Trade Liberalization and Local Labor Market Adjustment in South Africa*

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Abstract

Despite a large literature analyzing trade liberalization in developing countries, little evidence exists around its effects in sub-Saharan African economies characterized by relatively weak manufacturing sectors and highly segmented labor markets. Using a local labor market approach, we investigate the causal effects of tariff reforms implemented in South Africa between 1994 and 2004 on labor market outcomes at the individual level. More specifically, we construct a district-level measure of exposure to tariff reductions equal to a weighted average of industry tariffs using baseline industry shares as weights, and estimate the effect of this shock on labor market outcomes. We find that workers in districts facing larger tariff reductions experience a significant decline in both formal and informal employment in the tradable sector, driven primarily by a decline in manufacturing employment, relative to workers in districts less exposed to these reductions. There is no evidence of any significant effect on wages for those who remain employed. However, displaced workers do not show any evidence of transitions into other sectors, or migration to less affected regions; rather, they are more likely to become discouraged workers or exit the labor force entirely, and show an increased probability of accessing government transfers. Our estimates imply that trade liberalization accounts for half the decline in tradable employment experienced by the median district during this period, 11% of the increase in unemployment, and 21% of the increase in discouraged workers.

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1 Introduction

Over the past two decades, barriers to trade have been rapidly reduced around the world, and exports from the developing world—particularly from Asian and Latin American countries—have concurrently surged. A large body of empirical work finds evidence that these trade reforms generated substantial shifts in developing country labor markets.[1] On the one hand, positive shocks that increased access to developed country markets in East Asia reduced poverty and shifted labor away from agriculture (McCaig, 2011; McCaig and Pavcnik, 2017; Erten and Leight, 2017). On the other hand, domestic tariff cuts that increased competition from imports served to slow the pace of poverty reduction and wage growth in India and Brazil (Topalova, 2010; Dix-Carneiro and Kovak, 2017b).

However, much less is known about the impact of trade liberalization on economies in sub-Saharan Africa, generally characterized by weaker manufacturing sectors, segmented labor markets, and persistently low levels of exports outside of basic commodities.[2] South Africa has been a leader in trade reform in sub-Saharan Africa; following its democratic transition in 1994, the South African government introduced substantial and relatively abrupt tariff cuts as part of a broad post-apartheid liberalization process (Belli et al., 1993; Edwards, 2005). Nonetheless, the economy's subsequent evolution has been characterized by consistently weak levels of employment generation and persistently high levels of unemployment and inequality (Banerjee et al., 2008; Leibbrandt et al., 2010; Statistics South Africa, 2017).

In this paper, we investigate whether rapid trade liberalization in South Africa may have contributed to this weak employment growth by affecting labor reallocation across a number of margins of adjustment. The impact of tariff reductions on labor market adjustment is a priori ambiguous. The reductions in import tariffs are likely to increase the demand for imported goods by reducing their prices. On the one hand, access to cheaper intermediate inputs may lead to a reduction in production costs and increase profitability in both traded and non-traded goods sectors (De Loecker et al., 2016). On the other hand, the increase in import competition may directly displace workers in traded industries, and may also indirectly displace workers in non-traded industries via local demand effects (Acemoglu et al., 2016).

This paper presents the first causal evidence around the effects of a quasi-exogenous

[1] See Pinelopi (2007), Harrison et al. (2011), and Pavcnik (2017) for comprehensive reviews of the literature on the effects of trade on labor reallocation and inequality in developing countries.

[2] In a recent and comprehensive review of the literature on how trade affects labor reallocation in developing countries, Pavcnik (2017) provides an overview of causal evidence from developing countries ranging from China and India to Colombia and Brazil. Yet, there is no reference to any causal evidence from sub-Saharan Africa, or South Africa in particular.

reduction in import tariffs on labor market adjustment in South Africa, an economy characterized by one of the highest and most persistent unemployment rates in the world. The previous literature analyzing this shock has generally focused on estimates using computable general equilibrium (CGE) models, where the results may be somewhat sensitive to the elasticity parameters and the closure assumptions employed in the models,[3] and studies employing decomposition techniques or industry-level correlations between import competition and labor market outcomes.[4] In contrast to these papers, we use a local labor market approach to estimate the causal effects of regional exposure to tariff reductions on labor market outcomes using individual level data between 1994 and 2004, the period of rapid trade liberalization in South Africa.

More specifically, we construct a variable capturing exposure to tariff cuts at the level of the local economy, here characterized as the magisterial district, equal to a time-varying weighted average of industry-level tariffs. The weights are constituted by industry employment shares as observed in the preliberalization period in 1994. South Africa's liberalization entailed drastic reductions in overall trade protection and a decline in the variation of trade protection across industries, implying large cross-industry variation in tariff reductions. Moreover, the industrial composition of employment varies significantly across South African districts. The combination of variation in cross-industry tariff changes and industrial composition across districts allow us to identify the effect of liberalization on local labor market outcomes.

Using nationally representative household and labor force survey data from 1994 to 2004, we estimate the effects of regional tariff declines on a range of labor market outcomes, examining adjustment along several margins including shifts between employment, unemployment, and nonparticipation, tradable and non-tradable employment, and formal and informal employment; we also evaluate changes in hourly wages, earnings, and hours of work. After analyzing average effects at the individual level, we also examine heterogeneity by education, race, gender, location, and age. Finally, we investigate

[3] Mabugu and Chitiga (2009) provides a systematic review of these studies that analyze effects of trade liberalization in South Africa, and concludes that the CGE models generally have restrictive assumptions about elasticity parameters as well as selective closure assumptions, which tend to generate results that are highly sensitive to changes in these assumptions. We provide an overview of these studies in Section 1.1 below.

[4] Two papers report a negative correlation between import competition and employment outcomes at the industry level in South Africa. Rodrik (2008) finds that increases in import penetration are related to declines in employment within manufacturing sectors in South Africa. Lawrence and Rhys (2013) find that higher import competition from China is related to greater employment declines, particularly for labor-intensive industries in South Africa. While these results are informative, this empirical strategy may suffer from omitted variable bias, as unobservable characteristics of industries can impact both the degree to which they are exposed to import competition and their employment trajectories.

whether regional tariff cuts have induced any migration away from harder hit districts, and shifts in patterns of access to government transfers in more affected districts.

South Africa's labor market has a number of unusual characteristics. It has one of the highest unemployment rates in the world, and this high rate has persisted over time (Banerjee et al., 2008). The formal sector is characterized by large enterprises showing high levels of unionization, but coexists with a relatively small informal sector; growth in formal small and medium enterprises has been consistently weak (Magruder, 2012). In addition, the economy exhibits persistently high levels of inequality in employment and wages with respect to education, race and gender (Banerjee et al., 2008; Brahima and Trevon, 2009). These distinguishing characteristics of the South African labor market render it particularly interesting to evaluate patterns of labor market adjustment in this context.

We find that workers employed in districts facing larger tariff reductions experience a significant decline in employment, driven primarily by a decline in manufacturing sector employment, relative to workers in districts facing smaller tariff reductions. We find no evidence of labor reallocation from manufacturing into other traded subsectors including mining and agricultural sectors, or into non-traded sectors (i.e., services). Instead, displaced workers are more likely to become discouraged unemployed workers or exit the labor force entirely. Using the broad definition of unemployment including both searching and discouraged unemployed workers (Statistics South Africa, 2017), we find evidence of an increase in broad unemployment, as well as an increase in nonparticipation in harder hit districts in comparison to less affected districts. Our estimates imply that trade liberalization accounts for about half the decline in tradable employment experienced by the median district during this period, about 11% of the increase in employment, and about 21% of the increase in discouraged workers.

We also examine whether regional tariff declines induce workers to substitute from formal to informal employment; however, we find no evidence that growth in the informal sector absorbs displaced workers. Our findings indicate that workers employed in districts facing larger tariff reductions experience significant and similar declines in both formal and informal employment. While the decline in formal employment is concentrated in manufacturing, the decline in informal sector employment is mainly driven by a decline in agricultural employment. This pattern is consistent across a range of definitions of informality, including working in an unregistered enterprise, working without a written contract, and self-employment.

In addition to labor market adjustment at the extensive margin, we examine whether tariff reductions induce adjustment in the intensive margin. We find no evidence of a

significant impact on hourly wages, monthly earnings, or hours of work. Moreover, we examine heterogeneity with respect to education and race. The observed employment effects are consistent for individuals at varying education levels, including workers who have not completed ninth grade; workers who have completed between nine and eleven years of education; and workers who have completed secondary school. However, among the relatively less educated workers, black and colored workers face a higher likelihood of losing employment. By contrast, there is no evidence of significant heterogeneity with respect to gender, age, or location.

Finally, we find no evidence of a significant impact of tariff declines on migration patterns, implying that workers do not respond to depressed local labor market conditions by migrating to less exposed regions. By contrast, workers in harder hit regions are more likely to receive government transfers, including disability grants, child support grants, and care dependency grants. This result echoes the findings from the U.S. literature on import competition from China (Autor et al., 2013), suggesting that displaced workers are more likely to rely on social safety nets in response to the deterioration in local labor market conditions.

We conduct a number of robustness checks to verify that our results are robust to alternative specifications. Given that the tariff cuts were highest for the textile sector and lowest for the coal mining sector, we show that the results are robust to excluding districts with relatively high shares of initial textile employment, and/or excluding districts with relatively high shares of initial coal employment. Additionally, we demonstrate that the results are not driven by differential pre-trends that the districts followed prior to the trade liberalization.

We conclude that districts in South Africa exposed to substantial reductions in import tariffs exhibit a significant deterioration in labor market outcomes relative to less exposed districts. Formal employment (particularly within the manufacturing sector) contracts significantly, and in the absence of an expansion in informal employment opportunities or any significant adjustment in wages, displaced workers are more likely to transition to a discouraged search status or exit the labor force. Among relatively less educated workers, black and colored workers in particular are disproportionately affected by the adverse effects of trade liberalization.

1.1 Related Literature

This paper contributes to a large literature analyzing the effects of trade liberalization on developing country labor markets. Evidence from India suggests that districts more ex-

posed to domestic tariff cuts experienced a slower decline in poverty and weaker growth in consumption, particularly for individuals who are less geographically mobile and in states characterized by inflexible labor reallocation (Topalova, 2007, 2010). Similarly, recent work by Dix-Carneiro and Kovak (2017a) finds that trade liberalization in Brazil led to a prolonged decline in formal sector employment and earnings in regions specializing in industries that face larger tariff cuts, a process they argue reflects slow capital adjustment and imperfect interregional labor mobility. Complementing this evidence from the formal sector, Dix-Carneiro and Kovak (2017b) find that workers in more affected regions shift into informal employment and non-employment in the medium run.[5] As previously noted, there is very little evidence around the effects of trade liberalization in sub-Saharan Africa. However, one recent paper finds that tariff cuts in Botswana stimulated shifts from formal to informal employment in industries exposed to more import competition (McCaig and McMillan, 2017). Our study contributes to this literature by examining the impact of tariff reductions on several margins of local labor market adjustment in South Africa, a developing country with persistently weak employment generation and one of the highest unemployment rates in the world.

Our work also relates to the literature on the effects of improved access to advanced country markets on developing countries' labor reallocation and structural change. Analysis of a distinct shock—increased access to the U.S. market—in Vietnam indicates that a positive export shock led to both a reduction in poverty and a reallocation of labor from agricultural to non-agricultural production (McCaig, 2011; McCaig and Pavcnik, 2017). Similarly, evidence from China suggests that a reduction in tariff uncertainty following China's accession to the WTO and the associated increase in manufacturing exports stimulated substitution by workers from agricultural to non-agricultural production (Erten and Leight, 2017), as well as migration to regions experiencing export-led growth (Facchini et al., 2016).

Several papers in this literature have particularly highlighted the effect of trade shocks on substitution between the formal and informal sector. Recent evidence suggests import tariff cuts in Brazil generated declines in formal employment and a partial shift of displaced workers into the informal sector (Dix-Carneiro and Kovak, 2017b). In Vietnam, by contrast, positive export shocks associated with external tariff reductions led to a contraction in informal employment as workers shift to the formal sector (McCaig

[5] Dix-Carneiro (2014) also documents that the slow pace of labor market adjustment to trade liberalization in Brazil significantly reduces welfare gains from this liberalization. Other evidence from Brazil suggests that trade liberalization led to small declines in the skill premium (Dix-Carneiro and Kovak, 2015), and that labor adjustment by different firms may reflect variation in de facto regulations (Almeida and Poole, 2017).

and Pavcnik, 2017). Our study contributes to this strand of literature by examining the effects of import tariff cuts in South Africa, a reform that exposed both formal and informal producers to increased foreign competition and resulted in a decline in both formal and informal employment.

Our paper also joins a literature focusing on trade liberalization in South Africa that has primarily utilized macroeconomic modeling techniques. Using a computable general equilibrium (CGE) model, Thurlow (2006) examines the effects of trade liberalization on growth, employment, and poverty in South Africa. His results suggest that trade liberalization contributed to higher economic growth, and the decline in manufacturing employment was more than offset by increase in service sector employment. Using Chenery-style decomposition techniques, Dunne and Edwards (2007) find that the loss of employment through import penetration was matched by employment created through export growth. Using similar decomposition techniques and industry-level correlation analysis, Lawrence and Rhys (2013) document that labor-intensive industries exposed to high import competition from China suffered large employment declines. In a comprehensive evaluation of the poor growth performance in South Africa, Rodrik (2008) highlights the importance of increased import competition in declining profitability of the manufacturing sector by examining correlations among industry-level outcomes. While these studies are very informative and useful, decomposition techniques and industry-level correlations may suffer from omitted variable bias, and the estimation of CGE models may entail restrictive assumptions about elasticity parameters used in the calibration. In a systematic review of the CGE models applied to analyze trade liberalization in South Africa, Mabugu and Chitiga (2009) conclude that the results obtained from the models are highly sensitive to elasticity parameters and closure assumptions used in the models. Our study contributes to this literature by providing the first micro-level evidence on the impact of trade liberalization in South Africa.

The remainder of the paper proceeds as follows. Section 2 provides background on the trade reform and characteristics of the labor market in South Africa. Section 3 describes the data. Section 4 presents the identification strategy, the empirical results, and the robustness checks, and Section 5 concludes.

2 Background

2.1 Trade Reform in South Africa

2.1.1 Context and Details of South Africa's Trade Reform

From the 1920s to the 1960s, South Africa pursued a policy of import substitution industrialization, entailing the protection of South African firms from international competition with a large range of trade barriers including high tariffs and nontariff barriers (Bell and Cattaneo, 1997; Cassim et al., 2004). The slow pace of growth in the protected manufacturing sector combined with the continued dependence of the economy on gold exports for foreign exchange reserves led to the consensus view among policymakers that the existing trade policy regime was not sustainable, and the initial policy response was to steer the focus of ISI from consumer goods towards capital-intensive heavy industry together with the introduction of specific incentives to promote exports (Belli et al., 1993; Jenkins and Siwisa, 1997). However, despite these early attempts to achieve greater trade openness, South Africa continued to be characterized by moderately high industry-varying tariff rates and a wide variety of quantitative restrictions.

In the early 1990s, South Africa had an extremely complex and opaque tariff structure, with the highest numbers of tariff lines and tariff rates in the world, the widest range of tariffs and the second highest level of dispersion (Belli et al., 1993; Hviding, 2005). However, tariff levels were not especially high by international standards, with the average nominal tariff rate of about 20% in the early 1990s (Figure 1). Following the initiation of post-apartheid economic reforms, South Africa made a tariff liberalization offer to the General Agreement on Tariffs and Trade (GATT) in the Uruguay Round in 1994 for a five-year liberalization program. This offer was implemented beginning in April 1995, marking the beginning of South Africa's trade liberalization. This liberalization had three main components: an overall reduction in tariffs; the cutting of tariff peaks; and the consolidation of tariff lines to simplify the tariff structure and reduce tariff dispersion.

We measure trade protection by the sum of tariff rates (including *ad valorem* equivalents) plus surcharges imposed by South Africa. The data on trade protection is provided by Lawrence Edwards, covering the period 1990 to 2008, and is described in more detail in Edwards (2005). The tariff rates and surcharges in this dataset are reported at the 8-digit HS level. We match this detailed industry tariff data to the industry classification in the 1994 October Household Survey (OHS) by constructing a simple average of tariffs within industries using the concordance available in the industry documentation of the

1994 OHS.

Figure 1 shows the trend in average nominal tariffs during this period, and the rapid pace of tariff liberalization in the second half of the 1990s is evident. The unweighted average tariff rate (inclusive of surcharges) declined from 19% in 1994 to 6% in 2004 for all goods. The manufacturing sector experienced the largest cuts in tariffs, from 22% in 1994 to 7% in 2004. In comparison, the tariff declines in agriculture and mining were more modest: average tariffs for agricultural goods fell from 7% in 1994 to 3% in 2004, while average tariffs for mining goods declined from 4% in 1994 to 1% in 2004.

The main elements of the initial reform agenda included increasing the number of bound tariff lines, increasing the percentage of bound zero-rated tariff lines, reducing average tariff rates, and reducing the number of tariff categories. While some import surcharges had been abolished earlier, all remaining surcharges were dropped in 1995. The push towards tariff liberalization then accelerated under the New Tariff Rationalization Process of 1996, emphasizing the further reduction of tariff peaks and the consolidation of tariff lines, the conversion of specific duties into ad valorem rates and the capping of those rates. In addition, export subsidies under the General Export Incentive Scheme were phased out between 1995 and 1997 (Cassim et al., 2004).

The multilateral tariff reductions of the mid-1990s were followed by bilateral tariff reductions resulting from new free trade agreements in 2000s. Among these agreements, the European Union (E.U.) – South Africa Free Trade Agreement reduced tariffs on 95% of E.U. imports into South Africa from 2000 to 2003. Moreover, two additional free trade agreements—the Southern African Development Community (SADC) in 2000 and the Southern Common Market (MERCOSUR) in 2004—were effective in reducing tariffs on imports from major Southern African countries and Latin American countries, respectively. As Figure 1 illustrates, tariffs remained fairly constant after 2004.

2.1.2 Exogeneity of Tariff Changes to Industry Performance

The empirical analysis employs the variation in tariff rates across industries and over time to estimate the causal impact of trade liberalization. This estimation relies on the assumption of the exogeneity of tariff changes with respect to the characteristics of the industries subject to liberalization, as well as the regions of South Africa in which those industries are concentrated. If tariff cuts are imposed differentially based on industry or region characteristics (e.g. if policymakers impose different tariff reductions on stronger or weaker industries, or if better performing industries lobby for smaller tariff cuts), such correlation would violate the exogeneity assumption.

In the case of South Africa's trade liberalization, the threats to identification related

to the potential endogeneity of tariff reductions are reduced for a number of reasons. First, there is qualitative evidence from the political economy of South Africa's trade liberalization that the major impetus for liberalization originated from the post-apartheid government, eager to demonstrate its commitment to market-friendly policies to the rest of the world, rather than from the private sector (Rangasamy and Harmse, 2003; Roberts, 2000). In 1995 the new democratic government announced its Growth, Employment and Redistribution (GEAR) strategy, calling for a "transformation towards a competitive outward-oriented economy" using trade liberalization as a major reform for achieving efficiency gains and faster growth (Republic of South Africa, 1996). During this liberalization process, the private sector firms appear to have played a relatively small role in influencing relative tariff declines (Bell and Cattaneo, 1997).

Second, the tariff reductions implemented in 1995 were largely influenced by the offer that South Africa had made to the WTO in 1994. In the five-year tariff reduction program, South Africa committed to reduce the number of tariff categories from 100 to six groups: 0%, 5%, 10%, 15%, 20%, and 30%, ruling out any discretionary changes to the structure of tariffs (Cassim et al., 2004). Hence, the absence of interference from the private sector combined with the role of multilateral trade negotiations reduce the probability that the tariff reductions were designed to provide differential protection to industries depending on the strength of their performance.

Further support for the assumed exogeneity of tariff reductions can be found by examining the degree to which tariff reductions varied by initial levels, following the common approach in the literature (Goldberg and Pavcnik, 2005; Kovak, 2013). The primary goal of tariff reform in this period was to simplify the tariff structure and reduce variation in tariffs across industries to minimize the gaps between internal and external costs of production and reduce anti-export bias (Belli et al., 1993). Such equalization of tariff levels implies that the preliberalization tariff levels largely determined the tariff reductions across industries. Figure 2 shows the relationship between ex ante tariff levels and tariff reductions, and it is evident that industries with high tariffs before liberalization experienced the greatest cuts: the correlation between preliberalization tariff rate and change in tariff rate is nearly one in absolute magnitude (-0.97). Table A2 in the Appendix also presents detailed summary statistics on tariff changes by sectors over time.[6] Given that the tariff reductions were based on a structure of protection that was implemented in South Africa two decades earlier (Cassim et al., 2004), the scope for

[6]The sectors are defined based on the industrial classification used in the 1994 October Household Survey, and roughly correspond to the 2-digit SIC level, although some categories aggregate a number of 2-digit categories into one category; employment data is reported for 19 different subsectors of tradable employment, in addition to the services sector.

the manipulation of tariff cuts to reflect subsequent industry performance or regional economic growth is likely to be limited.

2.2 Characteristics of the South African Labor Market

The South African labor market is characterized by extraordinarily high levels of unemployment and inequality, a pattern that reflects the legacy of the apartheid regime, during which labor markets were segregated by race, educational opportunities were highly racially differentiated, wealth and income were unequally distributed, and the economy was characterized by concentrated and racialized patterns of ownership and control. Despite the formal deracialization of the labor market and economy after 1994, the distribution of skills and income remains highly race-dependent, and inequality and unemployment have, if anything, risen. In fact, Leibbrandt et al. (2010) find that income inequality increased between 1993 and 2008, with inequality between racial groups declining over time but intra-group inequality rising, and some estimates suggest that South Africa is characterized by the most unequal distribution of income in the world.[7]

South Africa's official unemployment rate has been persistently high, and even in 2017 stands at 27.7%, with a broader rate including discouraged workers — defined as those who are not actively seeking employment, but are willing and able to work — of 34.7% (Statistics South Africa, 2017). These rates are largely unchanged since the final year examined in this analysis (2004), when the narrow unemployment rate was 27.1% and the broad rate was 40.6%. Unemployment is particularly high among blacks (and to a lesser extent coloreds), women, the unskilled, and youth (Oosthuizen and Bhorat, 2005; Festus et al., 2016; Statistics South Africa, 2017). Unemployment and inequality are closely linked, with unemployment found to be central in explaining both the level and trend of inequality (Tregenna, 2011a) and with inequality in earnings accounting for the bulk of overall income inequality (Tregenna and Tsela, 2012).

In addition, South Africa's informal sector is small compared to other low and middle-income countries (World Bank, 2017). While the World Bank uses a different definition of informality relative to the definition of informal employment employed within South Africa during the period of interest here, World Bank estimates suggest that informal sector's share of non-agricultural employment in South Africa in 2010 was about 40% of the corresponding share in India, and less than 60% of the corresponding share in Mexico. Given the legacy of the apartheid system that prohibited entrepreneurial activity for blacks, small size firm growth in the informal sector has historically been weak (Rogerson,

[7]See, for example, World Bank (2017).

2000; Lewis, 2002).

Heintz and Posel (2008) present evidence that not only are there significant earnings differentials between the formal and informal sectors, there also exist significant wage differentials within the informal sector, attributable to segmentation and barriers to entry and mobility. These barriers may help explain the co-existence of an apparently underdeveloped informal sector with extremely high unemployment. Valodia and Devey (2010) provide additional evidence about the high degree of churning between the informal sector and the low end of the formal labor market, as well as the various linkages between the formal and informal sectors.

In terms of the sectoral distribution of employment, South Africa has a relatively overdeveloped services sector given its level of income per capita, while the share of manufacturing employment is slightly lower than expected (derived from United Nations (2017); see also Tregenna (2008)). This is indicative of the early onset of deindustrialization in the 1980s, at a point when the economy was characterized by a relatively low level of income per capita (Tregenna, 2011b; Rodrik, 2016).

Finally, we will briefly summarize the system of labor regulations.[8] During the period of analysis here, South Africa had no national minimum wage. Wages are set through a combination of three main mechanisms: firm-level bargaining (bilateral collective bargaining); collective agreements through bargaining councils, which are then applied to all firms and employees within the jurisdiction of the bargaining council; and sectoral determinations. Sectoral determinations are issued through the Employment Conditions Commission for certain sectors in which workers are deemed particularly vulnerable and a bargaining model would be inappropriate, such as domestic workers and farmworkers.

Spatially, some wages are thus set uniformly nationally (for a particular sector and employment category), others are set at the firm level, and others are set nationally, but differentiated for particular areas or types of areas. This spatial differentiation could be set either through sectoral determinations or through bargaining councils. An example of the latter is in the clothing manufacturing industry, where wages are bargained nationally but the wage determinations subsequently issued by the National Bargaining Council for the Clothing Manufacturing Industry set separate minimum wage levels for metropolitan areas and for two categories of non-metropolitan areas. Where there is spatial differentiation in wage levels, this is not according to magisterial districts, but typically by political entities such as provinces or municipal districts.

[8]More details are provided in Budlender (2009), Godfrey et al. (2007), Magruder (2012) and Elsley (2014).

3 Data

In our analysis of the labor market adjustment of South Africa to trade liberalization, we use the Post Apartheid Labor Market Series (PALMS), available by request from DataFirst (Kerr et al., 2017). The PALMS dataset combines data from 39 nationally representative surveys conducted by Statistics South Africa between 1994 and 2012, including the October Household Survey (from 1994 to 1999), the bi-annual Labor Force Surveys (from 2000-2007), and the Quarterly Labor Force Surveys (from 2008 to 2012). The data consists of repeated cross-sectional surveys at the individual level and includes questions on labor market outcomes such as employment status, earnings, and demographic variables such as gender, age, marital status, race, and education. The employment status indicators include information on both formal and informal employment, as well as sector and work status for workers. The data also includes information on migration and government transfers that individuals receive. In the surveys, households are sampled using two-stage complex sampling, and each member of every sampled household is surveyed.

We analyze trade shocks defined at the level of 362 magisterial districts, allowing for the evaluation of broader labor market effects of liberalization that includes nontradable sector employment. Previous studies focusing on local labor market outcomes in South Africa have also employed the magisterial district as the unit of analysis (Dinkelman, 2011; Magruder, 2012), as the borders of magisterial districts have been relatively constant over the post-apartheid period, and they constitute the lowest level of aggregation (below district councils and provinces) that has remained consistent. In the PALMS data, the only other geographic indicator available is for district councils, a higher level of aggregation for which there are only 52 units nationwide. Since the magisterial district indicators can only be identified in the data through 2004, we define the period of analysis as 1994 to 2004.

Summary statistics for the sample are presented in Table 1. We focus on working-age individuals between the ages of 15 and 64 inclusive. The sample includes 686,670 individuals, and each individual is observed in a single survey. Panel A reports the summary statistics on demographic indicators of the sample. Approximately 52% of individuals observed are female; nearly half have not completed junior high school, while 30% have received 9-11 years of education, and only about a quarter have received 12 or more years of education. The majority of the sample is black (76%), with approximately 9% colored and 12% white, as well as a small Asian minority. Slightly less than half of the sample is rural, and around 11% report membership in a union.

Panel B of Table 1 presents descriptive statistics on employment outcomes. Approximately 41% of individuals in our sample are employed; of these, the majority (29%) are employed in the nontraded sector (i.e. services), with the remaining 12% employed in the traded sector: 6% in manufacturing, 2% in mining, and 4% in agriculture. We will also analyze both formal and informal employment. Following the official definition of Statistics South Africa, the informal sector includes two components: i) employees working in establishments that employ fewer than five employees, who do not deduct income tax from their salaries or wages; and ii) employers, own-account workers and persons helping unpaid in their household business who are not registered for either income tax or value-added tax (Statistics South Africa, 2017). This definition of informal employment is consistent with previous studies that define a business as informal depending on its registration status (La Porta and Shleifer, 2008, 2014; McCaig and Pavcnik, 2014; McCaig and McMillan, 2017).[9] Accordingly, approximately 12% of the individuals in our sample are employed in the informal sector, and the remaining 29% are employed in the formal sector. As a robustness check, we also construct a broader and a more restricted definition of informal employment. In the broader definition, we include all individuals who are working without any written contract.[10] In a more restricted definition of informality, we use the sample of self-employed individuals. Roughly 15% of individuals in our sample are employed without any written contract and 7% are self-employed.

Among those individuals who are not working, 13% are unemployed and actively searching (i.e. narrow unemployment), while 10% are discouraged workers who are not actively searching, but identify as willing and able to work. The sum of narrow unemployment and discouraged workers yields broad unemployment, which is 23% of the working-age population. Another 36% of sampled individuals are out of the labor force.

Panel C of Table 1 presents summary statistics on wage outcomes for the subsample of workers who report paid employment. We use the real monthly earnings and hours of work to construct the hourly wage across sectors.[11] The average hourly wage across

[9] In India, firms in the manufacturing sector are required to register with the government if they have at least 10 workers and use electricity; or if they have at least 20 workers, but do not use electricity (Nataraj, 2011). Similarly, in Vietnam household businesses are not required to register with the government if they have fewer than 10 workers and do not function in more than one location (McCaig and Pavcnik, 2014). Note that registration-based definitions of informal employment differ from definitions of informality based on whether firms comply with labor legislation or not (Goldberg and Pavcnik, 2003; Lourenço, 2014; Dix-Carneiro and Kovak, 2017b).

[10] Since the information for working without a contract is reported only post-2000, we have limited ability to capture this dimension of informality.

[11] The figures presented in Panel C of Table 1 are converted to USD terms, while we use the logarithm of hourly wages in South African Rand terms in the rest of the analysis.

all sectors is \$2.26. Wages are highest in manufacturing, followed by non-traded sectors, mining, and agriculture, where the average wage is around 30% of the wage observed in manufacturing.

Figure 3 provides an overview of the trends in employment and unemployment rates during our sample period from 1994 to 2004. In Panel A, we observe that traded employment as a share of working-age population declined from about 16% in 1994 to 11% in 2004, while the nontraded employment share fluctuated around 30% during the same period. Panel B of Figure 3 presents the trends in unemployment rate over time. Using the narrow definition of unemployment that only includes those individuals unemployed and actively searching for jobs, the unemployment rate increased from 20% of the labor force in 1994 to 27% in 2004. If the discouraged workers are included, the unemployment rate broadly defined rose from 33% in 1994 to 41% in 2004.[12]

4 Empirical Analysis

4.1 Empirical Methodology

Following South Africa's trade liberalization, national tariff levels varied substantially across industries and over time. Moreover, there was significant heterogeneity in the industrial composition of South African districts prior to the implementation of trade liberalization in 1994. Hence, depending on the initial industrial composition of employment at the time of the reform, some districts were more exposed to tariff reductions than others. Following a large body of empirical literature (Topalova, 2010; Kovak, 2013; Dix-Carneiro and Kovak, 2017b), our identification strategy relies on this relative exposure to estimate the causal effect of trade reform.

More specifically, we construct a measure of regional exposure to trade liberalization for district d at year t, $Tariff_{dt}$, by interacting the national ad-valorem tariff rate faced by industry i in year t, $Tariff_{it}$, with the share of tradable employment in industry i and district d in 1994, $Empshare_{id}^{1994}$:

$$Tariff_{dt} = \sum_i Empshare_{id}^{1994} \times Tariff_{it} \tag{1}$$

Figure 4 illustrates the spatial variation in tariff reductions defined at the magisterial district level. The long difference from 1994 to 2004 is plotted. The different color shades represent quintiles of the long difference in district tariff measure. Districts that

[12]Note that the unemployment rates in Figure 3 are defined as a share of the labor force, whereas the summary statistics in Table 1 are reported as a share of working-age population.

experienced larger tariff declines are represented as lighter and yellower, while districts that experienced smaller reductions are shown as darker and bluer. The average district faced a tariff reduction of 10.6 percentage points. Hence, while we interpret the regression estimates below, we will use this average reduction in district tariffs. It is important to note that the tariff reductions display substantial variation across districts, and there is even high variation among districts within the same province.

Approximately 28% of districts do not report sectoral-level employment data in 1994, and accordingly the baseline employment shares are missing; this reflects primarily the smaller sample and lower quality of the initial survey conducted in 1994. For these districts, we use reported employment in 1995 to construct the district-level weighted tariff. We will subsequently demonstrate that the results are robust to using the 1995 employment weights for all magisterial districts, and to restricting the sample to exclude those districts that are missing 1994 data.

We employ the following specification to compare the labor market outcomes for workers located in districts exposed to larger versus smaller tariff reductions.

$$y_{jdt} = \alpha + \beta Tariff_{dt} + \chi_{jdt} + \mu_t + \gamma_d + \delta_d t + \epsilon_{jdt} \tag{2}$$

where y_{jdt} denotes labor market outcomes for individual j in district d at year t, $Tariff_{dt}$ is the district tariff in district d at year t, χ_{jdt} is a vector of worker characteristics, including a second degree polynomial in age, gender, race, and dummy variables for three educational categories (education below ninth grade, between ninth and eleventh grade, and twelfth grade and above), and an indicator for whether an individual lives in a rural area. The specification also includes year fixed effects (μ_t), district fixed effects (γ_d), and district-specific linear time trends ($\delta_d t$). The key parameter of interest is the coefficient on district tariffs. A positive coefficient implies that a decrease in district tariffs is associated with a decline in the probability of being employed in a given sector. Standard errors are clustered at the district level to account for serial correlation in the error term within a district.

The inclusion of year fixed effects in (2) controls for any aggregate South Africa-wide yearly changes in labor market outcomes coinciding with the liberalization of tariffs. District fixed effects control for time-invariant differences across districts. District-level linear trends account for changes in time trends specific to each district across years. Individual-level worker demographic characteristics control for differences in worker composition across districts and over time that could affect the labor reallocation and correlate spuriously with district tariffs. This specification thus compares labor market outcomes for workers with the same observable characteristics exposed to different local

trade shocks due to their initial regions of residence.

4.2 Primary Results

In Table 2, we report the results of estimating equation (2) for employment outcomes in Panel A, and unemployment and labor force non-participation in Panel B. In each panel, the first row includes district and year fixed effects, and district-specific trends, and the second row adds individual-level covariates in addition to these controls. All standard errors are clustered at the district level.

In Column (1) in Panel A, we can observe that workers in a magisterial district that faced greater reductions in import tariffs experience larger decreases in the probability of employment relative to those in districts exposed to smaller tariff reductions. The magnitude of the coefficient (0.241) implies that workers in a magisterial district exposed to the average reduction in tariffs, a decline of 10.6 percentage points in tariff rates, experienced a 2.6 percentage point decrease in the probability of being employed relative to workers in districts not exposed to any reduction in tariffs. This corresponds to a 6.2% decrease relative to the outcome mean.

Columns (2) through (5) of the same panel report results for parallel specifications for employment by sector, including all tradable employment as well as its constituent subsectors (manufacturing, mining and agriculture), and employment in non-tradables. We find that workers employed in regions more exposed to import competition experienced a relative declines in tradable sector employment, driven by a significant decline in manufacturing employment; the point estimate in Column (3) indicates that workers in districts exposed to the average decline in tariffs experienced a 1.5 percentage point decrease in probability of employment in manufacturing. Given that the underlying probability of manufacturing employment is only 6%, this is a proportional effect of 25%. Moreover, this effect is not offset by an increase in nontradable employment, as the estimate in Column (6) suggests there is an (insignificant) decline in nontradable employment. Hence, there is no evidence that workers displaced from manufacturing move into other sectors. All of these coefficients are consistent across specifications with and without individual covariates.

In Panel B of Table 2, we examine parallel specifications for unemployment and labor force non-participation. In Column (1), we observe that there is no shift in unemployment that is narrowly defined, excluding discouraged workers. However, there is a significant increase in discouraged workers evident in Column (2), and a significant increase in broad unemployment, as reported in Column (3). The point estimate im-

plies that workers exposed to the average reduction in district tariffs experienced a one percentage point increase in the probability of unemployment broadly defined, driven entirely by an increase in discouraged workers. Moreover, we can observe that workers in more exposed districts also show an increase of 1.6 percentage points in the probability of labor force non-participation. In conjunction with the results reported in Panel A of Table 2, these results suggest that liberalization-induced declines in manufacturing employment correspond nearly one-for-one to rising broad unemployment and nonemployment within affected regions.

We can employ some simple back-of-the-envelope calculations to calibrate the importance of tariff reductions relative to the overall shifts in district-level employment during this period. The average district in this sample shows a decrease of 3.4 percentage points in the share of employed workers in the tradable sector relative to the working-age population from 1994 to 2004, an increase of 9 percentage point increase in the share of broadly unemployed workers, and an increase of 4.8 percentage points in the share of discouraged workers. Our results suggest that trade liberalization through large declines in regional tariffs accounts for around half the decrease in tradable sector employment, 11% of the increase in unemployment broadly defined, and 21% of the increase in discouraged workers.[13]

Formal and informal employment The preceding analysis analyzed labor market outcomes for all workers regardless of the level of formality of their employment. As previously noted, the existing literature has suggested that trade shocks generated significant reallocation between formal and informal employment in Brazil and Vietnam (Dix-Carneiro and Kovak, 2017b; McCaig and Pavcnik, 2017); however, South Africa is characterized by an unusually small and slow-growing informal sector, and thus it is plausible to hypothesize the observed effects may be different.

Table 3 presents the results of estimating equation (2) for employment in the formal sector in Panel A, and employment in the informal sector in Panel B; for concision, only the specifications including individual-level covariates as controls are included. We can observe in Column (1) in Panels A and B point estimates that are positive, significant, and of roughly comparable magnitude, suggesting that workers in harder hit districts experienced a decline in the probability of employment in both the formal sector and the informal sector; in both cases, the magnitude suggests a decline in the probability of employment of around one percentage point in an average district. The coefficients

[13]We calculate the proportion of the change in unemployment explained by tariff declines: 1.8/3.4 for tradable employment, 1/9 for broad unemployment, 1/4.8 for discouraged workers.

estimated in Columns (2) through (6) in Panels A and B further indicate that the decline in formal employment is particularly concentrated in the manufacturing sector, whereas the decline in informal employment is driven mostly by the contraction in agricultural employment, followed by manufacturing and mining.[14]

In Panels C and D of Table 3, we explore the robustness of these results to utilizing alternative definitions of informal employment. In Panel C, we define as informally employed any worker who reports working without a written contract, and find that the results are very similar.[15] In Panel D, we report the results for self-employment, a more restrictive definition of informal employment. The estimated coefficients are in this case somewhat smaller in magnitude, but the pattern of effects remains entirely consistent.

Wages In addition to shifts along the margin of employment, workers' wages may also respond to changes in local labor demand induced by trade liberalization. In Table 4, we analyze the effects of exposure to tariff reduction at the district level on workers' log hourly wages.[16] Panel A reports the estimates of equation (2) for all sectors, while Panels B and C report the same specifications for the formal and informal sectors respectively. Wage observations are reported only for employed individuals.

In Table 4, we find no evidence of a significant impact of exposure to tariff reductions at the district level on workers' hourly wages in all sectors (Panel A), or separately for the formal sector (Panel B), or the informal sector (Panel C). We also find no evidence of a subsector-specific wage response to tariff reductions. Finally, in Appendix Tables A4 and A5, we find no evidence of a significant change in hours worked and log monthly earnings in response to liberalization-induced changes in labor demand.

It is important to highlight that if previously reported employment effects are concentrated among workers with lower ability and earnings, the observed change in wages may understate the composition-constant change in wages. (Intuitively, wages should be increasing if the pool of employed workers is shifting toward more educated and productive workers; however, the observed pattern for wages is flat.) In addition, the structure of centralized bargaining in South Africa may reduce the responsiveness of wages to liberalization-induced labor demand changes in comparison to other countries with more flexible labor market institutions.

[14] The estimate for mining in column 4 is small in magnitude even though it is significant and positive, so it should be interpreted with caution.

[15] As explained in the data section, the group of workers without any written contact is only available for after 2000, and therefore, our preferred definition does not include this group.

[16] We use the log hourly wage as the outcome variable to measure the net effect of changes in monthly earnings and hours worked. The results for using log monthly earnings and hours worked as separate outcome variables are reported in Appendix Tables A4 and A5, respectively.

4.3 Heterogeneous Effects

To sum up, our evidence suggests that workers initially employed in districts facing larger tariff declines exhibit a lower probability of both formal and informal employment, particularly in manufacturing, and are more likely to be discouraged in an employment search or exit the labor market entirely. However, the overall effects examined so far might mask heterogeneity in responses of workers. We focus on this potential heterogeneity to tariff reductions by education, race, location, gender, and age.

In Table 5, we begin by examining heterogeneity in responses to tariff declines with respect to education and race. The differences in adjustment costs across workers with different demographic characteristics, or differences in the labor demand changes across different groups of workers may result in heterogeneous responses (Dix-Carneiro, 2014; McCaig and Pavcnik, 2017). We characterize the sample as low-skilled (i.e. workers who completed eight years or less of education), medium-skilled (workers who completed nine to eleven years of education), or skilled (workers who completed twelve or more years of education). Within each subsample, we then estimate separate coefficients for individuals who are black and colored as well as white and Asian.

The results reported in Column (1) of Table 5 suggest that the employment responses in low-skilled and medium-skilled groups are largely driven by the black and colored workers, whereas the effects are consistent across all subpopulations of skilled workers. This implies that among the relatively less educated workers, black and colored workers have a greater probability of losing employment and becoming unemployed or exiting the labor force. However, highly educated white and Asian workers also experience a significant decline in the probability of employment, and this decline is in fact somewhat larger than the effect observed for highly educated black and colored workers; however, the differences are not statistically significant. The high probability of employment loss for the skilled workers is consistent with the loss of managerial and supervisory positions, particularly within manufacturing, in response to large tariff cuts.[17]

In Appendix Table A6, we examine heterogeneity with respect to location (rural/urban), gender, and age. In general, the estimated effects are quite consistent for rural and urban workers, male and female workers, and workers of varying age. The differences in the estimated coefficients are small in magnitude, and again not statistically significant.

[17]This result is similar to the heterogeneity in responses to external tariff declines in Vietnam, where larger responses are observed for low or high levels of education in comparison to medium level of education as workers transition from informal to formal work.

4.4 Robustness Checks

In order to explore the robustness of these results, we estimate a number of alternate specifications in Table 6; for concision, we focus on reporting the estimated coefficients for employment and non-employment. In Panel A, we use the log of the district tariff rather than the level as the explanatory variable. We find that the results are consistent in sign and magnitude. In the next three panels, we explore whether the results are robust to excluding sectoral outliers – more specifically, districts concentrated in the two subsectors characterized by tariff shifts in this period that are largest and smallest in magnitude (textiles and coal mining, respectively). We identify districts in the top quantile of reported baseline employment shares in these two subsectors and re-estimate the primary specification excluding the textile-heavy districts, the coal-mining heavy districts, and both sets of districts. In all three cases, the results are consistent.

In addition, in the Appendix we re-estimate the full set of results for employment, wages, unemployment, and nonparticipation using two alternate measures of the tariff shock. In Table A7, we construct the tariff shocks utilizing employment weights from the 1995 survey, available for all districts. In Table A8, we restrict the sample to the districts that report employment weights in the initial, 1994 survey. We observe that the results are robust to the use of these alternate specifications. In Table A9, we use the original tariff shock measure and include additional individual-level controls including years of education fixed effects, and dummy variables for union membership, age younger than 30, and marital status. We again observe no meaningful shifts in the results.

Migration Given that individuals in districts exposed to greater tariff cuts exhibit a large and persistent decline in the probability of employment compared to individuals in districts that were less exposed, we might hypothesize that they would respond to this decline in employment opportunities by migrating into other districts. In order to test this hypothesis, we construct a measure of in-migration using the individual-level module of October Household Surveys from 1994 to 1998. In particular, we define a dummy variable that takes the value of one if the respondent has migrated into the current district within the past year. We would expect in-migration to decline in districts that experience large tariff declines if the transaction costs associated with migration are low.

Table 7 presents the results. Column 1 reports the baseline specification as in Table 2, and Column 2 adds the additional individual-level controls as reported in Table A9. Column 3 employs the baseline specification, but uses 1995 employment shares as weights in the district tariff, and column 4 excludes missing districts in 1994. Across all

specifications, we find no evidence of a significant impact of tariff reductions on migration. This evidence is consistent with patterns of limited migration in response to trade liberalization in India and Brazil (Topalova, 2010; Dix-Carneiro and Kovak, 2017b), and suggests that the cost of migration may be high. Alternatively, there may be other barriers to worker mobility in response to trade shocks.

Government transfers Households experiencing a decline in labor market earnings due to adverse import competition shocks may increase their take-up of government transfers in order to minimize the observed decline in consumption. The PALMS data reports some limited information on individual-level and household-level receipt of transfers, indicating whether the respondent or any other member of the household receives disability grants, old age pensions, child support grants, grants for the care of dependents, and foster care grants. The individual-level indicators are reported from 1997 to 2000, while the household-level ones are reported from 2001 to 2004.

We re-estimate our primary specification employing these dummy variables, and report the results in Table 8; Panel A reports the results for individual transfers, and Panel B reports the results for household transfers. In general, we observe coefficients that are negative, though in many cases noisily estimated. There is some evidence of an increase in the probability of receipt of a disability grant (in the individual-level data) and a child support grant (in the household-level data), as well as a significant increase in the probability of receiving a care dependency grant (in both individual- and household-level data).[18]

Overall, we conclude that there is some limited evidence that receipt of government transfers in districts that were disproportionately exposed to tariff reductions increased significantly compared to other districts. These results are consistent with previous evidence around the response of transfers to adverse shocks driven by import competition in the United States (Autor et al., 2013), and suggest that households experiencing negative shocks may be partially insured by existing social support mechanisms.

Pre-trends The identification assumption for the main specification requires the assumption that the reduction in tariffs in this period is orthogonal to other trends observed at the industry and magisterial district level; this assumption would be violated, for example, if the reduction in tariffs was designed to protect districts characterized by relatively weaker economies ex ante. We have previously noted that the main objective

[18]Data on the value of these transfers is not reported, and accordingly it is not feasible to estimate what share of lost income is replaced by these transfer mechanisms.

of the tariff reduction was to reduce tariff dispersion, and accordingly industries with the highest tariff levels ex ante experienced the largest reduction. Here, we present further evidence on pre-trends in the sample using data from the censuses collected in 1970, 1980, 1991 and 2001.

More specifically, we match each of the magisterial districts as observed in 2001 to the borders of the magisterial districts observed in the previous census years. In many cases, borders have shifted over time; here, we calculate for each "modern" magisterial district (as observed in 2001) what share of its area can be assigned to magisterial districts extant in previous census waves, and construct the weighted average of the indicator of interest using these area shares as weights.[19] We focus on examining a limited set of demographic characteristics that are reported in all four census waves: the percentage of population that is female, the percentage ever-married, the percentage born in South Africa, the percentage reporting any education, the percentage reporting tertiary education, and the percentage reporting employment.

We analyze this data in two ways. First, we estimate a simple specification regressing each indicator Y_{dt} observed at the district level in year t on the tariff long-difference (i.e., the total reduction in tariffs experienced in this district between 1994 and 2004.)

$$Y_{dt} = \beta Diff_d + \epsilon_{dt} \tag{3}$$

The objective is to analyze correlations between ex ante district characteristics and the magnitude of the tariff reduction experienced. The results are reported in Table 9; we can observe the estimated coefficients are generally small in magnitude and insignificant, with the exception of the percentage born in South Africa, for which the coefficient is narrowly significant at the 10 percent level. (The mean population share born in South Africa is 95%.)

To provide graphical evidence, we also construct the means of each variable in each year for districts above and below the median level of tariff reduction observed in this period. These graphs are presented in Figure 5, and suggest that there is no significant evidence of diverging pre-trends in this period. Both the regression and graphical analysis suggest that endogeneity of the tariff reform with respect to ex ante district characteristics is not a significant source of bias in the primary results.

[19] The 1980 and 1991 censuses are also incomplete; 316 out of 364 magisterial districts are observed in 1980, and 225 are observed in 1990. Accordingly, some 2001 magisterial districts cannot be matched to any data in these years.

5 Conclusion

In this paper, we provide novel evidence on the effects of substantial import tariff reductions driven by post-apartheid trade liberalization in South Africa on labor market outcomes measured at the individual level between 1994 and 2004. More specifically, we construct a measure of exposure to tariff cuts at the level of the local economy, using baseline industrial composition and variation in industry-level tariffs over time. We then analyze the effect of these tariff shocks on multiple margins of labor market adjustment, including transitions between employment, unemployment, and nonparticipation; shifts between tradable and nontradable employment; shifts between formal and informal employment; and changes in hourly wages, earnings, and hours of work. We also evaluate whether trade-induced changes in local labor market conditions induce interregional migration or changes in government transfers to displaced workers.

We find that workers in districts more exposed to tariff declines exhibit a significant decline in employment, driven primarily by declines in the manufacturing sector, relative to less affected districts. We find no evidence of a transition from formal to informal sector employment; instead, the effects of regional tariff reductions are evenly distributed as both formal and informal employment decline at a similar magnitude. Moreover, at the intensive margin, we find no evidence of a significant impact of tariff reductions on hourly wages, monthly earnings, or hours of work. Given the lack of expansion in informal sector employment and the absence of a significant adjustment in wages, workers displaced primarily from the manufacturing sector either become discouraged workers or exit the labor force entirely. While there is some evidence that these adverse effects are larger for black and colored workers among less educated workers, in general they are observed consistently across individuals characterized by varying demographic characteristics and education levels.

Given that our results are estimated employing a cross-sectional comparison across districts and over time, we cannot draw any conclusions about the macro-level effects of trade reform. However, they are consistent with the hypothesis that South African districts that were more affected by trade liberalization have exhibited a deterioration in labor market outcomes relative to districts that were less affected. Future research may probe further the relationship between South Africa's rapid trade liberalization and the persistently low employment growth the economy has exhibited since the fall of apartheid.

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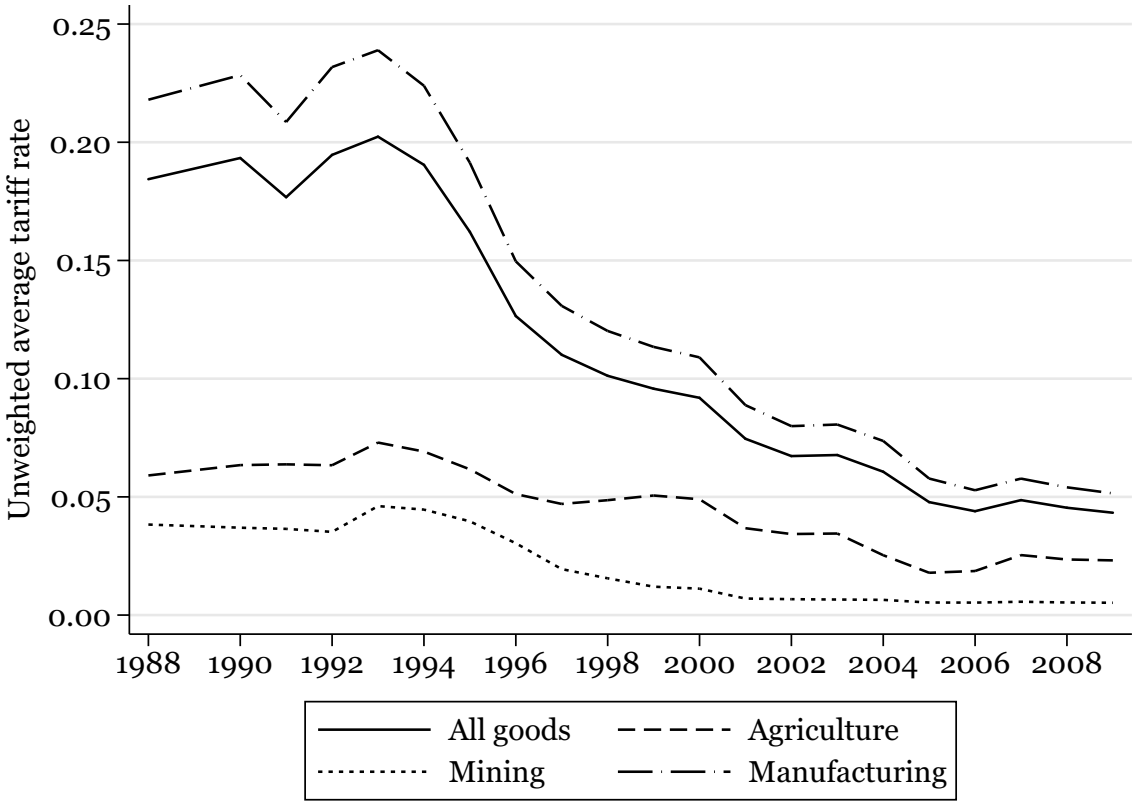
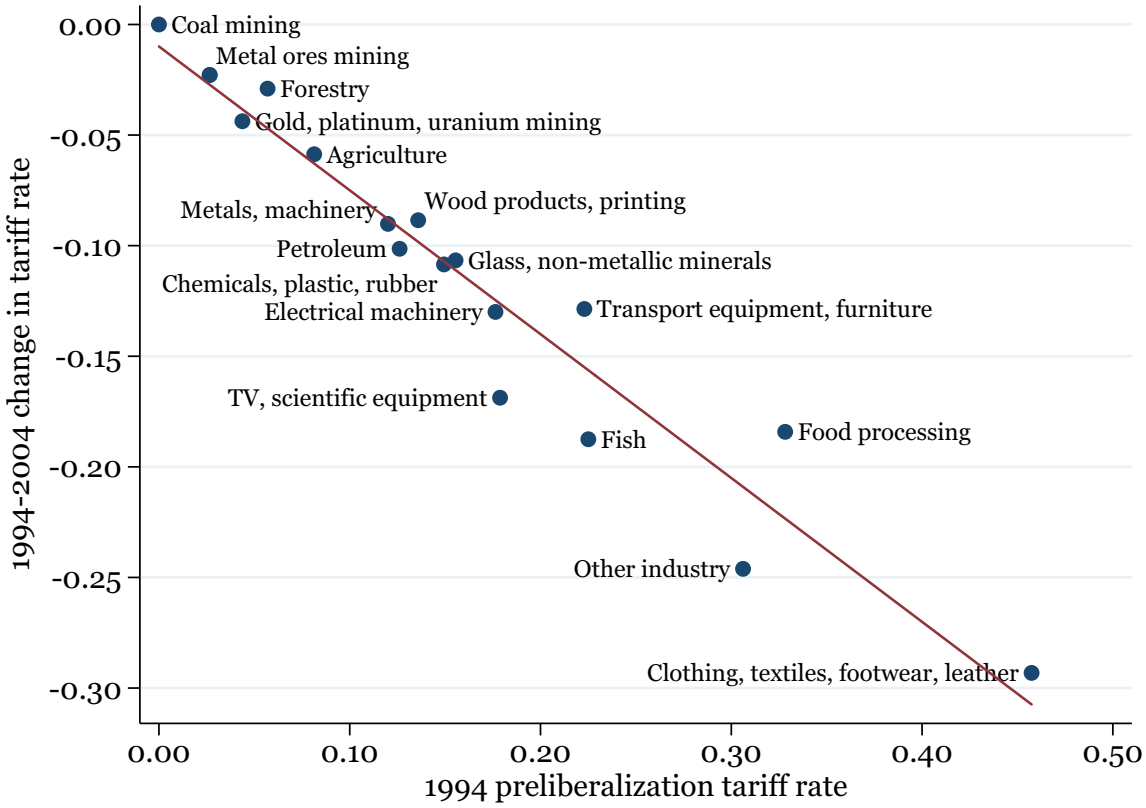
6 Figures and Tables

Figure 1: Nominal Tariffs and Surcharges, 1988–2009



Notes: This graph plots the sum of unweighted average nominal tariffs and surcharges over time for each subsector in the economy. The averages are constructed at the 2-digit industrial classification. The data is obtained from Lawrence Edwards and explained in detail in Edwards (2005).

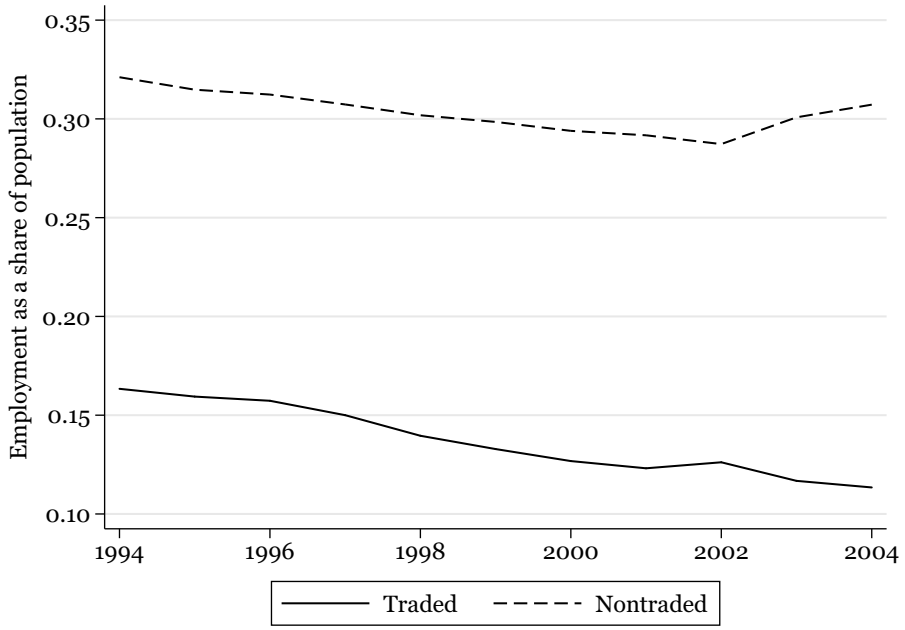
Figure 2: Tariff Reductions and Preliberalization Tariff Rates by Sector



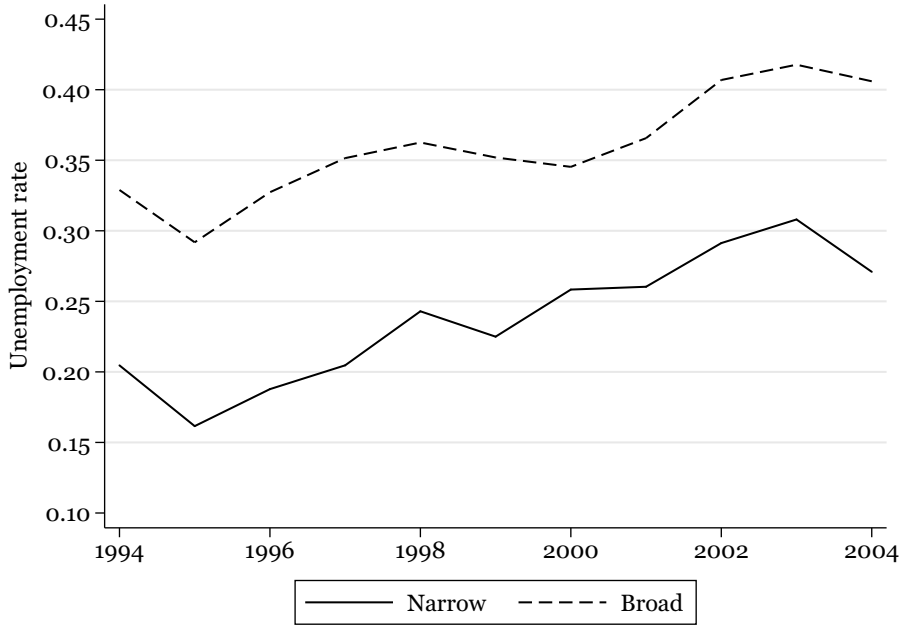
Notes: This graph shows the total reduction in tariffs between 1994 and 2004 observed by subsector relative to the pre-liberalization tariff rate observed in 1994. Correlation: -0.966; regression coefficient: -0.650; standard error: 0.044; t: -14.93.
Source: Authors' calculations based on data from Edwards (2005).

Figure 3: Trends in Employment and Unemployment

(a) Employment as a Share of Working-Age Population

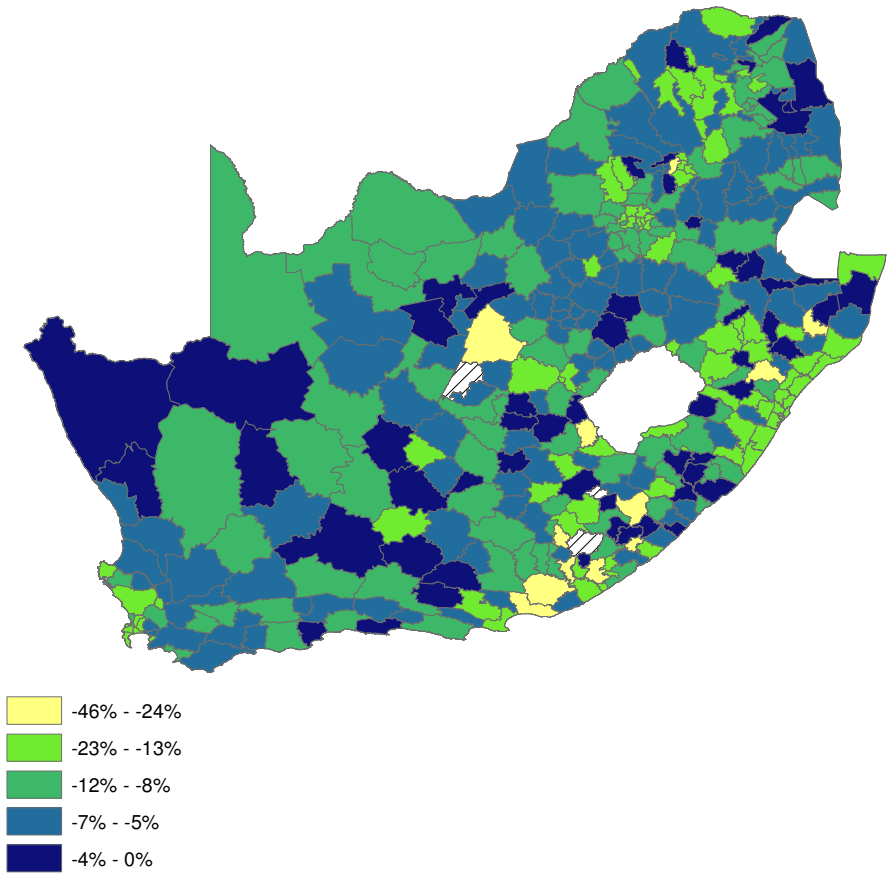


(b) Unemployment Rate



Notes: This graph shows the evolution of traded and nontraded employment as a share of working-age population in Panel A, and the trends in narrow and broad unemployment rates as a share of labor force participation in Panel B. The narrow unemployment includes only those who are unemployed and searching for a job, while the broad unemployment includes narrow unemployment plus discouraged workers.
Source: Authors' calculations based on data from Quantec and PALMS.

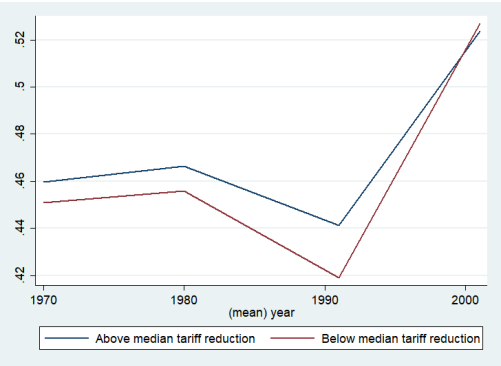
Figure 4: District Tariff Reductions



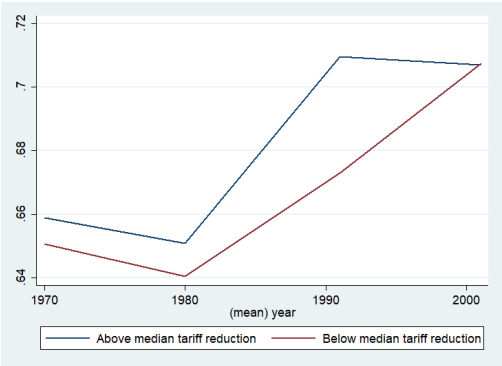
Notes: This graph illustrates the regional variation in tariff reductions defined at the magisterial district level. Districts are colored based on the district tariff measure defined in Equation (1). Districts that experienced larger tariff declines are represented as lighter and yellower, while districts that experienced smaller reductions are shown as darker and bluer. The boundaries represent magisterial district borders. Cross-hatched districts are omitted due to missing data in PALMS.
Source: Authors' calculations based on data from Edwards (2005) and PALMS.

Figure 5: Pre-Trends in Observed Characteristics of Districts

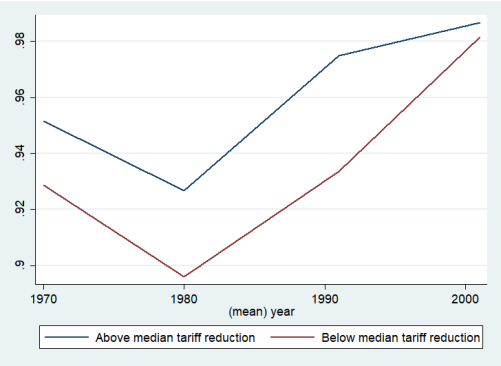
(a) Female



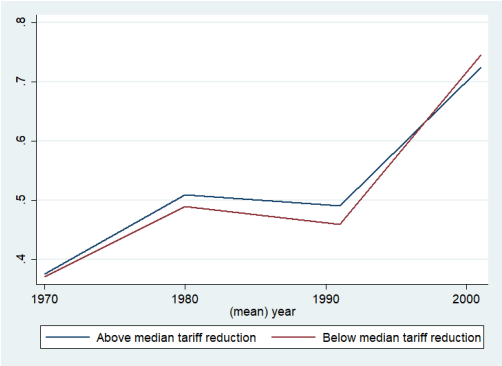
(b) Ever married



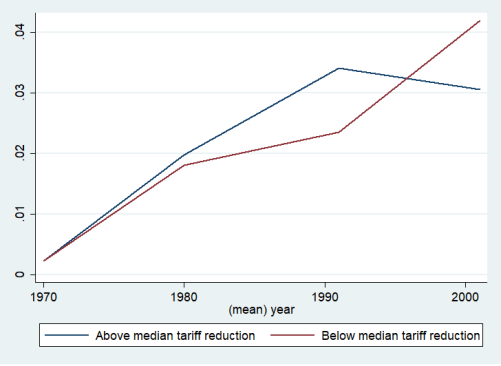
(c) Born in SA



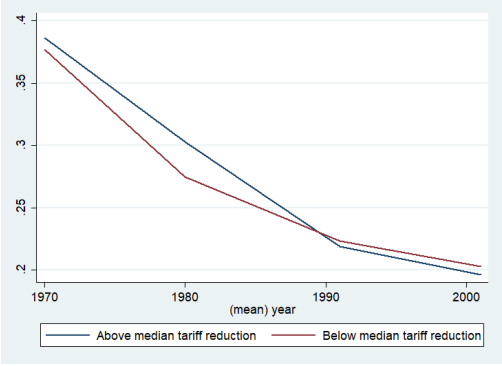
(d) Any educ.



(e) Tertiary educ.



(f) Employed



Notes: This graph plots trends at the magisterial level observed in the South African censuses collected in 1970, 1980, 1991, and 2001. Averages in each census year are reported for magisterial districts above the median of tariff reduction observed in the sample period, and below the median.

Table 1: Summary Statistics

	Mean	St. dev.	Min.	Max.	Obs.
Panel A: Demographic Characteristics					
Female	0.52	0.50	0	1	686,615
Did not complete junior high school (0-8 years)	0.44	0.50	0	1	681,986
Completed junior high school (9-11 years)	0.30	0.46	0	1	681,986
Completed high school (12 and above years)	0.26	0.44	0	1	681,986
Black	0.76	0.43	0	1	686,608
Colored	0.09	0.29	0	1	686,608
White	0.12	0.32	0	1	686,608
Asian	0.03	0.17	0	1	686,608
Younger than 30	0.50	0.50	0	1	686,670
Rural	0.41	0.49	0	1	686,670
Married	0.50	0.50	0	1	685,878
Union membership	0.11	0.31	0	1	686,670
Panel B: Employment Outcomes					
Total employment	0.41	0.49	0	1	686,670
Traded employment	0.12	0.32	0	1	686,670
Manufacturing employment	0.06	0.23	0	1	686,670
Mining employment	0.02	0.13	0	1	686,670
Agricultural employment	0.04	0.20	0	1	686,670
Nontraded employment	0.29	0.45	0	1	686,670
Employment in the formal sector	0.29	0.45	0	1	686,670
Employment in the informal sector	0.12	0.33	0	1	686,670
Employment in the informal sector (without any written contract)	0.15	0.36	0	1	686,670
Self-employment	0.07	0.25	0	1	686,670
Narrow unemployment	0.13	0.34	0	1	686,670
Discouraged workers	0.10	0.30	0	1	686,670
Broad unemployment	0.23	0.42	0	1	686,670
Not in labor force (NILF)	0.36	0.48	0	1	686,670
Panel C: Wage Outcomes					
Hourly wages in all sectors	2.26	10.14	0	1550.54	157,771
Hourly wages in traded sectors	1.94	11.37	0	1330.37	49,650
Hourly wages in manufacturing	2.70	16.03	0	1330.37	19,713
Hourly wages in mining	2.16	3.74	0	132.72	8,661
Hourly wages in agriculture	0.83	4.83	0	330.82	21,276
Hourly wages in non-traded sectors	2.39	9.58	0	1550.54	107,135

Notes: This table reports summary statistics for the working-age individuals (aged 15 to 64) in the PALMS dataset from 1994 to 2004. Panel A reports demographic characteristics, including gender, education, race, age, rural vs. urban, marital status, and union membership. Panel B reports employment variables. Employment in traded sectors includes manufacturing, agriculture and mining. Employment in the informal sector includes employees working in establishments that employ fewer than five employees, who do not deduct income tax from their salaries/wages; and employers, own-account workers and persons helping unpaid in their household business who are not registered for either income tax or value-added tax. The rest of the employed workers are in formal sector employment. Employment in the informal sector (without any written contract) adds employed workers who do not have a written contract into informal sector employment. Self-employed individuals are employers or own-account workers. The narrow definition of unemployment includes individuals who are actively searching for work; discouraged workers are those who are not searching, but report that they are willing and able to work; the broad definition of unemployment includes narrow unemployment and discouraged workers; individuals not in the labor force are not willing to work. Panel C reports real hourly wages in USD terms per sector for the subset of individuals who report paid employment.

Table 2: Employment, Unemployment, and Tariffs

	(1) All sectors	(2) Traded	(3) Manufacturing	(4) Mining	(5) Agriculture	(6) Nontraded
Panel A: Employment						
I. District and year fixed effects, and district-specific trends						
District tariff	0.210***	0.178***	0.144***	-0.016	0.050	0.033
	(0.076)	(0.055)	(0.022)	(0.014)	(0.047)	(0.061)
N	686482	686482	686482	686482	686482	686482
R^2	0.083	0.067	0.033	0.193	0.114	0.063
II. District and year fixed effects, district-specific trends, and individual covariates						
District tariff	0.241***	0.188***	0.144***	-0.014	0.057	0.053
	(0.066)	(0.053)	(0.024)	(0.015)	(0.047)	(0.043)
N	681683	681683	681683	681683	681683	681683
R^2	0.281	0.133	0.060	0.215	0.163	0.194

Panel B: Unemployment and Not in Labor Force (NILF)				
	Narrow unemployment	Discouraged	Broad unemployment	NILF
I. District and year fixed effects, and district-specific trends				
District tariff	0.005	-0.089	-0.084*	-0.126**
	(0.059)	(0.055)	(0.050)	(0.063)
N	686482	686482	686482	686482
R^2	0.032	0.033	0.036	0.059
II. District and year fixed effects, district-specific trends, and individual covariates				
District tariff	-0.002	-0.092*	-0.094*	-0.147***
	(0.058)	(0.055)	(0.051)	(0.049)
N	681683	681683	681683	681683
R^2	0.064	0.055	0.092	0.336

Notes: In all specifications, the independent variable is the district-level tariff variable constructed using employment subsector weights as measured in 1994 and industry-specific tariffs over time. All specifications are estimated conditional on district fixed effects, year fixed effects, and district-specific linear time trends. In each panel, the specifications in the second row also add individual-level covariates, including a second degree polynomial in age, gender, race, and dummy variables for three educational categories (education below ninth grade, between ninth and eleventh grade, and twelfth grade and above), and an indicator for whether an individual lives in a rural area. Standard errors are clustered at the level of the magisterial district.

In Panel A, the dependent variables include indicator variables for being employed in any sector, and being employed in specific subsectors. In Panel B, the dependent variables include indicator variables for being unemployed (narrow), discouraged workers, unemployed (broad) or out of the labor force. The narrow definition of unemployment includes individuals who are actively searching for work; discouraged workers are those who are not searching, but report that they are willing and able to work; the broad definition of unemployment includes narrow unemployment and discouraged workers; individuals not in the labor force are not willing to work. *, **, and *** indicate significance at the ten, five and one percent level, respectively.

Table 3: Employment in Formal and Informal Sectors and Tariffs

	(1) All sectors	(2) Traded	(3) Manufacturing	(4) Mining	(5) Agriculture	(6) Nontraded
Panel A: Employment in Formal Sector						
District tariff	0.117**	0.068*	0.119***	-0.016	-0.036	0.050
	(0.054)	(0.040)	(0.023)	(0.015)	(0.035)	(0.040)
N	681683	681683	681683	681683	681683	681683
R^2	0.243	0.147	0.060	0.213	0.190	0.172
Panel B: Employment in Informal Sector						
District tariff level	0.123***	0.120***	0.025***	0.002*	0.093***	0.003
	(0.046)	(0.033)	(0.005)	(0.001)	(0.031)	(0.026)
N	681683	681683	681683	681683	681683	681683
R^2	0.072	0.049	0.009	0.005	0.068	0.055
Panel C: Employment in Informal Sector (without any written contract)						
District tariff	0.152***	0.150***	0.025***	0.002	0.123***	0.004
	(0.047)	(0.035)	(0.007)	(0.002)	(0.034)	(0.029)
N	681683	681683	681683	681683	681683	681683
R^2	0.107	0.059	0.016	0.022	0.079	0.076
Panel D: Self-employment						
District tariff level	0.064*	0.098***	0.015***	-0.000	0.084***	-0.034
	(0.037)	(0.029)	(0.004)	(0.000)	(0.028)	(0.021)
N	681683	681683	681683	681683	681683	681683
R^2	0.056	0.058	0.009	0.004	0.073	0.037

Notes: In all specifications, the independent variable is the district-level tariff variable constructed using employment subsector weights as measured in 1994 and industry-specific tariffs over time. All specifications are estimated conditional on district fixed effects, year fixed effects, district-specific linear time trends, and individual-level covariates, including a second degree polynomial in age, gender, race, and dummy variables for three educational categories (education below ninth grade, between ninth and eleventh grade, and twelfth grade and above), and an indicator for whether an individual lives in a rural area. Standard errors are clustered at the level of the magisterial district.

In each panel, the dependent variables are indicator variables for employment in the formal and informal sectors. In Panel B, employment in the informal sector includes employees working in establishments that employ fewer than five employees, who do not deduct income tax from their salaries/wages; and employers, own-account workers and persons helping unpaid in their household business who are not registered for either income tax or value-added tax. In Panel A, formal sector employment includes all employed workers who are not defined as employed in the informal sector. In Panel C, employment in the informal sector (without any written contract) adds employed workers who do not have a written contract into informal sector employment. In Panel D, self-employed individuals are employers or own-account workers. *, **, and *** indicate significance at the ten, five and one percent level, respectively.

Table 4: Hourly Wages and Tariffs

	(1) All sectors	(2) Traded	(3) Manufacturing	(4) Mining	(5) Agriculture	(6) Nontraded
Panel A: Hourly Wages in All Sectors						
District tariff level	0.160	-0.186	-0.472	0.811	-0.094	0.283
	(0.250)	(0.470)	(0.689)	(1.064)	(0.418)	(0.269)
N	156645	49346	19573	8616	21157	106318
R^2	0.450	0.539	0.436	0.449	0.422	0.441
Panel B: Hourly Wages in Formal Sector						
District tariff level	0.190	-0.260	-0.232	0.726	-0.229	0.495
	(0.287)	(0.485)	(0.788)	(1.090)	(0.384)	(0.335)
N	113278	44652	17537	8535	18580	68626
R^2	0.470	0.563	0.433	0.448	0.436	0.422
Panel C: Hourly Wages in Informal Sector						
District tariff level	0.060	-1.455	-2.702	-7.463	-0.790	0.144
	(0.338)	(0.960)	(2.799)	(43.870)	(1.334)	(0.359)
N	42386	4694	2036	81	2577	37692
R^2	0.378	0.540	0.563	0.967	0.598	0.379

Notes: In all specifications, the independent variable is the district-level tariff variable constructed using employment subsector weights as measured in 1994 and industry-specific tariffs over time. All specifications are estimated conditional on district fixed effects, year fixed effects, district-specific linear time trends, and individual-level covariates, including a second degree polynomial in age, gender, race, and dummy variables for three educational categories (education below ninth grade, between ninth and eleventh grade, and twelfth grade and above), and an indicator for whether an individual lives in a rural area. Standard errors are clustered at the level of the magisterial district.

In each panel, the dependent variables are real hourly wages in South African Rand terms for all sectors (Panel A), for the formal sector (Panel B), and for the informal sector (Panel C). The informal sector employment includes employees working in establishments that employ fewer than five employees, who do not deduct income tax from their salaries/wages; and employers, own-account workers and persons helping unpaid in their household business who are not registered for either income tax or value-added tax. The formal sector employment includes all employed workers who are not defined as employed in the informal sector. *, **, and *** indicate significance at the ten, five and one percent level, respectively.

Table 5: Employment, Unemployment, and Tariffs by Education and Race

	(1) All	(2) Traded	(3) Manuf.	(4) Mining	(5) Agr.	(6) Nontr.	(7) Narrow Unemp.	(8) Discour.	(9) Broad Unemp.	(10) NILF
Panel A: Did not complete junior high school (0-8 years of education)										
District tariff	0.254***	0.224***	0.149***	-0.005	0.080	0.031	-0.005	-0.090	-0.095	-0.160**
× Black / Colored	(0.081)	(0.074)	(0.021)	(0.014)	(0.070)	(0.053)	(0.070)	(0.071)	(0.067)	(0.066)
District tariff	-0.267	-0.172	-0.069	-0.076	-0.028	-0.095	0.454**	0.056	0.510**	-0.243
× White / Asian	(0.431)	(0.330)	(0.319)	(0.097)	(0.174)	(0.496)	(0.208)	(0.168)	(0.250)	(0.441)
N	318029	318029	318029	318029	318029	318029	318029	318029	318029	318029
R^2	0.241	0.168	0.058	0.278	0.170	0.129	0.058	0.061	0.090	0.311
Panel B: Completed junior high school (9-11 years of education)										
District tariff	0.169**	0.150***	0.120***	-0.006	0.037	0.019	-0.026	-0.081	-0.107*	-0.063
× Black / Colored	(0.069)	(0.050)	(0.035)	(0.019)	(0.028)	(0.058)	(0.075)	(0.058)	(0.064)	(0.066)
District tariff	0.249	0.072	0.074	-0.123	0.121*	0.177	0.119	-0.107	0.012	-0.261
× White / Asian	(0.268)	(0.193)	(0.178)	(0.136)	(0.070)	(0.283)	(0.134)	(0.203)	(0.254)	(0.324)
N	201832	201832	201832	201832	201832	201832	201832	201832	201832	201832
R^2	0.318	0.120	0.083	0.203	0.097	0.205	0.087	0.064	0.127	0.442
Panel C: Completed high school (12 or more years of education)										
District tariff	0.208**	0.189***	0.148***	-0.031	0.072***	0.019	0.063	-0.053	0.010	-0.218**
× Black / Colored	(0.081)	(0.051)	(0.035)	(0.026)	(0.024)	(0.081)	(0.090)	(0.068)	(0.086)	(0.096)
District tariff	0.335*	0.486***	0.403***	-0.090**	0.172***	-0.151	-0.044	-0.017	-0.061	-0.274
× White / Asian	(0.200)	(0.157)	(0.142)	(0.045)	(0.054)	(0.218)	(0.091)	(0.093)	(0.133)	(0.182)
N	161884	161884	161884	161884	161884	161884	161884	161884	161884	161884
R^2	0.282	0.093	0.066	0.157	0.129	0.200	0.132	0.097	0.211	0.180

Notes: In all specifications, the independent variable is the district-level tariff variable constructed using employment subsector weights as measured in 1994 and industry-specific tariffs over time, interacted with dummy variables for individuals who are black or colored and individuals who are white or Asian. The sample is also subdivided by reported educational level. All specifications are estimated conditional on district fixed effects, year fixed effects, district-specific linear time trends, and individual-level covariates, including a second degree polynomial in age, gender, race, and dummy variables for three educational categories (education below ninth grade, between ninth and eleventh grade, and twelfth grade and above), and an indicator for whether an individual lives in a rural area. Standard errors are clustered at the level of the magisterial district. The dependent variables include total employment and employment by subsector, and dummy variables for individuals that are unemployed (narrow), discouraged workers, unemployed (broad), or not in the labor force. *, **, and *** indicate significance at the ten, five and one percent level, respectively.

Table 6: Alternate Specifications

	(1) All	(2) Traded	(3) Manuf.	(4) Mining	(5) Agr.	(6) Nontr.	(7) Narrow Unemp.	(8) Discour.	(9) Broad Unemp.	(10) NILF
Panel A: Log district tariff										
Log district tariff	0.280***	0.217***	0.155***	-0.019	0.081	0.063	-0.007	-0.099*	-0.106*	-0.175***
	(0.073)	(0.058)	(0.026)	(0.017)	(0.051)	(0.048)	(0.063)	(0.060)	(0.056)	(0.053)
N	681683	681683	681683	681683	681683	681683	681683	681683	681683	681683
R^2	0.281	0.133	0.060	0.215	0.163	0.194	0.064	0.055	0.092	0.336
Panel B: Excluding districts with high share of initial textile employment (top quartile)										
District tariff	0.252***	0.183***	0.151***	-0.012	0.044	0.069	-0.033	-0.083	-0.116*	-0.136**
	(0.078)	(0.064)	(0.025)	(0.018)	(0.054)	(0.048)	(0.069)	(0.065)	(0.062)	(0.054)
N	517288	517288	517288	517288	517288	517288	517288	517288	517288	517288
R^2	0.289	0.158	0.058	0.221	0.172	0.198	0.065	0.057	0.095	0.344
Panel C: Excluding districts with high share of initial coal employment (top quartile)										
District tariff	0.255***	0.193***	0.140***	-0.008	0.061	0.062	-0.022	-0.101*	-0.123**	-0.131**
	(0.071)	(0.057)	(0.026)	(0.015)	(0.051)	(0.044)	(0.062)	(0.060)	(0.055)	(0.053)
N	575024	575024	575024	575024	575024	575024	575024	575024	575024	575024
R^2	0.279	0.137	0.062	0.236	0.170	0.192	0.066	0.056	0.095	0.337
Panel D: Excluding districts with high share of initial textile and coal employment (top quartiles)										
District tariff	0.255***	0.184***	0.145***	-0.005	0.045	0.071	-0.042	-0.098	-0.140**	-0.115**
	(0.081)	(0.065)	(0.026)	(0.017)	(0.056)	(0.049)	(0.071)	(0.068)	(0.065)	(0.054)
N	446066	446066	446066	446066	446066	446066	446066	446066	446066	446066
R^2	0.289	0.160	0.060	0.241	0.182	0.200	0.066	0.059	0.098	0.343

Notes: In all specifications, the independent variable is the district-level tariff variable constructed using employment subsector weights as measured in 1994 and industry-specific tariffs over time. All specifications are estimated conditional on district fixed effects, year fixed effects, district-specific linear time trends, and individual-level covariates, including a second degree polynomial in age, gender, race, and dummy variables for three educational categories (education below ninth grade, between ninth and eleventh grade, and twelfth grade and above), and an indicator for whether an individual lives in a rural area. Standard errors are clustered at the level of the magisterial district. The dependent variables include total employment and employment by subsector, and dummy variables for individuals that are unemployed (narrow), discouraged workers, unemployed (broad), or not in the labor force.

In Panel A, the specification includes uses the log of the district-level tariff variable, rather than the level. Panels B, C, and D restrict the sample to exclude the quartile of districts reporting the highest concentration of employment in textiles (in Panel B), or coal employment (Panel C), or both (Panel D). Textiles is the sector reporting tariff cuts that are largest in magnitude in this period, while coal mining reports tariff cuts that are smallest in magnitude. *, **, and *** indicate significance at the ten, five and one percent level, respectively.

Table 7: Migration and Tariffs

	(1) Baseline	(2) Additional individual-level controls	(3) 1995 weights	(4) Excluding missing districts in 1994
District tariff	0.095	0.096	0.090	0.090
	(0.096)	(0.096)	(0.064)	(0.099)
N	284146	283940	284146	255362
R^2	0.089	0.095	0.089	0.089

Notes: In all specifications, the independent variable is the district-level tariff variable constructed using employment subsector weights and industry-specific tariffs over time. All specifications are estimated conditional on district fixed effects, year fixed effects, district-specific linear time trends, and individual-level covariates, including a second degree polynomial in age, gender, race, and dummy variables for three educational categories (education below ninth grade, between ninth and eleventh grade, and twelfth grade and above), and an indicator for whether an individual lives in a rural area. The dependent variable is a dummy variable equal to one if an individual reports migrating into a district in the last year. Standard errors are clustered at the level of the magisterial district.

In Column (1), the base specification is estimated. In Column (2), the specification is estimated conditional on a larger set of individual-level controls (a second degree polynomial in age, gender, race, union membership, marital status, a rural dummy, a dummy for age younger than 30, and years of education fixed effects). In Column (3), the tariff variable is constructed using employment subsector weights measured in 1995. In Column (4), the sample is restricted to districts who report employment data in 1994. *, **, and *** indicate significance at the ten, five and one percent level, respectively.

Table 8: Government Transfers and Tariffs

	(1) Disability grant	(2) Old age pension	(3) Child support grant	(4) Care dependency grant	(5) Foster care grant
Panel A: Individual-level transfers					
District tariff	-0.026**	-0.017	-0.006	-0.003*	0.000
	(0.012)	(0.016)	(0.011)	(0.002)	(0.001)
N	257451	259087	259096	259042	259026
R^2	0.023	0.180	0.010	0.004	0.005
Panel B: Household-level transfers					
District tariff	-0.005	-0.185	-0.446*	-0.023***	0.009
	(0.088)	(0.119)	(0.271)	(0.008)	(0.014)
N	257795	257825	257789	195817	257791
R^2	0.057	0.075	0.155	0.026	0.018

Notes: In all specifications, the independent variable is the district-level tariff variable constructed using employment subsector weights as measured in 1994 and industry-specific tariffs over time. All specifications are estimated conditional on district fixed effects, year fixed effects, district-specific linear time trends, and individual-level covariates, including a second degree polynomial in age, gender, race, and dummy variables for three educational categories (education below ninth grade, between ninth and eleventh grade, and twelfth grade and above), and an indicator for whether an individual lives in a rural area. Standard errors are clustered at the level of the magisterial district.

The dependent variables in Panel A include dummy variables reported at the individual level for whether that individual receives any of a set of enumerated government transfer payments (disability grants, old age pensions, child support grants, care dependency grants, and foster care grants). The dependent variables in Panel B include the same dummy variables, equal to one if any individual in the household reports receiving the same transfer payments. *, **, and *** indicate significance at the ten, five and one percent level, respectively.

Table 9: Pre-Trends at Magisterial District Level

	Female	Ever married	Born SA	Any educ.	Tertiary educ.	Employed
Tariff long difference	.029	.096	.144*	-.001	-.012	.021
	(.052)	(.068)	(.078)	(.065)	(.009)	(.064)
N	1233	1233	1233	1233	1233	1233
R^2	.032	.034	.044	.015	.023	.089

Notes: In all specifications, the independent variable is the long difference in tariffs from 1994 to 2004 calculated at the magisterial district. The dependent variable is the mean of the specified indicator at the magisterial district level as observed in the censuses conducted in 1970, 1980, 1991, and 2001.

A1 Appendix - for online publication

Table A1: Employment Shares by Race, Education, and Gender

	Manufacturing	Mining	Agriculture	Nontraded
Black	0.13	0.06	0.12	0.70
Colored	0.19	0.01	0.14	0.66
White	0.14	0.04	0.02	0.80
Asian	0.26	0.00	0.01	0.73
Did not complete junior high school (0-8 years)	0.12	0.06	0.20	0.62
Completed junior high school (9-11 years)	0.19	0.05	0.06	0.70
Completed high school (12 and above years)	0.13	0.03	0.02	0.82
Female	0.11	0.00	0.09	0.80
Male	0.16	0.07	0.11	0.66

Notes: This table reports the share of employment in manufacturing, mining, agriculture, and nontraded sectors by racial groups, levels of education, and gender. The figures represent average employment shares in each sector covering 1994 to 2004 using the PALMS data. The figures may not sum up to 1 due to rounding error.

Table A2: Summary Statistics by Industry

	Percentage of workers			Tariff rates		
Industry Description	1994	2004	Change	1994	2004	Change
Agriculture	13.86	5.07	-8.79	0.081	0.023	-0.059
Forestry	0.38	1.98	1.60	0.057	0.028	-0.029
Fish products	0.04	0.00	-0.04	0.225	0.038	-0.188
Coal mining	0.36	0.61	0.25	0.000	0.000	0.000
Petroleum	0.01	0.01	0.00	0.126	0.025	-0.101
Gold, platinum, uranium mining	1.20	3.08	1.88	0.044	0.000	-0.044
Metal ores mining	0.59	1.03	0.44	0.027	0.004	-0.023
Other mining	0.65	0.31	-0.34	0.027	0.004	-0.023
Service activities incidental to mining	0.05	0.01	-0.04	0.000	0.000	0.000
Food processing	2.98	2.58	-0.40	0.328	0.144	-0.184
Clothing, textiles, footwear, leather	3.49	2.57	-0.92	0.457	0.164	-0.293
Wood products, printing	1.84	1.58	-0.26	0.136	0.047	-0.089
Chemicals, plastic, rubber	1.69	1.52	-0.17	0.149	0.041	-0.108
Glass, non-metallic minerals	0.75	0.89	0.14	0.155	0.049	-0.107
Metals, general machinery	2.66	2.69	0.03	0.120	0.030	-0.090
Electrical machinery	0.44	0.28	-0.16	0.176	0.046	-0.130
TV, scientific equipment	0.26	0.09	-0.17	0.179	0.010	-0.169
Transport equipment, furniture	1.06	0.79	-0.27	0.223	0.094	-0.129
Other industry	0.40	1.02	0.62	0.306	0.060	-0.246
Services	67.30	73.89	6.59	0.000	0.000	0.000

Notes: This table reports summary statistics for each of the subsectors of employment identified in the PALMS data. This includes the percentage of workers by sector in 1994 and 2004, the two years that bracket the primary period of analysis for this paper, and the average tariff rate in the same years.

Table A3: Effects of Tariff Reductions on Paid and Unpaid Employment

	(1) All sectors	(2) Traded	(3) Manufacturing	(4) Mining	(5) Agriculture	(6) Nontraded
Panel A: Paid Employment						
District tariff	0.151***	0.079*	0.122***	-0.015	-0.028	0.072*
	(0.054)	(0.041)	(0.023)	(0.015)	(0.035)	(0.042)
N	681683	681683	681683	681683	681683	681683
R^2	0.236	0.147	0.059	0.214	0.187	0.159
Panel B: Unpaid Employment						
District tariff	0.025*	0.011***	0.008***	0.002*	0.001	0.014
	(0.013)	(0.004)	(0.003)	(0.001)	(0.002)	(0.011)
N	681683	681683	681683	681683	681683	681683
R^2	0.021	0.007	0.006	0.004	0.003	0.016

Notes: In all specifications, the independent variable is the district-level tariff variable constructed using employment subsector weights as measured in 1994 and industry-specific tariffs over time. All specifications are estimated conditional on district fixed effects, year fixed effects, district-specific linear time trends, and individual-level covariates, including a second degree polynomial in age, gender, race, and dummy variables for three educational categories (education below ninth grade, between ninth and eleventh grade, and twelfth grade and above), and an indicator for whether an individual lives in a rural area. Standard errors are clustered at the level of the magisterial district.

In Panel A, the dependent variables are dummy variables for paid employment in all sectors and by specific economic sector. In Panel B, the dependent variables are dummy variables for unpaid employment (e.g., in a household business). *, **, and *** indicate significance at the ten, five and one percent level, respectively.

Table A4: Effects of Tariff Reductions on Monthly Earnings

	(1) All sectors	(2) Traded	(3) Manufacturing	(4) Mining	(5) Agriculture	(6) Nontraded
Panel A: Monthly Earnings in All Sectors						
District tariff	0.395	-0.151	-0.530	0.880	0.202	0.539
	(0.359)	(0.687)	(0.889)	(1.091)	(1.006)	(0.381)
N	158618	49737	19768	8689	21280	107430
R^2	0.399	0.483	0.386	0.405	0.383	0.399
Panel B: Monthly Earnings in Formal Sector						
District tariff	0.356	-0.544	-0.132	0.730	-0.428	0.850*
	(0.425)	(0.737)	(1.076)	(1.107)	(1.073)	(0.467)
N	114068	44931	17652	8607	18672	69137
R^2	0.401	0.494	0.367	0.403	0.373	0.360
Panel C: Monthly Earnings in Informal Sector						
District tariff	0.295	0.014	1.947	-26.610	-0.562	0.313
	(0.621)	(1.198)	(3.867)	(67.780)	(1.749)	(0.662)
N	43099	4806	2116	82	2608	38293
R^2	0.375	0.542	0.587	0.952	0.612	0.374

Notes: In all specifications, the independent variable is the district-level tariff variable constructed using employment subsector weights as measured in 1994 and industry-specific tariffs over time. All specifications are estimated conditional on district fixed effects, year fixed effects, district-specific linear time trends, and individual-level covariates, including a second degree polynomial in age, gender, race, and dummy variables for three educational categories (education below ninth grade, between ninth and eleventh grade, and twelfth grade and above), and an indicator for whether an individual lives in a rural area. Standard errors are clustered at the level of the magisterial district.

In each panel, the dependent variables are real monthly earnings in South African Rand terms for all sectors (Panel A), for the formal sector (Panel B), and for the informal sector (Panel C). The informal sector employment includes employees working in establishments that employ fewer than five employees, who do not deduct income tax from their salaries/wages; and employers, own-account workers and persons helping unpaid in their household business who are not registered for either income tax or value-added tax. The formal sector employment includes all employed workers who are not defined as employed in the informal sector. *, **, and *** indicate significance at the ten, five and one percent level, respectively.

Table A5: Effects of Tariff Reductions on Hours of Work

	(1) All sectors	(2) Traded	(3) Manufacturing	(4) Mining	(5) Agriculture	(6) Nontraded
Panel A: Hours of Work in All Sectors						
District tariff	-5.977	5.327	6.172	-13.300	10.500	-2.066
	(4.468)	(9.006)	(11.250)	(14.410)	(13.540)	(4.995)
N	357707	78112	35241	12107	30764	184107
R^2	0.402	0.211	0.093	0.155	0.408	0.056
Panel B: Hours of Work in Formal Sector						
District tariff	-1.783	7.161	-0.410	-14.460	16.440	-5.914
	(4.432)	(9.350)	(11.340)	(15.600)	(17.550)	(4.683)
N	188961	66184	31180	11876	23128	122777
R^2	0.089	0.140	0.099	0.158	0.242	0.078
Panel C: Hours of Work in Informal Sector						
District tariff	-4.124	24.340	59.180	-135.100	5.405	3.909
	(9.765)	(23.890)	(36.990)	(201.200)	(31.860)	(9.317)
N	73258	11928	4061	231	7636	61330
R^2	0.095	0.348	0.227	0.694	0.450	0.072

Notes: In all specifications, the independent variable is the district-level tariff variable constructed using employment subsector weights as measured in 1994 and industry-specific tariffs over time. All specifications are estimated conditional on district fixed effects, year fixed effects, district-specific linear time trends, and individual-level covariates, including a second degree polynomial in age, gender, race, and dummy variables for three educational categories (education below ninth grade, between ninth and eleventh grade, and twelfth grade and above), and an indicator for whether an individual lives in a rural area. Standard errors are clustered at the level of the magisterial district.

In each panel, the dependent variables are hours of work for all sectors (Panel A), for the formal sector (Panel B), and for the informal sector (Panel C). The informal sector employment includes employees working in establishments that employ fewer than five employees, who do not deduct income tax from their salaries/wages; and employers, own-account workers and persons helping unpaid in their household business who are not registered for either income tax or value-added tax. The formal sector employment includes all employed workers who are not defined as employed in the informal sector. *, **, and *** indicate significance at the ten, five and one percent level, respectively.

Table A6: Heterogeneous Effects by Location, Gender, and Age

	(1) All	(2) Traded	(3) Manuf.	(4) Mining	(5) Agr.	(6) Nontr.	(7) Narrow Unemp.	(8) Discour.	(9) Broad Unemp.	(10) NILF
Panel A: By Location										
District tariff	0.222***	0.215***	0.108***	0.005	0.103	0.007	0.017	-0.125	-0.108	-0.115*
× Rural	(0.084)	(0.071)	(0.020)	(0.018)	(0.065)	(0.053)	(0.082)	(0.076)	(0.074)	(0.060)
District tariff	0.371***	0.296***	0.269***	-0.069*	0.097***	0.075	-0.080	-0.097	-0.177**	-0.194**
× Urban	(0.074)	(0.063)	(0.051)	(0.037)	(0.023)	(0.085)	(0.083)	(0.068)	(0.083)	(0.090)
N	681683	681683	681683	681683	681683	681683	681683	681683	681683	681683
R^2	0.298	0.162	0.070	0.287	0.231	0.206	0.069	0.063	0.103	0.341
Panel B: By Gender										
District tariff	0.291***	0.194***	0.095***	-0.002	0.100**	0.098*	0.003	-0.078	-0.075	-0.216***
× Female	(0.084)	(0.053)	(0.022)	(0.005)	(0.048)	(0.054)	(0.071)	(0.066)	(0.069)	(0.076)
District tariff	0.255***	0.243***	0.226***	-0.042	0.059	0.013	-0.019	-0.121*	-0.141**	-0.115*
× Male	(0.080)	(0.085)	(0.039)	(0.032)	(0.070)	(0.062)	(0.063)	(0.065)	(0.062)	(0.064)
N	681683	681683	681683	681683	681683	681683	681683	681683	681683	681683
R^2	0.295	0.167	0.071	0.322	0.192	0.201	0.067	0.061	0.010	0.349
Panel C: By Age										
District tariff	0.276***	0.159***	0.105***	-0.011	0.065	0.117***	-0.044	-0.118*	-0.163**	-0.114*
× Younger than 30	(0.067)	(0.056)	(0.024)	(0.016)	(0.049)	(0.042)	(0.069)	(0.068)	(0.066)	(0.064)
District tariff	0.278***	0.284***	0.207***	-0.026	0.102*	-0.006	0.022	-0.080	-0.058	-0.219***
× Older than 30	(0.098)	(0.072)	(0.034)	(0.020)	(0.062)	(0.083)	(0.068)	(0.074)	(0.072)	(0.082)
N	681683	681683	681683	681683	681683	681683	681683	681683	681683	681683
R^2	0.296	0.145	0.068	0.249	0.171	0.205	0.087	0.074	0.137	0.371

Notes: In all specifications, the independent variable is the district-level tariff variable constructed using employment subsector weights as measured in 1994 and industry-specific tariffs over time. In Panel A, the independent variable is interacted with dummy variables for rural and urban residence; in Panel B, it is interacted with dummy variables for male and female; in Panel C, it is interacted with dummy variables for individuals of different age ranges (above and below 30 years). All specifications are estimated conditional on district fixed effects, year fixed effects, district-specific linear time trends, and individual-level covariates, including a second degree polynomial in age, gender, race, and dummy variables for three educational categories (education below ninth grade, between ninth and eleventh grade, and twelfth grade and above), and an indicator for whether an individual lives in a rural area. Standard errors are clustered at the level of the magisterial district.

The dependent variables include total employment and employment by subsector, and dummy variables for individuals that are unemployed (narrow), discouraged workers, unemployed (broad), or not in the labor force. *, **, and *** indicate significance at the ten, five and one percent level, respectively.

Table A7: Robustness: Using 1995 Employment Shares

Panel A: Employment						
	(1)	(2)	(3)	(4)	(5)	(6)
	All sectors	Traded	Manufacturing	Mining	Agriculture	Nontraded
District tariff	0.154	0.163**	0.161***	-0.042***	0.043	-0.009
	(0.115)	(0.075)	(0.030)	(0.016)	(0.066)	(0.069)
N	681683	681683	681683	681683	681683	681683
R^2	0.281	0.133	0.060	0.215	0.163	0.194
Panel B: Log hourly wages						
	All sectors	Traded	Manufacturing	Mining	Agriculture	Nontraded
District tariff	0.056	-0.273	-0.262	3.195*	-0.610	0.208
	(0.321)	(0.546)	(0.765)	(1.808)	(0.642)	(0.317)
N	156645	49346	19573	8616	21157	106318
R^2	0.450	0.539	0.436	0.450	0.422	0.441
Panel C: Unemployment and Not in Labor Force (NILF)						
	Narrow unemployment	Discouraged	Broad unemployment	NILF		
District tariff	-0.034	-0.026	-0.060	-0.094*		
	(0.067)	(0.063)	(0.088)	(0.057)		
N	681683	681683	681683	681683		
R^2	0.064	0.055	0.092	0.336		

Notes: In all specifications, the independent variable is the district-level tariff variable constructed using employment subsector weights as measured in 1995 and industry-specific tariffs over time. All specifications are estimated conditional on district fixed effects, year fixed effects, district-specific linear time trends, and individual-level covariates, including a second degree polynomial in age, gender, race, and dummy variables for three educational categories (education below ninth grade, between ninth and eleventh grade, and twelfth grade and above), and an indicator for whether an individual lives in a rural area. Standard errors are clustered at the level of the magisterial district.

In Panel A, the dependent variables include indicator variables for total employment and employment by subsector. In Panel B, the dependent variables include log hourly wages for total employment and employment by subsector. In Panel C, the dependent variables are indicator variables for individuals that are unemployed (narrow), discouraged workers, unemployed (broad), or not in the labor force. *, **, and *** indicate significance at the ten, five and one percent level, respectively.

Table A8: Robustness: Restricting Sample to Districts Reporting 1994 Employment Shares

Panel A: Employment						
	(1)	(2)	(3)	(4)	(5)	(6)
	All sectors	Traded	Manufacturing	Mining	Agriculture	Nontraded
District tariff	0.185***	0.153***	0.135***	-0.009	0.027	0.033
	(0.069)	(0.054)	(0.024)	(0.017)	(0.048)	(0.046)
N	600370	600370	600370	600370	600370	600370
R^2	0.286	0.134	0.061	0.222	0.160	0.198
Panel B: Log hourly wages						
	All sectors	Traded	Manufacturing	Mining	Agriculture	Nontraded
District tariff	0.274	-0.153	-0.030	0.754	-0.078	0.388
	(0.269)	(0.514)	(0.677)	(1.109)	(0.458)	(0.298)
N	135644	43249	17286	8152	17811	91490
R^2	0.444	0.527	0.437	0.437	0.408	0.438
Panel C: Unemployment and Not in Labor Force (NILF)						
	Narrow unemployment	Discouraged	Broad unemployment	NILF		
District tariff	0.027	-0.085	-0.058	-0.127**		
	(0.060)	(0.059)	(0.051)	(0.052)		
N	600370	600370	600370	600370		
R^2	0.061	0.056	0.092	0.338		

Notes: In all specifications, the independent variable is the district-level tariff variable constructed using employment subsector weights as measured in 1994 and industry-specific tariffs over time. Here, the sample is restricted to magisterial districts that report employment data in 1994. All specifications are estimated conditional on district fixed effects, year fixed effects, district-specific linear time trends, and individual-level covariates, including a second degree polynomial in age, gender, race, and dummy variables for three educational categories (education below ninth grade, between ninth and eleventh grade, and twelfth grade and above), and an indicator for whether an individual lives in a rural area. Standard errors are clustered at the level of the magisterial district.

In Panel A, the dependent variables include indicator variables for total employment and employment by subsector. In Panel B, the dependent variables include log hourly wages for total employment and employment by subsector. In Panel C, the dependent variables are indicator variables for individuals that are unemployed (narrow), discouraged workers, unemployed (broad), or not in the labor force. *, **, and *** indicate significance at the ten, five and one percent level, respectively.

Table A9: Robustness: Extensive Individual-Level Controls

Panel A: Employment						
	(1)	(2)	(3)	(4)	(5)	(6)
	All sectors	Traded	Manufacturing	Mining	Agriculture	Nontraded
District tariff	0.216***	0.182***	0.138***	-0.018	0.061	0.034
	(0.063)	(0.052)	(0.025)	(0.014)	(0.046)	(0.041)
N	680937	680937	680937	680937	680937	680937
R^2	0.374	0.176	0.093	0.260	0.169	0.236
Panel B: Log hourly wages						
	All sectors	Traded	Manufacturing	Mining	Agriculture	Nontraded
District tariff	0.111	-0.336	-0.394	0.700	-0.278	0.268
	(0.242)	(0.438)	(0.682)	(1.076)	(0.368)	(0.266)
N	156541	49319	19562	8611	21146	106241
R^2	0.519	0.573	0.465	0.468	0.439	0.514
Panel C: Unemployment and Not in Labor Force (NILF)						
	Narrow unemployment	Discouraged	Broad unemployment	NILF		
District tariff	0.002	-0.086	-0.084*	-0.132***		
	(0.057)	(0.055)	(0.049)	(0.047)		
N	680937	680937	680937	680937		
R^2	0.103	0.075	0.158	0.363		

Notes: In all specifications, the independent variable is the district-level tariff variable constructed using employment subsector weights as measured in 1994 and industry-specific tariffs over time. All specifications are estimated conditional on a larger set of individual-level control variables (a second degree polynomial in age, gender, race, union membership, marital status, a rural dummy, a dummy for age younger than 30, and years of education fixed effects), as well as year fixed effects, district fixed effects, and district-specific linear time trends. Standard errors are clustered at the level of the magisterial district.

In Panel A, the dependent variables include indicator variables for total employment and employment by subsector. In Panel B, the dependent variables include log hourly wages for total employment and employment by subsector. In Panel C, the dependent variables are indicator variables for individuals that are unemployed (narrow), discouraged workers, unemployed (broad), or not in the labor force. *, **, and *** indicate significance at the ten, five and one percent level, respectively.