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 high levels of baseline unemployment and weak manufacturing sectors. 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 local economies. 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.

JEL Classification: F14, F16, O14, O19

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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 Asia and Latin America—have concurrently surged. A large body of empirical work finds evidence that these trade reforms generated substantial shifts in developing country economies.[1] On the one hand, positive shocks that increased access to developed country markets reduced poverty and shifted labor away from agriculture in Vietnam and China (McCaig, 2011; McCaig and Pavcnik, 2017; Erten and Leight, 2017). On the other hand, domestic tariff cuts that increased competition from imports slowed the pace of poverty reduction and wage growth in India and Brazil (Topalova, 2010; Dix-Carneiro and Kovak, 2017a).

However, much less is known about the impact of trade liberalization on economies in sub-Saharan Africa.[2] South Africa has been a leader in trade reform in the region; following its democratic transition in 1994, the 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 (Banerjee et al., 2008; Leibbrandt et al., 2010; Statistics South Africa, 2017). In addition, the South African labor market has several unusual features that may affect the response to trade shocks: the base level of unemployment is persistently high, the informal sector is small and exhibits high barriers to entry compared to other middle-income economies, wages are relatively rigid due to a strong presence of unions in the formal sector, and the manufacturing sector was underdeveloped even at the initiation of liberalization.[3]

In this paper, we investigate the effects of rapid trade liberalization in South Africa, focusing on substitution of workers from tradable to non-tradable production, from formal to informal employment, and from employment to unemployment. 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

[1] See Goldberg and Pavcnik (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.

[3] A large body of empirical work has documented these features of the South African labor market; see for example Kingdon and Knight (2007), Banerjee et al. (2008), Magruder (2012), and Rodrik (2016). Section 2.2 provides additional background information on the South African labor market, and examines how its unique characteristics may influence the response of local labor markets to trade liberalization.

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 reduction in import tariffs on local economies in South Africa. The previous literature analyzing this shock has generally focused on estimates using computable general equilibrium (CGE) models, where the results may be sensitive to the elasticity parameters and the closure assumptions employed in the models,[4] and studies employing decomposition techniques or industry-level correlations between import competition and labor market outcomes.[5] In contrast, we use a local labor market approach to estimate the causal effects of regional exposure to tariff reductions on labor market outcomes employing 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 prior to the initiation of liberalization 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. Our empirical strategy in this respect follows a large existing literature, including Topalova (2007, 2010), McCaig (2011), Kovak (2013a), and Autor et al. (2013), analyzing the effects of trade

[4] 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, generating results that are highly sensitive to changes in these assumptions. We provide an overview of these studies in Section 1.1 below.

[5] 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.

exposure on poverty and local labor market outcomes in India, Vietnam, Brazil, and the United States, respectively; Kovak (2013a) also provides additional evidence around the theoretical foundations for this empirical strategy.

Using 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 monthly earnings. After analyzing average effects at the individual level, we also examine heterogeneity by education, race, gender, location, and age. Finally, we investigate whether regional tariff cuts have induced any migration away from harder hit districts, or generated shifts in patterns of access to government transfers in more affected districts.

South Africa's labor market has a number of unusual characteristics that may influence the response of local economies to trade liberalization; more details will be provided in Section 2.2. First, it has one of the highest and most persistent unemployment rates in the world. As of 2017, unemployment was 28% employing the narrower definition of unemployment, and 35% including discouraged workers. These high rates of unemployment may pose a significant challenge for workers displaced by unfavorable trade shocks in finding new employment opportunities, given the large pool of searchers. Second, the informal sector is relatively small and exhibits high barriers to entry; a weak and slowly growing informal sector may have a limited capacity to absorb workers displaced from formal employment.[6] Third, wages are relatively rigid given the significant role played by trade unions and bargaining mechanisms in the determination of wages, and these institutional constraints may limit firms' response to trade shocks along the wage margin (Godfrey et al., 2007; Magruder, 2012). Fourth, the manufacturing sector was relatively underdeveloped even at the beginning of liberalization compared to other middle-income economies (Tregenna, 2011; Rodrik, 2016). These distinct characteristics of the labor market suggest a pattern of adjustment that may be qualitatively and quantitatively different from the pattern observed in other liberalizing middle-income countries.

Our results suggest 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 subsec-

[6]This has been identified as a legacy of an apartheid system that prohibited entrepreneurial activity for blacks and restricted their mobility within urban areas. Establishing small businesses is challenging due to the costs of compliance with tax and labor regulations (Magruder, 2012), and the presence of high penalties imposed for failing to comply with these regulations (Kingdon and Knight, 2007).

tors 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. When we examine adjustment to tariff cuts along the intensive margin, we find no evidence of a significant impact on monthly earnings, hourly wages, or hours of work conditional on employment.

We also evaluate whether regional tariff declines induce workers to substitute from formal to informal employment, and 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.

Moreover, we examine heterogeneity with respect to education and race. The observed employment effects are consistent for individuals at varying education levels; however, among 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 using a subsample of survey years in which migration data was reported (1994–1998), 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 dependent care 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 demon-

strate 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 local economic 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.

1.1 Related Literature

This paper contributes to a large literature analyzing the effects of trade liberalization on developing country labor markets; we add 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. Evidence from India suggests that districts more exposed 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). However, a more recent analysis using state- and industry-level data from India found no evidence that trade reform increased urban unemployment (Hasan et al., 2012). Similarly, recent work by Dix-Carneiro and Kovak (2017b) 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.

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. 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 types of employment. 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, 2017a).[7] Another recent paper finds that tariff cuts in Botswana stimulated shifts from formal to informal employment in industries exposed to more import competition, similar to the evidence from Brazil (McCaig and McMillan, 2017). On the other hand, the reduction of Mexico's import tariffs as a result of NAFTA has been found to reduce informal employment within tradable industries by forcing less productive informal firms to exit the market (Aleman-Castilla, 2006). In Vietnam, positive export shocks associated with external tariff reductions led to a contraction in informal employment as workers shift to the formal sector (McCaig and Pavcnik, 2017).

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 that follow, Dunne and Edwards (2007) find that the loss of employment through import penetration was matched by employment created through export growth (Chenery, 1979). 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, particularly potential bias introduced by the presence of manufacturing sectors exposed to both sharp tariff reductions and increasing competition from growing Asian exporters

[7] 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).

in destination markets. At the same time, 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 robustness checks, and Section 5 concludes.

2 Background

2.1 Trade Reform in South Africa

In this section, we will provide an overview of the trade liberalization process in South Africa, and briefly describe why it may be plausibly exogenous to industry characteristics.

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, mean 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 primarily driven 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 serve to 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 an empirical strategy previously used in the literature (Goldberg and Pavcnik, 2005; Kovak, 2013b). 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). In addition, we will subsequently present evidence that districts characterized by varying degrees of tariff reduction during this period do not show any evidence of differential trends in key outcomes in prior census waves observed before the onset of liberalization.

Table A2 in the Appendix presents detailed summary statistics on tariff changes by sectors over time.[8] It is evident that the largest reduction in tariffs (30 percentage points) was experienced by the textile industry, with reductions of between 15 and 25 points observed in fish, food processing, television and scientific equipment, and other industry. At the other end of the spectrum is mining, subject to almost no tariff reductions, and forestry. 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 the manipulation of tariff cuts to reflect subsequent industry performance or regional economic growth is likely to be limited. In addition, we will subsequently demonstrate that the results are robust to exclusion of the sectoral outliers.

2.2 Characteristics of the South African Labor Market

The South African labor market has a number of unusual features that could render its response to tariff reduction distinct vis-a-vis other low-income and middle-income economies. We will focus on four primary characteristics: a high baseline unemployment rate; a relatively underdeveloped informal sector; a high level of wage rigidity in the formal sector; and an anemic manufacturing sector in an economy increasingly dependent on services.

[8]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.

First, the broad backdrop for trade liberalization in South Africa is an economy characterized by persistently high unemployment. In 2017, unemployment 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), and represent an increase relative to the beginning of the post-apartheid period. In 2004, the narrow unemployment rate as reported in the PALMS data used in this analysis was 27.1% and the broad rate was 40.6%; in 1994, the narrow rate was 20.5% and the broad rate was 32.9%. 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). These high baseline rates may render it challenging for workers displaced by adverse trade shocks to identify new employment opportunities, given the large number of searchers.

Second, South Africa's informal sector is small compared to other low and middle-income countries (World Bank, 2017); this is a characteristic of the economy often cited as inextricably linked to the high rates of unemployment (Magruder, 2012). 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, Bank estimates suggest that the 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. Kingdon and Knight (2004) note that in 2002, the ratio of informal sector non-agricultural employment to unemployment was only 0.7 in South Africa, compared to averages in Sub-Saharan Africa, Latin America, and Asia of 4.7, 7.0, and 11.9 respectively.

The coexistence of an underdeveloped informal sector and persistently high unemployment has been an enduring empirical puzzle; however, analysts have postulated that barriers to entry in the informal sector may be particularly high in South Africa. Given the legacy of the apartheid system that prohibited entrepreneurial activity for blacks, social networks may have been underdeveloped, and restrictive zoning laws continue to limit the presence of informal enterprises in city centers (Rogerson, 2000; Lewis, 2002). Since South Africa is to a large extent successful in enforcing labor and tax regulations for small firms, the average costs of complying with these regulations as well as the penalties paid in failure to comply are high, deterring the entry of small and informal firms (Magruder, 2012). High levels of crime and absence of training or other government support are also cited as barriers (Kingdon and Knight, 2007). In addition, low levels of access to formal or even informal credit implies that informal sector operators are required to

rely on their own savings (Chandra et al., 2002). Heintz and Posel (2008) argue that the quantitative evidence is consistent with high barriers both to enter the informal sector and within the sector, and in fact present evidence that the ability of this sector to "mop up" high unemployment has been declining over time. Accordingly, an underdeveloped and slow-growing informal sector may be vulnerable to trade shocks, and particularly ineffective at absorbing increases in workers displaced from formal employment.

Third, employment in South Africa is characterized by a relatively high level of wage rigidity. This characteristic is also closely linked to the weakness of the informal sector, in that the high penalties imposed on firms for failure to comply with wage regulations may inhibit the growth and entry of small firms (Kingdon and Knight, 2007). During the period of analysis here, South Africa had no national minimum wage, but wages were set through a combination of three main mechanisms: firm-level bargaining (bilateral collective bargaining); collective agreements through bargaining councils that apply 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.[9]

Spatially, some wages are thus set uniformly nationally (for a particular sector and employment category), others are set at the firm level via bilateral bargaining, 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.[10] 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. Regardless of the level of determination, wages are generally not set freely by firms, but rather constrained by other institutional forces; accordingly, it is reasonable to hypothesize that adjustment to trade shocks will generally not be observed along the wage margin. This is broadly consistent with the evidence from high-income countries, where downward rigidity in wages is a commonly observed pattern.

Fourth, South Africa has an unusual sectoral distribution of employment relative to other middle-income countries. Given its level of income per capita, South Africa has a relatively overdeveloped services sector, while the share of manufacturing employment

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

[10] 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.

is lower than expected (derived from United Nations (2017); see also Tregenna (2008)). This is indicative of the early onset of deindustrialization in the 1980s (Tregenna, 2011; Rodrik, 2016). The relative underdevelopment of the manufacturing sector may reduce the capacity of this sector to resist competitive pressure from cheaper imported goods.

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 limited information on migration and government transfers that individuals receive. 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 are only provided through 2004, we define the period of analysis as 1994 to 2004.

It should be noted that South African micro-level surveys are generally not representative at the level of the magisterial district or at any level lower than the province, a point elaborated further in Magruder (2012). However, this is not necessarily a source of bias provided that the degree to which data is unrepresentative is uncorrelated with

other variables of interest. In addition, we will control extensively for both observed and unobserved local-level heterogeneity at the magisterial district level in the primary specifications.

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. (Some observations do not report educational information, accounting for the slightly smaller sample for these variables.) 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).[11] 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

[11] 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, 2017a).

all individuals who are working without any written contract.[12] 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, comprising 23% of the working-age population. Another 36% 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 reported real monthly earnings and hours of work to construct the hourly wage across sectors for individuals that provide a point estimate (as opposed to a bracket estimate) of monthly earnings; more details about the prevalence of bracketed estimates will be provided in Section 4.2.[13] The average hourly wage across 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 the unemployment rate. 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 discouraged workers are included, the unemployment rate broadly defined rose from 33% in 1994 to 41% in 2004. (Note that the unemployment rates in Figure 3 follow standard definitions and thus report unemployment as a share of the labor force, whereas the summary statistics in Table 1 are reported as a share of the working-age population.)

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

[13] 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.

4 Empirical Analysis

4.1 Empirical Methodology

Following South Africa's trade liberalization, 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, 2013b; Dix-Carneiro and Kovak, 2017a), 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, $Empshare_{id}^{1994}$ as reported in the PALMS data.[14] There are 19 traded industries represented in the dataset used in this analysis.

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

Figure 4 illustrates the spatial variation in tariff reductions defined at the magisterial district level, plotting the long difference from 1994 to 2004. The different color shades represent quintiles of the long difference in district tariff measure, and it is evident that the tariff reductions display substantial variation across districts, even within the same province. The average district faced a tariff reduction of 10.6 percentage points, and this average tariff reduction will be employed in interpreting the regression estimates below.

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. Again, the sample years include 1994 to 2004.

We employ the following specification to compare the labor market outcomes for

[14] While there are national censuses available during our sample period, census data does not report any information on employment by sector, other than whether the head of the household is employed. Accordingly, it is not possible to use other micro-level surveys to construct these employment shares.

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 ($\delta_d t$). Standard errors are clustered at the district level to account for serial correlation in the error term within a district, and weighted using weights generated by entropy estimation and calibrated to match consistent demographic and geographic trends projected by the Actuarial Society of South Africa; these weights are recommended for use in the analysis of PALMS (Branson and Wittenberg, 2014). The key parameter of interest is the coefficient on district tariffs, and 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.

The inclusion of year fixed effects in equation (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 specifications include district and year fixed effects, district-specific trends, and individual-level covariates, and 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 decline 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.

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 implies 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 broad unemployment, and 21% of the increase in discouraged workers. However, these estimates clearly require additional assumptions beyond those in the primary difference-in-difference analysis, and should be interpreted cautiously.[15]

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, 2017a; 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. We can observe in Column (1) in Panels A and B point estimates that are positive, significant, and of 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 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. (Agriculture was also exposed to a reduction in tariffs during this period, albeit of smaller magnitude, as evident in Figure 1.)[16]

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

[15]We calculate the proportion of the change in employment statistics explained by tariff declines by dividing the percentage point effect experienced by the mean district, by the mean change in that indicator observed over the period. For example, the results reported in Table 2 showed that workers in districts exposed to the average decline in tariffs experienced a 1.8 percentage point decline in tradable employment attributable to this shock, relative to a 3.4 percentage points decline overall in this period. We calculate the ratio of the two (1.8/3.4) as the share of the total shift explained by this shock. A similar calculation yields 1/9 for broad unemployment, and 1/4.8 for discouraged workers.

[16]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.

results are very similar.[17] 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.

Monthly earnings In addition to shifts along the margin of employment, workers' wages and hours conditional on employment 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 monthly earnings, equal to the product of the hourly wage and the hours worked.[18] 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.

The sample for this analysis is restricted to employed individuals, and more specifically, employed individuals who report point estimates of their earnings (as opposed to bracketed estimates of earnings). The prevalence of bracketed estimates as well as missing observations is a known challenge in working with PALMS earning data, discussed in more detail in Vermaak (2012) and Wittenberg (2014); of those reporting paid employment (either in the formal sector or the informal sector) in the sample years of interest, only 63% report a point estimate of earnings data. We follow the recommendation of Wittenberg (2008) in weighting these observations to account for missing data corresponding to bracketed wage reports.

In Table 4, we find no evidence of a significant impact of exposure to tariff reductions at the district level on workers' monthly earnings 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. Similar results are reported in Table A4 and A5 in the Appendix for hourly wages and hours worked, respectively. The magnitude of the primary coefficient for monthly earnings (in Column (1) of Panel A, Table 4) suggests that a district exposed to the mean reduction in tariffs would experience a decrease in monthly earnings of around 4 log points; however, the sign and magnitude are not stable across specifications, and in general the evidence of any effect on monthly earnings is weak.

We also explore some additional robustness checks for the earnings data. First, there is evidence in the previous literature that the measurement of earnings in the informal sector in this data series changed significantly between 1999 and 2000 (corresponding to

[17] 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.

[18] The results for using log wages and hours worked as separate outcome variables are reported in Appendix Tables A4 and A5, respectively.

the transition from the October Household Survey to the Labor Force Survey), leading to a substantial drop in measured earnings in the informal sector (Wittenberg, 2014). Accordingly, we re-estimate the effects on earnings in the informal sector employing only the post-2000 data; it should be noted as a caveat to this exercise that the number of earnings observations in the informal sector post-2000 is quite small outside of the non-tradable (services) sector. Second, we re-estimate the results for the pooled sample (formal and informal sector) excluding outliers, defined as the highest and lowest one percent of earnings observations recorded in each year.[19] Both robustness checks are reported in Table A11, and again show no evidence of an effect on monthly earnings.

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.

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. Differential effects for different subgroups could reflect differences in adjustment costs across workers with different demographic characteristics, or differential shifts in labor demand (Dix-Carneiro, 2014; McCaig and Pavcnik, 2017).

In Table 5, we begin by examining heterogeneity in responses to tariff declines with respect to education and race. 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

[19] Wittenberg (2014) recommends excluding outliers based on estimated residuals from a studentized t-regression, and these outliers are identified as such in the PALMS. However, in the sample years of interest here, using this outlier flag would only exclude about 200 observations. Accordingly, we preferentially implement our own procedure excluding additional outliers in order to further explore robustness to extreme values.

individuals who are black and colored, vis-avis 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 face a greater probability of losing employment and becoming unemployed or exiting the labor force. By contrast, 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.[20]

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.

4.4 Robustness Checks

Alternate specifications 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 two 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 and the coal-mining heavy districts, and find consistent results.

In the final panel, we re-construct the district tariff measure excluding the five sectors that seem to deviate from the linear relationship between initial tariff level and the magnitude of the tariff cut; these are the districts that appear "off-diagonal" in Figure

[20]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.

2, and include television and scientific equipment, transport equipment and furniture, fish, food processing, and other industries. We then re-estimate the primary specification using this alternate tariff measure. The results are entirely consistent, and in fact somewhat larger in magnitude.

In addition, in the Appendix we re-estimate the full set of results for employment, wages, unemployment, and nonparticipation by removing district-specific trends, using two alternate measures of the tariff shock, and including extensive individual-level control variables. Table A7 presents results without district-specific trends, and we observe that the results are consistent. In Table A8, we construct the tariff shocks utilizing employment weights from the 1995 survey, available for all districts. In Table A9, we restrict the sample to the districts that report employment weights in the initial, 1994 survey.[21] In both cases, we observe that the results are robust to the use of these alternate specifications. In Table A10, 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.

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 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 1996.

More specifically, we match each of the magisterial districts as observed in 1996 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 1996) 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.[22] We focus on examining a

[21] The correlation between the original tariff measure and the tariff measure constructed using 1995 weights is .69. The correlation between the original tariff measure and the tariff variable constructed for the restricted sample evident in the 1994 survey is .72.

[22] The 1980 and 1991 censuses are also incomplete; 316 out of 364 magisterial districts are observed in 1980, and 225 are observed in 1990.

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, the percentage of individuals 15 to 64 reporting employment, and the percentage of individuals 15 to 64 reporting that they are outside of the labor force.

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 7; 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. (It should be noted that while the inclusion of census year from 1996 may not be desirable given that it follows the initiation of tariff cuts, the results reported in Table 7 are consistent if data from 1996 is excluded, and the trend graphs are largely unchanged.) 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.

4.5 Additional Outcomes

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, it is reasonable to hypothesize that they would respond by migrating into other districts. In order to test this hypothesis, we construct a measure of in-migration using the individual-level module of the 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 8 presents the results. Column 1 reports the baseline specification as in Table 2, and Column 2 adds the additional individual-level controls reported in Table A10. 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.

These results should be considered suggestive, given the important caveats that the data is limited as to the available time period, and the measurement of migration may be imperfect; in particular, short-term migration followed by a return is not reported. An alternate strategy analyzes the effects of trade shocks on population measured at the level of the magisterial district; however, population data is available only in the 1996 and 2001 censuses. Re-estimating the primary specification of interest using the two available census waves similarly yields a null result.[23]

This evidence is consistent with patterns of limited migration in response to trade liberalization in other contexts, including India and Brazil (Topalova, 2010; Dix-Carneiro and Kovak, 2017a), 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 report 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 (targeted at children who are severely ill or disabled), and grants for children receiving foster care. All of these grants are means-tested using either an income threshold or an assets threshold, with the exception of the foster care grant; however, given that fostering a child could also be a choice made conditional on economic constraints, we include this transfer as well.[24]

[23]More specifically, we regress log population as measured in both years on the district-specific tariff measure conditional on district and year fixed effects. The coefficient is -.217, with a corresponding p-value of .399.

[24]The income and assets thresholds have shifted over time. The most recent publication from the government social security authorities provides the relevant thresholds as of April 2015 (South African Social Security Agency, 2016); these can be converted to the equivalents in 2004 rand, corresponding to the final year of the sample, using reported inflation over this eleven-year period. The asset threshold for disability and old-age pensions is 930,600 rand (532,658 in 2004 rand) for a single individual, and the income threshold for the same grant was 64,680 (37,021) rand; the income threshold for the child

The individual-level indicators are reported from 1997 to 2000, while the household-level variables are reported from 2001 to 2004. We re-estimate our primary specification employing these dummy variables, and report the results in Table 9; 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).

Data on the value of these transfers is not reported, and accordingly it is not feasible to directly estimate what share of lost income is replaced by these transfer mechanisms. We can glean some general information from the size of the transfers vis-a-vis monthly earnings. Average monthly real earnings in this sample are 2095 rand, or 2514 rand among individuals working in manufacturing, who seem most exposed to the loss of employment as a result of tariff reductions. In this period, the child support grant is valued around 100 rand monthly (Agüero et al., 2006); the disability grant is valued around 750 rand monthly (Cassim, 2005); and the care dependency grant is valued around 1000 rand monthly (Hall, 2010). While receipt of the child support grant would replace only about 4% of average monthly earnings for a wage worker in manufacturing, receipt of the disability or care dependency grant could replace between 35% and 40% of monthly earnings of a single wage worker in manufacturing. However, given that these grants require substantiation of a disability (on the part of the worker or the dependent) in addition to means-testing, they presumably do not constitute a safety net available to all affected households.

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.

support grant is lower at 39,600 (22,666) rand for a single individual, and the income threshold for a care dependency grant is higher at 169,200 (96,846) rand for a single individual.

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 earnings. 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. There is no evidence of transitions 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. Our results also lend credence to the hypothesis that the under-performance of the tradables sector and manufacturing in particular is a key determinant of weak employment growth in the South African economy in the post-apartheid period. 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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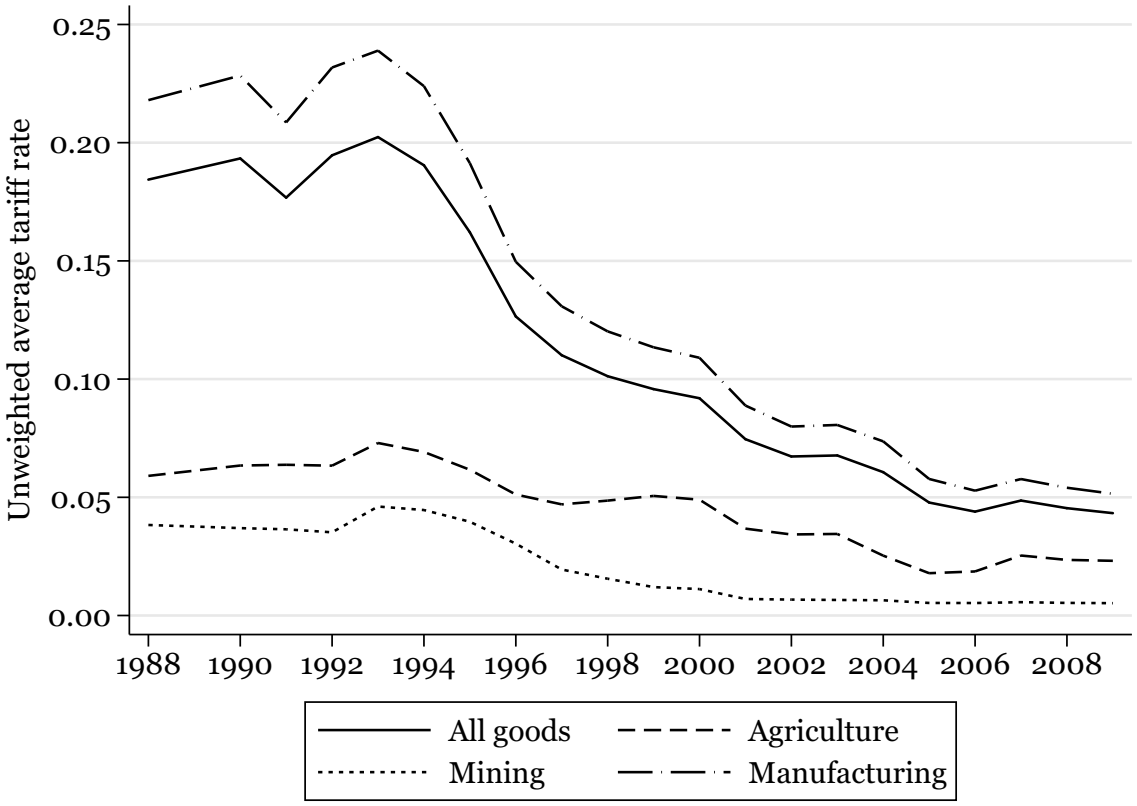
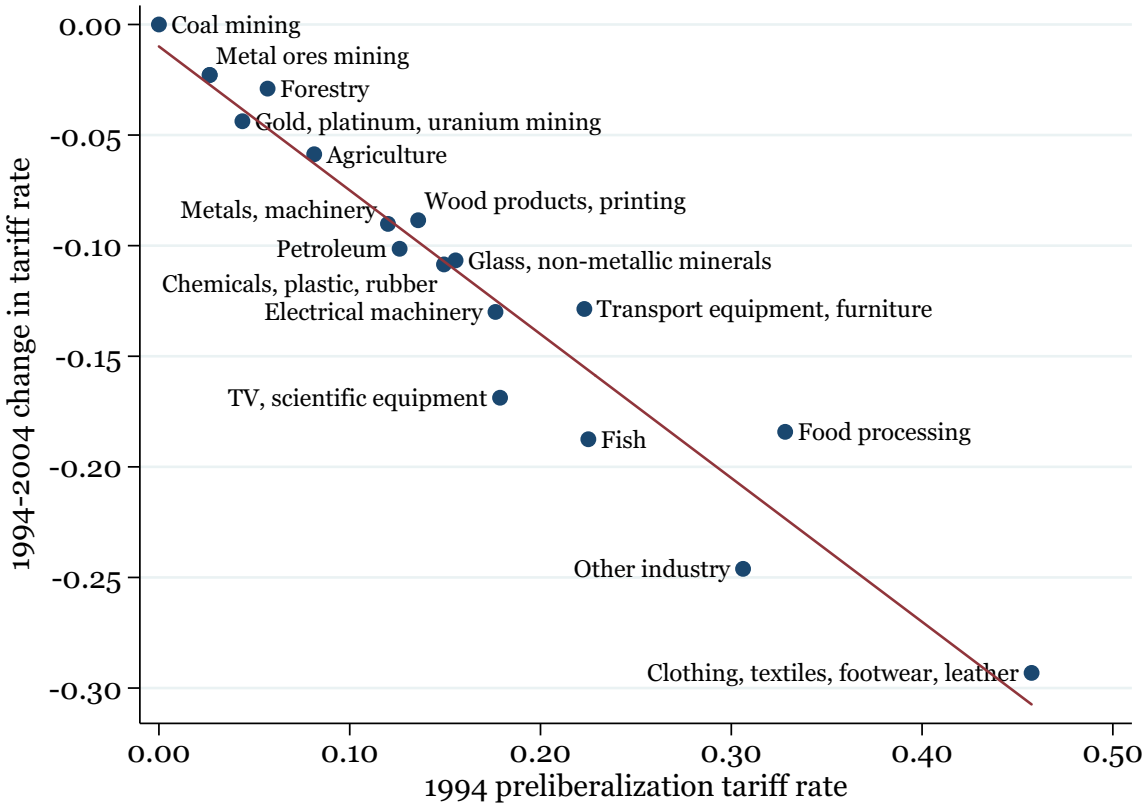
6 Figures and Tables

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 level.
Source: Authors' calculations based on data from Edwards (2005).

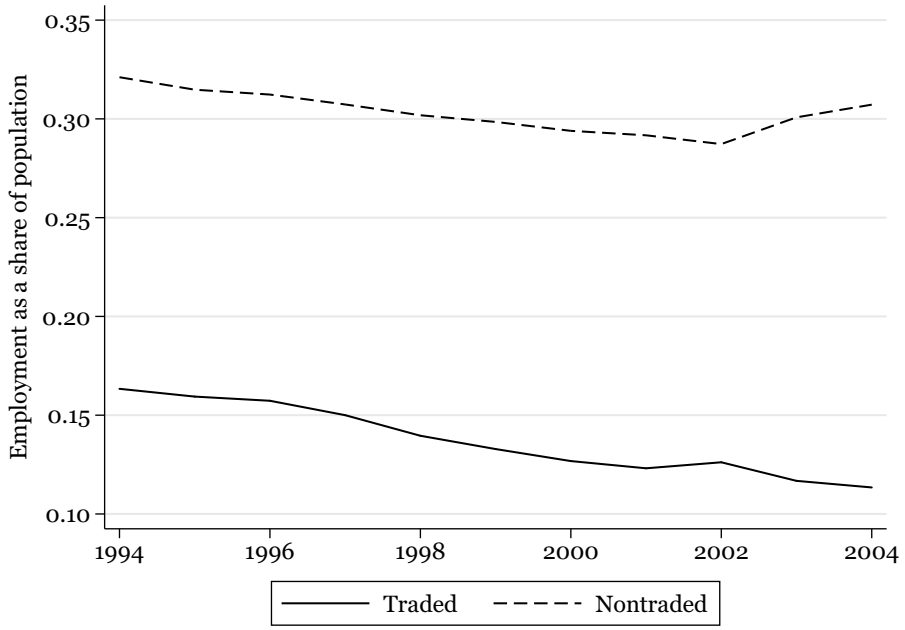
Figure 2: Tariff Reductions and Preliberalization Tariff Rates by Sector



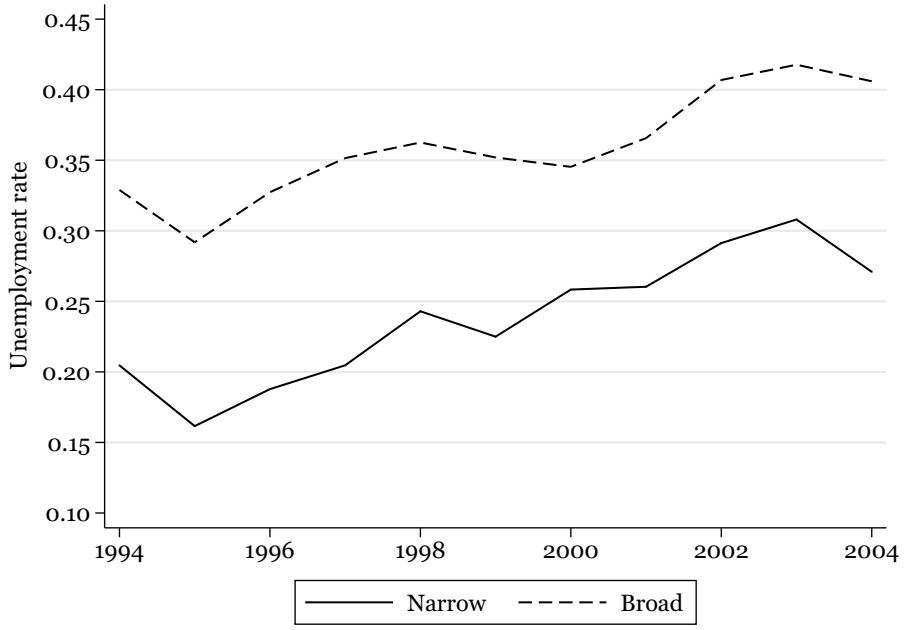
Notes: This graph shows the total reduction in tariffs between 1994 and 2004 observed by subsector relative to the pre-liberalization tariff rate observed in 1994. Correlation: -0.966; regression coefficient: -0.650; standard error: 0.044; t: -14.93.
Source: Authors' calculations based on data from Edwards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

Figure 3: Trends in Employment and Unemployment

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

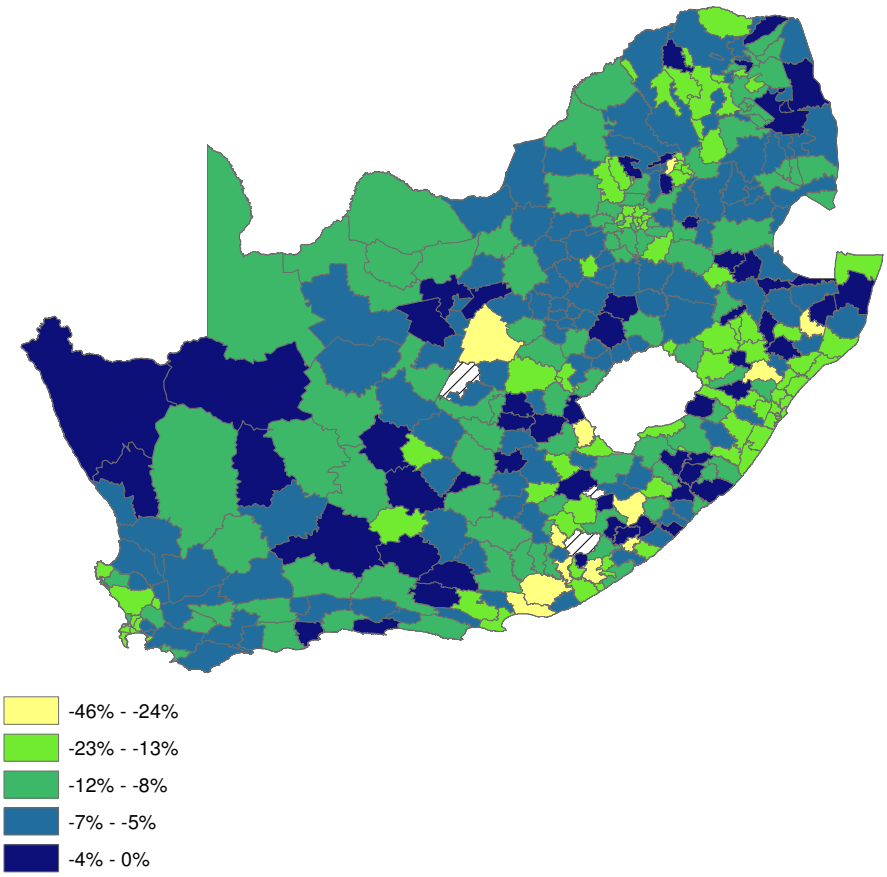


(b) Unemployment Rate



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 rate includes only those individuals who are unemployed and actively searching for a job, while the broad unemployment rate also includes individuals who are not actively searching, but report they are willing and able to work.
Source: Authors' calculations based on data from Quantec and PALMS.

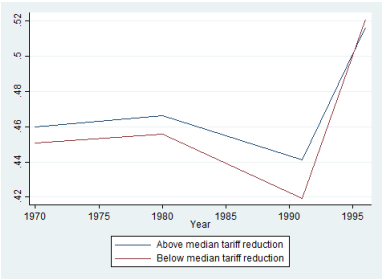
Figure 4: District Tariff Reductions



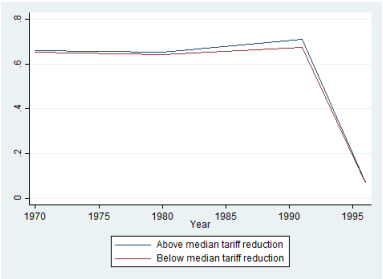
Notes: This graph illustrates the regional variation in tariff reductions defined at the magisterial district level. Districts are colored based on the district tariff measure defined in Equation (1). Districts that experienced larger tariff declines are represented as lighter and yellower, while districts 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

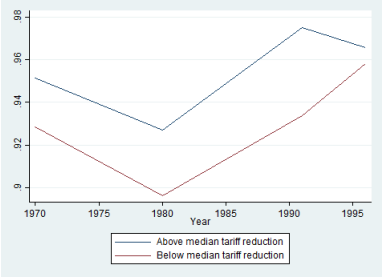
(a) Female



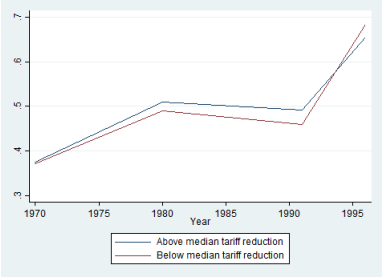
(b) Ever married



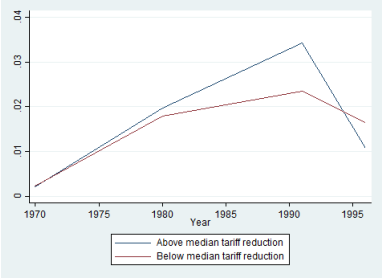
(c) Born in SA



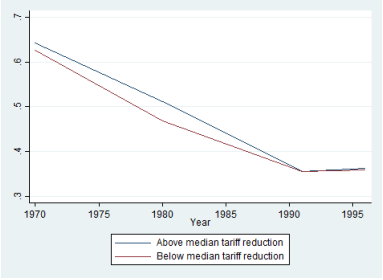
(d) Any educ.



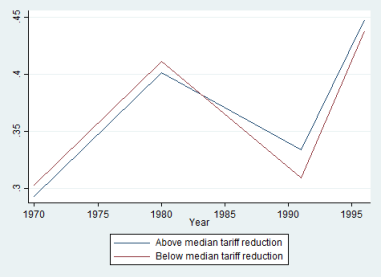
(e) Tertiary educ.



(f) Employed



(g) Not in the labor force



Notes: This graph plots trends at the magisterial level observed in the South African censuses collected in 1970, 1980, 1991, and 1996. 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 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 formal sector includes all employees not working in the informal sector. 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. 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, and report a point estimate of their monthly earnings.

Table 2: Employment and Unemployment

	(1) All sectors	(2) Traded	(3) Manufacturing	(4) Mining	(5) Agriculture	(6) Nontraded
Panel A: Employment						
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		
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, 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, and weighted following Branson and Wittenberg (2014).

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 dummy variables for individuals that are unemployed (narrow definition), discouraged workers, unemployed (broad definition), or not in 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. Asterisks indicate significance at the ten, five and one percent level, respectively.

Table 3: Employment in Formal and Informal Sectors

	(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	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	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, and weighted following Branson and Wittenberg (2014).

In each panel, the dependent variables are indicator variables for employment in the formal and informal sectors. In Panel A, formal sector employment includes all employed workers who are not defined as employed in the informal sector. 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 C, employment in the informal sector (without any written contract) additionally identifies 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. Asterisks indicate significance at the ten, five and one percent level, respectively.

Table 4: Monthly Earnings

	(1) All sectors	(2) Traded	(3) Manufacturing	(4) Mining	(5) Agriculture	(6) Nontraded
Panel A: Log Monthly Earnings in All Sectors						
District tariff	0.377	0.315	-0.763	0.775	0.347	0.260
	(0.358)	(0.632)	(0.860)	(1.138)	(1.005)	(0.406)
N	157167	49737	19768	8689	21280	107430
R^2	0.429	0.513	0.412	0.443	0.420	0.423
Panel B: Log Monthly Earnings in Formal Sector						
District tariff	0.433	-0.0557	-0.397	0.561	-0.328	0.537
	(0.342)	(0.663)	(0.980)	(1.151)	(1.047)	(0.383)
N	114068	44931	17652	8607	18672	69137
R^2	0.428	0.529	0.392	0.443	0.405	0.376
Panel C: Log Monthly Earnings in Informal Sector						
District tariff	0.143	0.267	0.695	-17.68	-0.142	0.0989
	(0.721)	(1.449)	(4.491)	(66.77)	(1.967)	(0.796)
N	43099	4806	2116	82	2608	38293
R^2	0.433	0.594	0.630	0.960	0.656	0.433

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, and weighted following Branson and Wittenberg (2014).

In each panel, the dependent variables are the log of 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). In Panel B, 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 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. Asterisks indicate significance at the ten, five and one percent level, respectively.

Table 5: Employment and Unemployment 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, and weighted following Branson and Wittenberg (2014). The dependent variables include total employment and employment by subsector, and dummy variables for individuals that are unemployed (narrow definition), discouraged workers, unemployed (broad definition), or not in the labor force. Asterisks 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: Reconstructing district tariff excluding off-diagonal industries										
District tariff alt.	0.376***	0.313***	0.140***	-0.0210	0.194***	0.0629	-0.0703	-0.0993	-0.170***	-0.206***
	(0.0817)	(0.0639)	(0.0300)	(0.0203)	(0.0561)	(0.0571)	(0.0690)	(0.0734)	(0.0615)	(0.0590)
N	681683	681683	681683	681683	681683	681683	681683	681683	681683	681683
R^2	0.281	0.133	0.0603	0.215	0.163	0.194	0.0636	0.0551	0.0923	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, 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, and weighted following Branson and Wittenberg (2014). The dependent variables include total employment and employment by subsector, and dummy variables for individuals that are unemployed (narrow definition), discouraged workers, unemployed (broad definition), 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 and C 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); 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. In Panel D, the specification employs an alternate measure of the district tariff that is re-constructed to exclude industries that appear as "off-diagonal"; this includes television and scientific equipment, transport equipment and furniture, fish, food processing, and other industries. Asterisks indicate significance at the ten, five and one percent level, respectively.

Table 7: Pre-Trends at Magisterial District Level

	Female	Ever married	Born SA	Any educ.	Tertiary educ.	Employed	NILF
Tariff long difference	0.022	0.099	0.139*	-0.027	-0.002	0.041	0.003
	(0.051)	(0.066)	(0.078)	(0.066)	(0.007)	(0.087)	(0.074)
N	1233	1233	1233	1233	1233	1233	1233
R^2	.032	.034	.044	.015	.023	.089	.035

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 1996. Asterisks indicate significance at the ten, five and one percent level, respectively.

Table 8: Migration

	(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, and weighted following Branson and Wittenberg (2014).

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. Asterisks indicate significance at the ten, five and one percent level, respectively.

Table 9: Government Transfers

	(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, and weighted following Branson and Wittenberg (2014).

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. Asterisks indicate significance at the ten, five and one percent level, respectively.

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 one 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: 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, and weighted following Branson and Wittenberg (2014).

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). Asterisks indicate significance at the ten, five and one percent level, respectively.

Table A4: Hourly Wages

	(1) All sectors	(2) Traded	(3) Manufacturing	(4) Mining	(5) Agriculture	(6) Nontraded
Panel A: Log Hourly Wages in All Sectors						
District tariff	0.173	0.0762	-0.735	0.896	0.0113	0.179
	(0.285)	(0.511)	(0.793)	(1.179)	(0.473)	(0.315)
N	155664	49346	19573	8616	21157	106318
R^2	0.466	0.554	0.452	0.474	0.461	0.453
Panel B: Log Hourly Wages in Formal Sector						
District tariff	0.305	0.0239	-0.442	0.805	-0.123	0.435
	(0.302)	(0.526)	(0.866)	(1.210)	(0.433)	(0.352)
N	113278	44652	17537	8535	18580	68626
R^2	0.479	0.578	0.450	0.474	0.459	0.424
Panel C: Log Hourly Wages in Informal Sector						
District tariff	-0.129	-1.758	-4.265	0.0943	-0.643	-0.0573
	(0.396)	(1.183)	(3.485)	(46.06)	(1.540)	(0.428)
N	42386	4694	2036	81	2577	37692
R^2	0.441	0.595	0.607	0.974	0.656	0.443

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, and weighted following Branson and Wittenberg (2014).

In each panel, the dependent variables are the log of 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). In Panel B, 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 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. Asterisks indicate significance at the ten, five and one percent level, respectively.

Table A5: 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	-2.927	5.327	6.172	-13.30	10.50	-2.066
	(5.116)	(9.006)	(11.25)	(14.41)	(13.54)	(4.995)
N	262219	78112	35241	12107	30764	184107
R^2	0.068	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	-14.46	16.44	-5.914
	(4.432)	(9.350)	(11.34)	(15.60)	(17.55)	(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	24.34	59.18	-135.1	5.405	3.909
	(9.765)	(23.89)	(36.99)	(201.2)	(31.86)	(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, and weighted following Branson and Wittenberg (2014).

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). In Panel B, 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 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. Asterisks 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, and weighted following Branson and Wittenberg (2014).

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

Table A7: Robustness: Specifications Excluding District-Specific Trends

Panel A: Employment						
	(1)	(2)	(3)	(4)	(5)	(6)
	All sectors	Traded	Manufacturing	Mining	Agriculture	Nontraded
District tariff	0.288***	0.165***	0.141***	0.00727	0.0172	0.122***
	(0.0738)	(0.0555)	(0.0211)	(0.0196)	(0.0482)	(0.0438)
N	681683	681683	681683	681683	681683	681683
R^2	0.276	0.125	0.0585	0.204	0.143	0.191
Panel B: Unemployment and Not in Labor Force (NILF)						
	Narrow unemployment	Discouraged	Broad unemployment	NILF		
District tariff	-0.116**	0.0880*	-0.0277	-0.260***		
	(0.0515)	(0.0505)	(0.0524)	(0.0541)		
N	681683	681683	681683	681683		
R^2	0.0589	0.0477	0.0883	0.333		
Panel C: Log monthly earnings						
	All sectors	Traded	Manufacturing	Mining	Agriculture	Nontraded
District tariff	0.0732	1.427***	-0.248	0.829	1.150*	-0.517
	(0.337)	(0.454)	(0.644)	(0.930)	(0.637)	(0.351)
N	157167	49737	19768	8689	21280	107430
R^2	0.417	0.491	0.381	0.415	0.369	0.411

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, 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, and weighted following Branson and Wittenberg (2014).

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

Table A8: 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: 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		
Panel C: Log monthly earnings						
	All sectors	Traded	Manufacturing	Mining	Agriculture	Nontraded
District tariff	0.410	0.260	0.126	3.136	-0.819	0.507
	(0.404)	(0.724)	(0.969)	(2.326)	(0.990)	(0.401)
N	157167	49737	19768	8689	21280	107430
R^2	0.429	0.513	0.412	0.444	0.420	0.423

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, and weighted following Branson and Wittenberg (2014).

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

Table A9: 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: 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		
Panel C: Log monthly earnings						
	All sectors	Traded	Manufacturing	Mining	Agriculture	Nontraded
District tariff	0.591	0.529	-0.517	0.947	0.677	0.412
	(0.388)	(0.666)	(0.856)	(1.199)	(1.110)	(0.449)
N	136027	43582	17448	8218	17916	92445
R^2	0.419	0.496	0.402	0.428	0.405	0.415

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, and weighted following Branson and Wittenberg (2014).

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

Table A10: 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: 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		
Panel C: Log monthly earnings						
	All sectors	Traded	Manufacturing	Mining	Agriculture	Nontraded
District tariff	0.312	0.120	-0.582	0.646	0.0516	0.230
	(0.346)	(0.594)	(0.851)	(1.121)	(0.910)	(0.395)
N	157062	49710	19757	8684	21269	107352
R^2	0.487	0.543	0.436	0.460	0.436	0.482

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, and weighted following Branson and Wittenberg (2014).

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

Table A11: Robustness: Alternate Specifications for Monthly Earnings

Panel A: Informal sector post-2000						
	(1)	(2)	(3)	(4)	(5)	(6)
	All sectors	Traded	Manufacturing	Mining	Agriculture	Nontraded
District tariff	-0.603	-2.341	-2.648	0	-2.253	-0.0158
	(0.721)	(2.023)	(4.222)	(.)	(4.016)	(0.707)
N	26541	3012	1621	40	1351	23529
R^2	0.453	0.670	0.672	0.977	0.758	0.445
Panel B: Pooled sample excluding outliers						
	All sectors	Traded	Manufacturing	Mining	Agriculture	Nontraded
District tariff	0.413	0.443	3.303	-67.96	-1.133	0.442
	(0.588)	(1.215)	(3.676)	(59.45)	(1.876)	(0.611)
N	41666	4633	2036	76	2521	37033
R^2	0.291	0.469	0.539	0.917	0.537	0.293

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, and weighted following Branson and Wittenberg (2014).

In Panel A, the dependent variables include monthly earnings in the informal sector post-2000. In Panel B, the dependent variable is a pooled variable of monthly earnings (both formal and informal sector) excluding the top and bottom 1% of outliers in each year. Asterisks indicate significance at the ten, five and one percent level, respectively.