12.0	-22.6	-11.5	10.0	-21.3
10th percentile	-4.33	-13.95	10.6	-29.6	-19.3	13.5	-28.2
Difference p75-p25	3.21	4.37	4.20	7.20	3.84	5.10	7.27

Note: All figures are percentage point changes. For each variable, microregions are ranked according to the change in that variable (1990-98 for TP^{inNT} and 1991-2000 for the other variables), weighted by 1991 population.

5. Results

5.1 Trade Liberalization and Labor Market Outcomes of Men and Women

Table 4 shows the estimation results for equation [2] on three different measures of labor market outcomes, for women and men. For each outcome, the table shows the effect of trade protection with the non-traded sector included (OLS) as well as the instrumental variable estimate where TP^{inNT} is instrumented by TP^{exNT} (2SLS). Table A1 in the appendix shows the results for the first stage, documenting a strong positive association between TP^{inNT} and TP^{exNT}.

The OLS estimates show that declining trade protection is associated with an increase the in employment rate and declining unemployment for women as well as men, with a positive net labor force participation effect for men and no labor force participation effect for women. All OLS estimates are statistically insignificant. With TP^{exNT} as instrumental variable, however, the estimates all change sign and become highly statistically significant. The difference between OLS and 2SLS results indicates there is a substantial bias in the OLS estimates, reflecting the impact of the initial share of workers in the non-tradable sector. To understand this bias, remember that microregions where employment is more concentrated in the tradable sector will have a larger reduction in TP^{inNT}. If these regions are less developed and there is convergence across microregions, they will have faster employment growth even in absence of any trade liberalization effect. Thus, the stronger decline in TP^{inNT} reflects the effect of being initially less developed, which biases the OLS estimate downwards.

Table 4: Trade liberalization and gender-specific labor market outcomes

	Women		Men	
	OLS	2SLS	OLS	2SLS
Dependent variable: labor force participation				
TP	-0.000	2.092***	-0.522	4.540***
	(0.308)	(0.789)	(0.369)	(0.998)
Dependent variable: employment				
TP	-0.221	2.672***	-0.750	5.707***
	(0.385)	(0.797)	(0.483)	(1.175)
Dependent variable: unemployment				
TP	0.221	-0.579	0.228	-1.167***
	(0.230)	(0.362)	(0.206)	(0.339)
N	988	988	988	988
F-stat excluded instrument	-	58.27	-	58.27

Note: All estimations control for microregion- and year-fixed effects and initial broad employment structure. Standard errors are clustered by microregion; regressions are weighted by microregions' 1991 population.

According to the 2SLS results, microregions more exposed to trade liberalization experienced slower growth in employment rates and labor force participation rates than microregions less exposed, while unemployment growth was higher in the more exposed regions. A one percentage point decline in trade protection is predicted to reduce (or slow down growth of) female labor force participation by 2 percentage points and male labor force participation by more than 4 percentage points. These are economically large effects, and substantially worse for men than for women.[16] Note that the male labor force participation and employment rate were more than twice as high as the female rates at the start of the period, so in proportional terms, men and women were affected similarly. Nevertheless, trade liberalization contributed to a substantial convergence of labor force participation and employment rates.

To what extent can the impact across regions explain spatial variation in this gender convergence in Brazil? Compare two microregions over period 1991-2000: one at 25th percentile of ΔTP and the other at 75th percentile of ΔTP. The change in TP^{inNT} in a highly exposed region (25th percentile) was -2.8 percentage points, while a less exposed region (75th percentile) experienced an increase in TP^{inNT} of 0.4 percentage points. According to our estimates, the p75-p25 difference of 3.2 percentage points translates into a 6.7 percentage points slower growth of female labor force participation and a 14.5 percentage points slower growth (or faster decline) of male labor force participation in the more exposed region. This means the more exposed microregion has a 7.9 pp larger reduction in the male-female labor force participation gap than the less exposed microregion. This difference is comparable the observed spatial variation in gender convergence (see Table 4: the p75-p25 difference observed is 7.2 percentage points).

5.2 Differences by Skill Level

We discussed in section 3 that gender gaps and gender convergence in the labor market have been most pronounced in the low-skilled population. To shed more light on skill-specific gender differences and to verify that the male-female differences in estimates are not driven by differences in education, Table 5 reports 2SLS results by gender and skill group. We find that the overall effects and the male-female differences are concentrated mainly in the low-skilled population. The effects on low-skilled men and women are somewhat larger than the effects for the total population, and again more than twice as large for men than for women.

[16] We estimated the same equation on pooled data for men and women, including a full set of interaction terms with gender, to directly compare the estimates for men and women. All differences are statistically significant at the five percent level at least.

For high-skilled men, liberalization reduced employment growth and increased unemployment growth, but the effects are much smaller and less precisely estimated than for low-skilled men. We find no impact of liberalization on high-skilled women's participation, employment, or unemployment. The male-female differences in the high-skilled population are not statistically significant either, except for the effect on unemployment.

Table 5: Trade liberalization and outcomes by gender and education

	All		Low-skilled		High-skilled	
	Women	Men	Women	Men	Women	Men
Dependent variable: *labor force participation*						
TP	2.092***	4.540***	2.180***	4.678***	-0.106	0.005
	(0.789)	(0.998)	(0.761)	(1.057)	(0.770)	(0.304)
Dependent variable: *employment*						
TP	2.672***	5.707***	3.141***	6.470***	-0.103	0.637
	(0.797)	(1.175)	(0.801)	(1.299)	(0.853)	(0.432)
Dependent variable: *unemployment*						
TP	-0.579	-1.167***	-0.960**	-1.793***	-0.002	-0.632**
	(0.362)	(0.339)	(0.445)	(0.431)	(0.351)	(0.270)
N	988	988	988	988	988	988

Note: All dependent variables are measured as share of the relevant population, age 25-55. 2SLS estimation, all include microregion- and year-fixed effects and initial broad employment structure. Standard errors are clustered by microregion; regressions are weighted by microregions' 1991 population.

The difference between low- and high-skilled workers is quite striking. Despite the fact that a considerable proportion of high-skilled men worked in the tradable sector at the start of the period, they appear not to be affected much by tariff reductions. One possible explanation is that the denominator in our dependent variable – the relevant population – was itself affected by liberalization. If education levels increased less in regions more exposed to liberalization, the low-skilled population would grow relatively fast and the high-skilled population relatively slowly. We find no evidence for this explanation, however. Female and male average years of education increased less in microregions more exposed to liberalization, but we do not find a significant impact on the high-skilled share of the population (appendix table A2), and controlling for years of education in our main specification does not affect the results.

Another explanation could be that tariff reductions were greater in less skill-intensive industries, such that *TP* declines more in microregions were tradable sector employment was concentrated in unskilled-intensive activities. As illustrated in appendix Figure A4, this is not

the case. If anything, more skill-intensive industries faced slightly larger tariff reductions, but the correlation is only -0.15.[17]

Meñezes-Filho and Muendler (2011) find that liberalization reduced tradable sector employment, with workers moving into unemployment, inactivity, and the non-tradable sector. If high-skilled workers reallocated from the tradable to the non-tradable sector, this could explain why we find no impact on aggregate high-skilled employment and participation rates. In Table 6 we present results for the impact of liberalization on employment rates by sector. In total, tradable sector employment was much more affected than non-tradable employment and indeed, liberalization did reduce high-skilled tradable sector employment, but led to an increase in non-tradable employment of similar magnitude: tariff cuts induced a reallocation of high-skilled workers from the tradable to the non-tradable sector.

We find no evidence that men moving into services crowd out women. In fact it appears high-skilled women are better able to reallocate towards the non-tradable sector than high-skilled men, as we find a significant increase in unemployment only for the latter. But overall, as the employment and labor force participation rates of high-skilled population are not affected, liberalization-induced tertiarization of employment has not been a channel for feminization of the workforce.

The negative impact on low-skilled employment is driven by tradable sector employment rates for men, and by both tradable and non-tradable employment rates for women. Low-skilled workers did not reallocate towards the non-tradable sector. If anything, high-skilled workers are partly replacing low-skilled workers in the non-tradable sector.

[17] Gonzaga et al. (2006) argue that tariff reductions should be adjusted for industries' initial import penetration to measure the actual change in protection. They show that import penetration-adjusted tariffs did decline more for skill-intensive industries. An important argument against this adjustment, however, is that import penetration itself is a function of tariffs (and non-tariff barriers). An industry can have zero import penetration exactly because of prohibitively high protection, which does not imply that tariff reductions have no real effect on the industry. Using import penetration data from Muendler (2003b) we find a correlation coefficient of -0.54 between tariff changes and the change in import penetration across manufacturing industries.

Table 6: Trade liberalization and employment by sector

	All		Low-skilled		High-skilled	
	Women	Men	Women	Men	Women	Men
Dependent variable: *employment*						
TP	2.672***	5.707***	3.141***	6.470***	-0.103	0.637
	(0.797)	(1.175)	(0.801)	(1.299)	(0.853)	(0.432)
Dependent variable: *tradable sector employment*						
TP	1.564***	5.077***	1.541***	5.266***	2.185***	2.830***
	(0.495)	(1.397)	(0.546)	(1.461)	(0.484)	(1.064)
Dependent variable: *non-tradable sector employment*						
TP	1.346*	0.677	1.801***	1.125	-1.972**	-1.804*
	(0.715)	(0.819)	(0.682)	(0.910)	(0.969)	(0.922)
N	988	988	988	988	988	988

Note: All dependent variables are measured as share of the relevant population, age 25-55. 2SLS estimations, all include microregion- and year-fixed effects and initial broad employment structure. Standard errors are clustered by microregion; regressions are weighted by microregions' 1991 population.

Given the large gender differences for the low-skilled population, it is important to note that the sectoral employment effects for high-skilled men and women are rather similar. This is despite the fact that high-skilled men's initial tradable sector employment rate (21.9 percent) is four times as high as high-skilled women's (5.5 percent). Low-skilled total and sector-specific employment rates, on the other hand, are affected more in proportion to start-of-period employment.

Note that if low-skilled employment in the tradable sector is dominated by brawn-intensive jobs, men and women are likely to be imperfect substitutes. This could explain the over-representation of men in this segment of the labor force, as in Juhn et al. (2014). As a consequence, the liberalization-induced slowdown of tradable sector employment growth affects low-skilled men more negatively than low-skilled women. High-skilled workers are more likely to work in jobs where males and females are close substitutes, so gender segregation across sectors is more likely to be driven by differences in preferences or social norms. High-skilled male and female workers are then affected more equally by the slow-down of employment growth in the tradable sector. While it goes beyond the scope of this paper to uncover the full picture of worker substitutability across gender and skill, our results highlight its importance for gender differences in the impact of trade liberalization.

5.3 Robustness Checks

In this section we test the robustness of our results with respect to our measures of employment and trade protection, our empirical specification, and FDI inflows. To start with, we note that an important change in Brazil's Demographic Census was a reduction in the

reference period for employment, from the entire last year (September 1, 1990 to August 31, 1991) in the 1991 census to a week (the last week of July) in the 2000 census. This could bias our estimates if, for example, liberalization increased temporary employment at the cost of permanent jobs, so that people are more likely to be out of work in a particular week even if they still worked most of the preceding year. We verify this by analyzing the effect of liberalization on paid employment, which we measure by two different definitions. The first is based on the question whether the respondent worked in the reference period, but excludes those who do unpaid work. This measure is subject to any bias induced by the change in reference period. The second definition uses reported earnings, and counts those with positive earnings only. Since earnings were recorded for the same reference period (one month) in both the 1991 and the 2000 census, this measure is not affected by any change in reference period. Table 7 shows results for the two measures of the paid employment rate. We see that the results are very similar, indicating that the impact of liberalization on employment rates is not biased by changes in the reference period. Furthermore, the effects on paid employment are similar to the effects on total employment, reported in the top row of Table 5.

Table 7: Robustness across different measures of employment

	All		Low-skilled		High-skilled	
	Women	Men	Women	Men	Women	Men
Dependent variable*: paid employment*						
TP	3.127***	5.902***	3.542***	6.707***	-0.238	0.531
	(0.836)	(1.203)	(0.850)	(1.331)	(0.855)	(0.441)
Dependent variable*: has positive earnings*						
TP	2.744***	5.513***	3.240***	6.433***	-0.654	-0.123
	(0.835)	(1.130)	(0.842)	(1.267)	(0.915)	(0.432)
N	988	988	988	988	988	988

Note: 2SLS estimation, all include microregion- and year-fixed effects, and initial broad employment structure. Standard errors are clustered by microregion; regressions are weighted by microregions' 1991 population.

Our results are also robust to changes in the measure of trade protection. We repeat our estimations using effective rates of protection instead of nominal tariffs. While nominal tariffs have been used in much of the existing empirical literature (e.g. Topalova 2010; Edmonds et al. 2010; Kovak 2013), the effective rate of protection is another common measure of trade protection, which better reflects indirect effects through the protection of intermediate inputs. The results using effective rates of protection (not shown but available on request) come out similar to those using tariff rates. Though the estimates are smaller in magnitude, effective rates of protection show a larger decline over time, translating into very similar impacts. In

addition, we estimate the effects of liberalization using tariffs in 1990 and 1995, instead of 1990 and 1998. Tariffs slightly increased after 1995 and stabilized only after 1997, which is why we prefer to analyze the impact of tariff changes between 1990 and 1998. If we take the shorter period up to 1995, as in Kovak (2013), we find almost the exact same results.

One might be concerned that despite controlling for microregion fixed effects and their broad initial employment structure, our measure of regional trade protection picks up unobserved time-varying determinants of labor market outcomes, biasing the effect of trade liberalization. In order to address this issue, we add macroregion-specific trends as control variables, which means we identify the effect of trade protection from within-macroregion differences across microregions. Results in Table 8 show that the estimates are smaller in magnitude, suggesting there is indeed some macroregion-specific unobserved factors that correlate with the change in *TP*. Qualitatively, however, all results hold, including significantly stronger impacts on men than on women, concentrated in the low-skilled population.[18] These estimates translate into a 3.1 (9.8) percentage point slower growth of female (male) labor force participation in a more exposed microregion, compared to a less exposed region (p75-p25), or a 6.7 percentage point faster convergence of male and female participation rates.

Table 8: Results with controls for macroregion-specific trends

	All		Low-skilled		High-skilled	
	Women	Men	Women	Men	Women	Men
Dependent variable*: labor force participation*						
TP	0.956	3.048***	0.814	3.071***	-0.392	-0.025
	(0.688)	(0.859)	(0.632)	(0.866)	(0.719)	(0.315)
Dependent variable*: employment*						
TP	1.148*	3.650***	1.342**	4.196***	-0.627	0.411
	(0.646)	(0.979)	(0.646)	(1.049)	(0.730)	(0.406)
Dependent variable*: unemployment*						
TP	-0.192	-0.602*	-0.528	-1.125***	0.235	-0.436*
	(0.370)	(0.343)	(0.431)	(0.425)	(0.336)	(0.245)
N	988	988	N	988	988	N

Note: 2SLS estimation, all include microregion- and year-fixed effects, initial broad employment structure, and macroregion-specific trends. Standard errors are clustered by microregion; regressions are weighted by microregions' 1991 population.

Finally, we analyze the impact of FDI. As discussed in section 3, the stock of FDI in Brazilian industry picked up significantly after 1992. Since there is some previous research

[18] Brazil consists of five macroregions. We also obtain very similar results if we include state-specific trends.

showing an effect of FDI on women's employment, rising capital inflows from abroad could also have affected employment and participation rates (see Cooray et al. 2012). If FDI flows were correlated with tariff changes at the sector level, this would contaminate our estimates of the effect of trade liberalization. To rule out the effect of FDI to some extent, we run our estimations with an additional control variable for local FDI. Local FDI is measured as a microregion-specific index similar to *TP*. That is, we take a weighted average of sectoral FDI stocks in 1990 and 2000, where the weights are the shares of sectoral employment in total manufacturing employment within the microregion in 1991. We exclude agriculture, mining, and the non-tradable sector, because FDI data (from Muendler 2003a) are available only for manufacturing industries. This index thus predicts the microregion-level stock of FDI based on the sectoral FDI stocks for the whole of Brazil and the microregion's 1991 structure of manufacturing employment. Within-microregion variation reflects the predicted net inflow of manufacturing FDI. All of the estimation results, reported in Table 9, are very similar to our main specification's results.

Table 9: Results with control for manufacturing FDI index

	All		Low-skilled		High-skilled	
	Women	Men	Women	Men	Women	Men
Dependent variable*: labor force participation*						
TP	2.364***	4.065***	2.397***	4.172***	0.023	-0.084
	(0.782)	(0.899)	(0.757)	(0.957)	(0.744)	(0.287)
FDI	-0.042*	0.074***	-0.034	0.078***	-0.020	0.014
	(0.024)	(0.026)	(0.024)	(0.027)	(0.019)	(0.008)
Dependent variable*: employment*						
TP	2.775***	5.196***	3.130***	5.868***	-0.078	0.459
	(0.763)	(1.064)	(0.765)	(1.168)	(0.820)	(0.405)
FDI	-0.016	0.079**	0.002	0.094**	-0.004	0.028**
	(0.027)	(0.033)	(0.029)	(0.037)	(0.021)	(0.013)
Dependent variable*: unemployment*						
TP	-0.410	-1.131***	-0.732*	-1.696***	0.100	-0.543**
	(0.335)	(0.321)	(0.403)	(0.402)	(0.338)	(0.252)
FDI	-0.026**	-0.006	-0.035***	-0.015	-0.016*	-0.014*
	(0.010)	(0.012)	(0.013)	(0.014)	(0.009)	(0.008)
N	988	988	988	988	988	988

Note: 2SLS estimation, all include microregion- and year-fixed effects, initial broad employment structure. Standard errors are clustered by microregion; regressions are weighted by microregions' 1991 population.

The inflow of manufacturing FDI is associated with higher employment rates for men – especially low-skilled men – and lower unemployment rates for low-skilled women, but there

is no sign that trade liberalization effects are picking up the effects of FDI inflows in manufacturing.

What we are not able to test, unfortunately, is whether our regional measure of trade liberalization is uncorrelated with pre-liberalization trends in labor market outcomes, an important assumption underlying our identification strategy. While the political economy of Brazil's trade liberalization and the strong industry-level correlation of pre-liberalization tariff levels and tariff reductions (see Section 3.2 and Figure A2) lend considerable reason to believe that tariff cuts were exogenous to industry performance, there is still the possibility that microregions with stronger reductions in trade protection were already experiencing slower growth in employment rates before 1990. Ideally we would like to test this formally using microregions' pre-liberalization employment rates, but the 1980 Demographic Census does not contain microregion identifiers. Instead, we look at pre-liberalization employment trends at the industry level using nationally representative household survey data from Brazil's National Household Sample Surveys (PNAD). We find a negative correlation between employment growth before liberalization (either 1985-1990 or 1976-1990[19]) and tariff reductions during 1990-1998, in large part driven by the slow growth of agricultural employment, where tariff rates actually increased. Since we control for the initial agricultural employment share in all our estimation, the within-manufacturing variation is most important for our identification. Across manufacturing industries, the correlation coefficient is -0.27 (also see Figure A6 in the Appendix), indicating that industries with larger tariff cuts had somewhat stronger employment growth before 1990. A continuation of pre-liberalization employment trends after 1990, therefore, would produce higher employment growth in microregions more exposed to liberalization, which runs counter to our estimates.[20]

In sum, the results in this section confirm that our main findings are not driven by FDI inflows in the manufacturing sector, and are robust to a number of specification and measurement issues. Industry-level trends based on PNAD data show that pre-liberalization employment trends are unlikely to be driving our estimates, supporting the causal interpretation of our estimates.

6. Conclusions

While there is a large literature analyzing the distributional impacts of trade reforms across the income or skill distribution, very little is known about the gender effects of trade reforms.

[19] The 1976 survey is the he earliest year of PNAD data we have access to.

[20] This same argument is put forward by Kovak (2013), who also concludes that a continuation of pre-liberalization trends would bias his positive estimates for regional wages downwards.

This paper seeks to fill this gap by examining the impact of Brazil's trade liberalization in the 1990s on male and female labor force participation, employment and unemployment. Brazil was one of the most heavily protected economies in the world until the late 1980s, when reforms were initiated that drastically reduced average nominal tariffs and lifted most non-tariff trade barriers. We relate tariff reductions in the 1990s to changes in labor market outcomes between 1991 and 2000, using data from Brazil's Demographic Census.

Previous research on Brazil's trade liberalization has shown that tariff reductions led to job losses in the tradable sector and reallocation of workers into other sectors of the economy and into unemployment and inactivity (Meñezes-Filho and Muendler 2011, Ferreira et al. 2010). In line with those studies, we find that microregions with greater exposure to trade liberalization experienced slower growth (or faster decline) in both female and male labor force participation and employment rates. Because the effects on men are more than twice as large as the effects on women, liberalization contributed to a substantial gender convergence in participation and employment rates.

The impacts are concentrated entirely in the low-skilled population (those with less than secondary schooling), while for high-skilled men and women, liberalization induced a shift from tradable to non-tradable sector employment with no net impact on employment and labor force participation rates. We find no evidence that men moving into services crowd out women or that liberalization-induced tertiarization of employment is a channel for feminization of the workforce, as the effects on high-skilled men and women are very similar.

Gender differences are confined to the low-skilled population and especially in the tradable sector. Because this is the segment of the labor force where jobs are most likely to require physical strength, our results suggest that gender differences in the impact of trade liberalization are strongest when segregation by sector is due to imperfect substitutability of male and female workers. This is in line with Juhn et al. (2014) who find gender convergence only among blue-collar workers, although they focus on the firm-level impact of technical change induced by new export opportunities. More research into the causes of segregation of men and women by sector of employment – i.e. the relative (fe)male-intensity of import competing and export sectors – would be important to form better expectations on the impacts of trade liberalization.

More generally, our analysis demonstrates that 'gender-blind' analysis can easily miss an important dimension of the labor market effects of trade liberalization. Furthermore, it illustrates the usefulness of the local labor market approach pioneered by Topalova (2007, 2010) in analyzing trade liberalization, as effects on the non-tradable sector are sizable.

Analyses of gender inequalities focusing only on the manufacturing sector (as in Wood 1991; Ozler 2000; Ederington et al. 2009; Juhn et al. 2014) thus only provide a partial picture of the effects of trade liberalization, missing out on important general-equilibrium effects.

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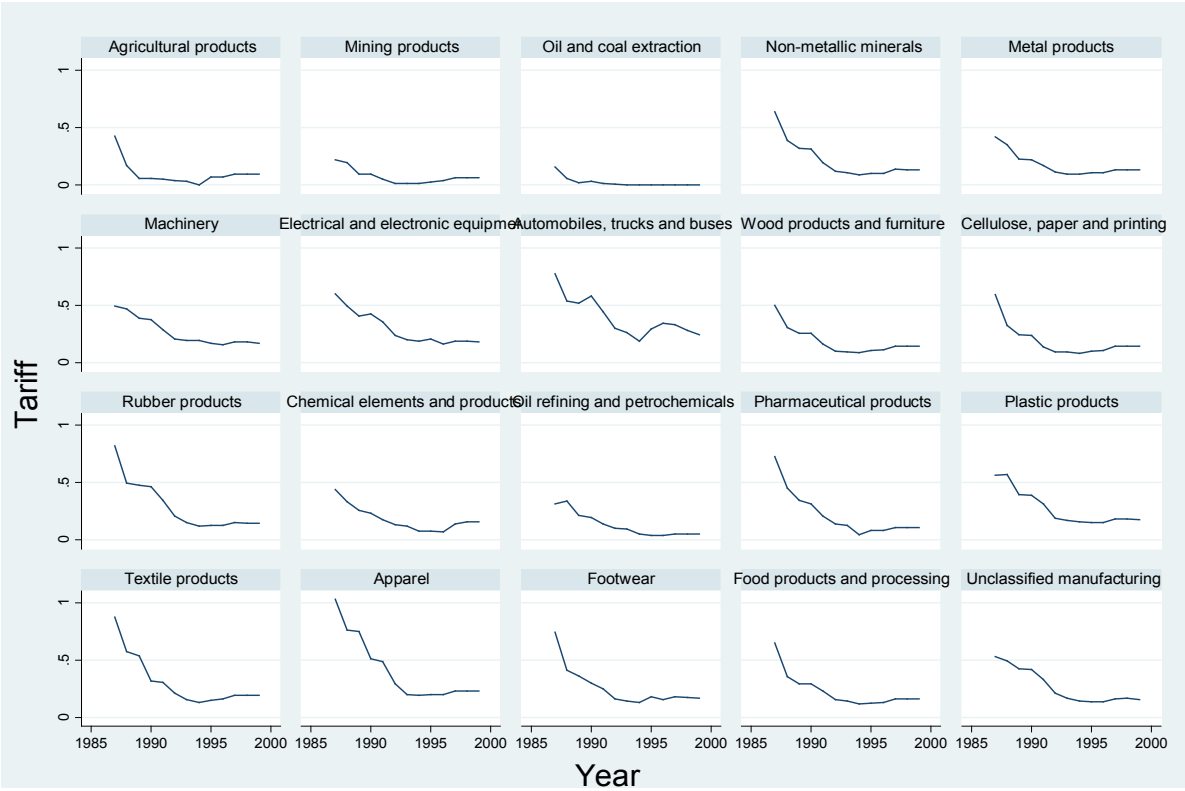
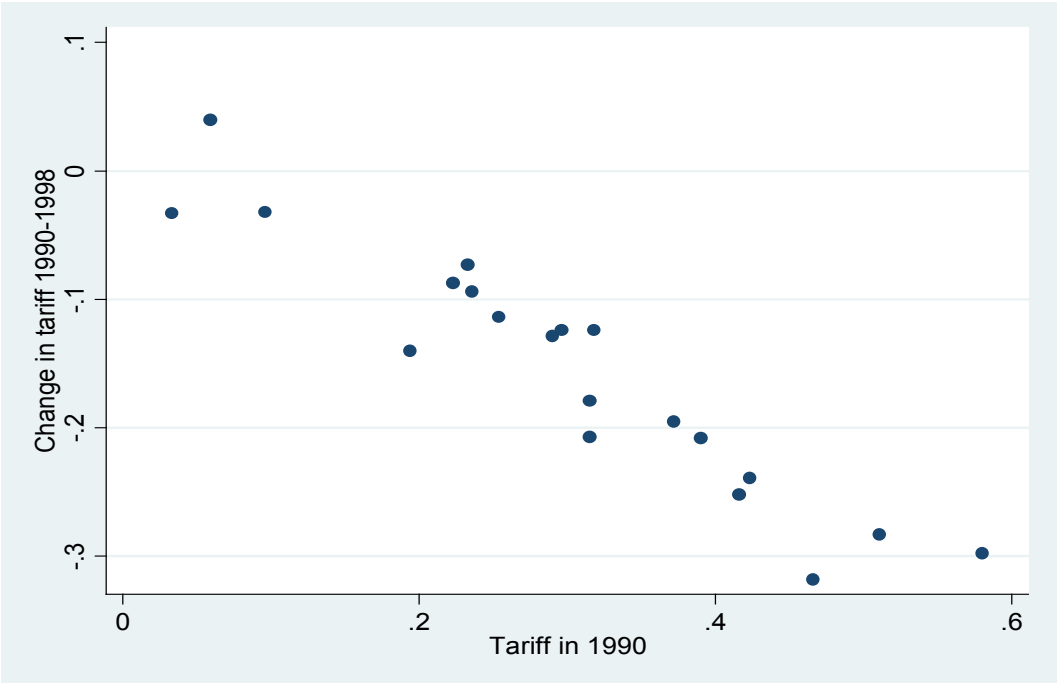
Appendix: Figures and Tables

Figure A1: Tariffs by sector, 1987-1999



Source: Tariffs from Kume, Piani and de Souza (2003), tabulated in Abreu (2004).

Figure A2: tariff changes 1990-1998 and 1990 tariff levels by industry



Source: Tariffs from Kume, Piani and de Souza (2003), tabulated in Abreu (2004).

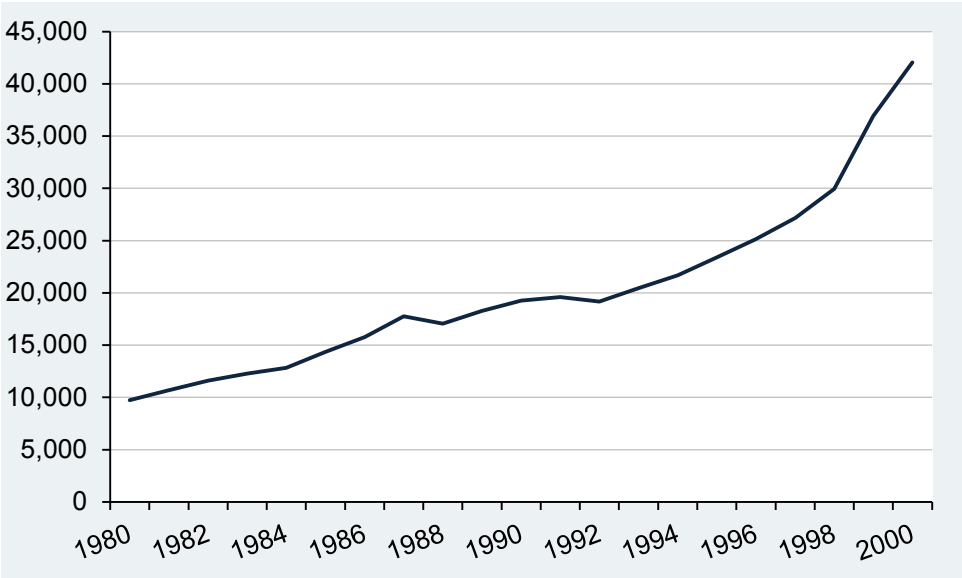
Figure A3: tariff changes 1990-1998 and 1991 female-intensity by industry

Source: Nominal tariffs from Kume, Piani and de Souza (2003), tabulated in Abreu (2004). Female share of workers from Brazil Demographic Census.

Figure A4: tariff changes 1990-1998 and 1991 skill-intensity by industry

Source: Nominal tariffs from Kume, Piani and de Souza (2003), tabulated in Abreu (2004). High-skilled share of workers from Brazil Demographic Census.

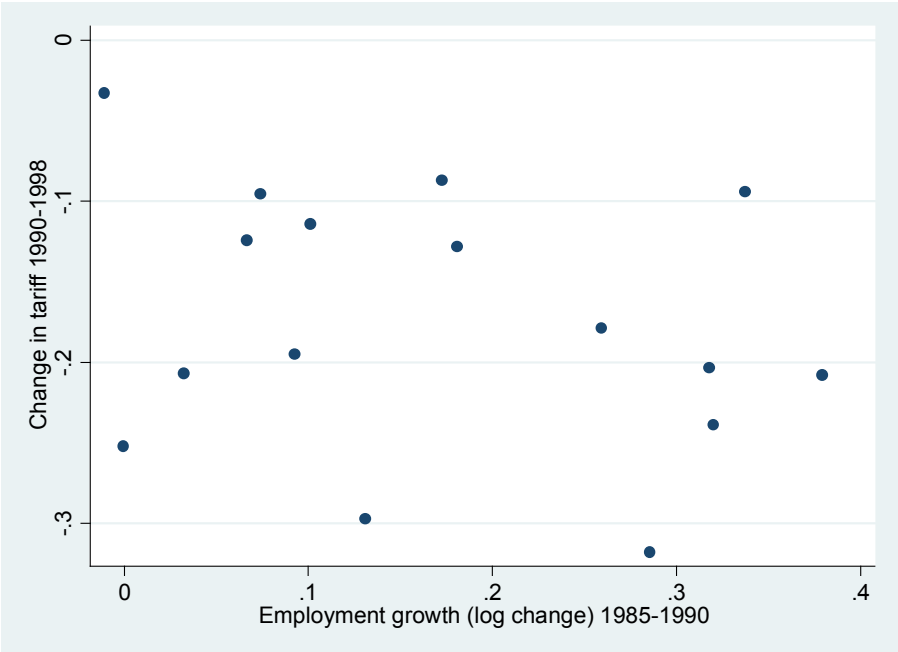
Figure A5: Foreign direct investment (FDI) in Brazilian manufacturing



Note: vertical axis measures the stock of FDI in Brazilian manufacturing in current Mio USD.

Source: Muendler (2003a).

Figure A6: tariff changes 1990-1998 and 1985-90 employment growth by industry



Source: Nominal tariffs from Kume, Piani and de Souza (2003), tabulated in Abreu (2004); employment data from PNAD.

Table A1: First stage regression of TP^{inNT} on TP^{exNT}

	First stage results
TP^{exNT}	0.106***
	(0.014)
N	988
F-stat (Kleibergen-Paap)	58.27
Partial R^2	0.307

Note: Estimation includes microregion- and year-fixed effects and initial broad employment structure. Standard errors are clustered by microregion; estimation is weighted by microregions' 1991 population . *** p<0.01, ** p<0.05, * p<0.1

Table A2: Trade liberalization and education

	Years of education		High-skilled share of population	
	Women	Men	Women	Men
TP	10.454*	20.044***	0.774	1.008
	(5.898)	(6.955)	(0.703)	(0.639)
N	988	988	N	988

Note: 2SLS estimation, all include microregion- and year-fixed effects, initial broad employment structure, and macroregion-specific trends. Standard errors are clustered by microregion; regressions are weighted by microregions' 1991 population.