The Effects of Trade Reform on Labour Mobility Across South African Local Labour Markets

Abstract

The extent to which labour market are affected by trade liberalization depends crucially on their ease of reallocating labour and factors of production across regions and sectors of the economy. However, previous literature has provided little insight on the role of migration and labour market frictions in shaping the effects of trade reform across regions in South Africa (SA). This paper considers this key question by observing the effect of tariff reform on the spatial reallocation of labour across sectors and regions over the period, 1996 to 2011. Overall, tariff reductions on imports in SA has induced spatial reallocation of labour in SA with a dominant flow of labour from regions/sectors with characteristically high tariff reductions towards regions/sectors of low tariff reductions. Critically, the paper finds that pull factors assimilated through the import competition channel have a positive significant effect on the migration rate, while the opposing push effect is insignificant.

Keywords: Trade Liberalization, Migration, South Africa, Tariff

1 Introduction

The importance of this study lies in the observation that the onset of tariff liberalization in SA from 1994 saw a substantial increase in imports that have reflected in a substantial restructuring of the economy (Edwards 2001, Rodrik 2008). Existing international literature (Topalov 2010, Porto 2003, Goldberg & Pavcnik 2004) has focused on the welfare effects of trade liberalization in terms of income and poverty, finding nuanced results. However, little research has addressed the mechanisms at the local level through which trade liberalization effects employment, which is critical for developing economies with an abundance of unskilled labour and high unemployment. In addition, there is a gap in the literature that considers trade liberalization and internal migration flows within the same framework. While Borjas et al. (1997) consider how immigration and trade openness affect labour market outcomes through skill based rigidities, little research has considered the effect of increased trade openness on internal migration flows. Hence, this paper seeks to contribute to existing trade literature by determining how increased trade openness can be mapped to internal labour market adjustments. Importantly, this study aims to uncover how the degree of mobility determines the impact of trade reform on social welfare, which may vary according to skill, gender and age.

The hypothesis underpinning this study is that there exists imperfect mobility or frictions to the movement of labour across sectors and across regions, which may compound the effect of regional disparities in trade reform on labour market outcomes. The central premise is that under imperfect mobility, a negative trade shock may provide distributional effects in the presence of imperfect factor reallocation. This is because expanding industries, such as services, may be unable to perfectly absorb labour losses in other industries, such as manufacturing that have experienced large exposure to import competition. Standard economic theory, the Heckscher-Ohlin model, provides the prediction that in the presence of perfect factor mobility, the gains of trade flow to the abundant factors, namely unskilled labour in developing countries. Specifically, this

paper breaks down the hypothesis of perfect mobility within the country and between industries. This paper rather supports the research on specific factors, which shows that when factors are immobile or specific, the gains/losses are concentrated on those factors to industry.

Furthermore, recent trade models (Flaig et al. 2013 and Patron 1999) have negated this theoretical prediction of perfect factor mobility. The studies suggest that trade liberalization may reduce the welfare of unskilled labour in a labour abundant country and furthermore, the distributional welfare consequences may vary across skill level and gender. In particular, Flaig et al. (2013) use a computable general equilibrium (CGE) model with imperfect reallocation of labour and the inclusion of a migration function to describe the movement of labour between sectors. The assumption of perfectly mobility of labour across regions means that the consequences of trade shocks for workers may be nullified. Hence, in this study, we relax this assumption by considering the sluggish or incomplete adjustment of labour demand movements in response to the trade shock, as suggested by previous literature, Autor et al. (2013) and Dix-Carneiro (2014). Hence, this study exploits the variation in tariff reduction across regions, sectors and time to determine the nature and size of the labour reallocations, stemming from the initial regional variations in industrial structure before the onset of the reforms.

The rest of the paper is organized as follows. Section 2 discusses the empirical evidence of trade liberalization induced spacial reallocation of labour and the migration frictions that arise in the presence of free trade and furthermore, contrasts our approach to the related literature. Section 3 describes how the variable measures for tariff reform and internal migration are derived, the regression models used and the related assumptions made. Furthermore, analysis of the data guides our interpretation of the responsiveness of labour in various sectors and regions to these shocks and the observed changes in the pattern of industry specialization, labour market outcomes and geographical dispersion. Section 4 provides our primary OLS and 2SLS estimates of the impact of tariff reform

on labour mobility and specifically, the movement of workers from regions/sectors of high import competition towards less internationally competitive regions/sectors. Section 5 concludes.

2 Literature Review

Baldàrrago and Salinas (2017) study the effect of tariff reform on socioeconomic factors in Peru. The paper suggests that there is a significant increase in migration in response to tariff reductions. Furthermore, the study uncovered a significant negative link between tariff reduction and socioeconomic indicators of import-competing regions. Consistent with this theory, Mendez (2015) analyzes the variation in import competition across regions in Mexico, originating from initial differences in industry specialization. In particular, the paper observed the effect of Chinese import exposure on the Mexican local labour market and found that there was a significant degree of labour mobility induced by the negative trade shock. In particular, a one standard deviation rise in import exposure is associated with a two percentage point decrease in the working age population of a municipality.

Furthermore, Zi (2017) analyses the effect of trade liberalization on the reallocation of labour in China. The study found that more than 30 percent of inter-regional employment changes can be attributed to trade reform and that this is mainly driven by labour adjustment/transfers between regions. Importantly, the paper pointed to trade-induced reallocation of labour across regions and sectors and migration frictions as the core determinants of the magnitude of trade impact on local regional units. Within this context, migration frictions pertain to the human capital and physical resources required to relocate across regions. It can be said that disparities in skill level, age and gender may determine the ability of individuals to overcome barriers to labour reallocation, and these are known as migration frictions. Nevertheless, Ma and Tang (2016) con-

duct a multi-city multi-industry framework with imperfect labour mobility. The authors suggest that increased trade openness induces bilateral migration flows from inland to coastal regions, which magnifies gains from trade and creates more spatial income inequality, concentrating the upper distribution of income towards richer coastal regions. Fan (2015) reveals that increased trade openness increases the skill premium within a region and raises the between region inequality for labour with similar skills. In more detail, across workers with similar skills, some urban unskilled workers experience welfare gains, while others experience welfare losses. The geographical location of a region is also imperative as regions on the coast achieve most of the welfare gains, while interior regions benefit little.

More generally, Artuç and McLaren (2010) construct a model of the Turkish labour market, wherein each worker is able to switch between sectors each period at a cost. This cost differs for each worker over time according to a distribution of parameters, estimated by a Euler equation. The paper found that the manufacturing and construction sector composed of 32.8 percent of the aggregate labour force in the tariff steady state, but under free trade, composed only 28.5 percent of the total labour force. Furthermore, the evidence revealed that high intersectoral moving costs lead to significant welfare losses for workers in the liberalizing sector that may only be partially alleviated over time. In contrast, workers in other sectors experienced a significant welfare benefit, as was the case for the aggregate economy. In addition, it is evident that all other sectors gain labour, driven by free trade, but this labour force adjustment is sluggish, taking roughly a decade to be realized.

Menezes-Filho and Muendler (2007) use linked employer-employee data on Brazil's broad labour force from 1986 to 2001 and the metropolitan household survey, which provides information on formal sector employment and annual work status changes, to determine whether labour force reallocations occur in response to trade reform. The authors suggest that trade liberalization is associated with more frequent failures of

labour reallocations in the formal sector, more frequent shifts to informal occupations and ultimately higher unemployment. Furthermore, free trade is consistent with more frequent labour force withdrawals, and longer durations of labour reallocations after trade reform. Hence, although product-market reallocations can occur rapidly after trade reform, developing countries, such as Brazil, may expect incomplete and prolonged labour market adjustment.

Topalov (2010) supports the theories of trade liberalization that do not assume perfect mobility of factors across sectors. In particular, the paper uses the 1991 post trade reform period in India to measure the impact of trade liberalization on poverty and found that inflexible labour laws in various Indian states had the effect of impeding labour adjustment across sectors. Consequently, these areas were more adversely affected by trade reform. In contrast, states with flexible labour laws, experienced movements of labour and capital across sectors and overall faster growth of manufacturing that eased the shock of the relative price change. In terms of the least mobile individuals, the paper found that the trade-consumption link is concentrated among individuals at the bottom end of the consumption distribution, which are the least geographically mobile. The premise underpinning this trade-consumption link may be that low income individuals consume relatively more traded goods, while high income individuals consume relatively more services, which comprise the least traded sectors. Hence, transitioning from autarky to trade, it could be that the relative prices of the goods consumed by the poor with higher intensities decreases to a larger extent relative to the rich.

Acemoglu et al. (2014) observe the effects of trade reform at the firm level by use of US input-output data in order to create downstream trade shocks for manufacturing and non-manufacturing activities. The paper suggests that an adverse shocks to one industry can be transferred to other industries through linkages between sectors. This lies in the tendency of buyers and suppliers to locate in close proximity. The impact of increased import competition in downstream industries is then likely to be transferred to

suppliers in the same regional market. Hence, inter-industry linkages magnify the size of the impact within manufacturing and produce a similarly large employment effect beyond manufacturing. Another linkage occurs between sectors through changes in aggregate demand and the labour adjustment. When manufacturing contracts, workers who have lost their jobs or suffered reduced earnings consequently curb demand for goods and services. Workers who exit manufacturing transition to jobs in the service sector or elsewhere, replacing some of the earnings lost in import competing industries, and hence offset these adverse aggregate demand effects. Thus, aggregate demand and reallocation effects work in opposing directions.

Casacuberta and Gandelman (2010) characterize the factor reallocation and adjustment process in the manufacturing sector in Uruguay to determine how trade reform affects reallocation of production factors and firm productivity. The paper found that creation and destruction rates for employment and capital were relatively high and persistent over time, both for white and blue-collar employment. Capital intensity rose in response to trade liberalization, while the capital labour price ratio fell. This is consistent with a shift towards more capital intensive technologies. Most of the excess reallocation, or reallocation not required to accommodate factor use changes, was due to flows within rather than between sectors. Hence the speed of reallocation appeared to be linked to firm level heterogeneity rather than to aggregate shocks. Specifically, larger, more mature firms have a tendency to create and destroy fewer jobs and less capital relative to smaller, younger firms.

In terms of the effects of trade reform by gender, UNCTAD (2004) suggest that the negative effects of increased trade exposure is experienced disproportionately by women relative to men, which can be attributed to generally lower skill and weaker bargaining power of women. This adverse shock is said to be magnified by existing gender inequality. Hayashi et al. (2004) confirm this theory and indicate that the textiles and clothing sector is an important source of employment for women in developing countries, which

is characteristically their largest employer after agriculture. However, they are largely underrepresented in occupations that require higher skills, such as supervisors or middle management.

Gu et al. (2016) observe the skill biased effects of trade liberalization, using a two-step empirical analysis applied to administrative data for Denmark and Portugal. The first step predicts the skill premium induced by trade shocks, while the second step estimates the effects of the skill premium on the resulting skill distribution. The main results for Denmark is that trade has a negative effect on the low-to-medium skill premium and a positive effect on the medium-to-high skill premium. Thus the overall distribution of skills in Denmark has a tendency to shift rightward and to become more dispersed in response to a trade shock.

In particular, Berman et al. (1998) study the effects of skills based technological change on the manufacturing sector in open economies. The study found that developed countries are transitioning toward high-skill workers, despite rising relative skill prices. This is indicative of a skill-biased demand shift that stems from the adoption of new technology. This skills upgrading is most prominent in three manufacturing sectors: machinery, electrical machinery and printing and publishing in US. Overall, the authors suggest that the fall in the share of manufacturing employment results in part from increased trade exposure, but can be largely attributed to the factor content of skills based technological change that has displaced unskilled workers in manufacturing.

Muendler (2010) extend the empirical methods used in Menezes-Filho and Muendler (2007), to observe the nature of workforce re-allocations. The paper indicates that within the traded-goods sector, there is a distinct occupational downgrading and a simultaneous educational upgrading, whereby firms fill expanding low skill occupations with increasingly educated employees. Between sectors, there is a labour demand shift towards the lowest and highest skilled workers. This is due to relatively weaker declines of traded-goods industries that use low skilled labour intensely and to relat-

ively stronger expansions of non-traded-goods industries that use high-skilled labour intensively. These observed patterns are consistent with predictions of trade theory, Heckscher-Ohlin Theory, for a low-skill abundant economy, such as SA. Importantly, these patterns relate back to skill based rigidities to mobility in that semi-skilled occupations may experience greater barriers to reallocation within a sector relative to unskilled and more highly skilled occupations, which will be investigated further in this study.

Nevertheless, Muendler (2010) suggests that the pattern in work-flows is nuanced as workforce changeovers are not achieved through reassignments of labour to new tasks within firms nor by reallocation of labour across firms and traded-goods industries. Rather, Muendler (2010) suggests industries, experiencing high trade exposure shrink their labour force by dismissing less educated workers more frequently, compared to more educated workers. Most displaced workers then move to non-traded-goods industries or shift out of formal employment. In particular, Brazil's trade liberalization triggers worker displacements especially from previously protected industries, as predicted by trade theory.

2.1 Trade Liberalization Episode in South Africa

SA signed the General Agreement of Tariffs and Trade (GATT) proposal during Uruguay Round in 1994. This marked the onset of trade liberalization in SA, with the expectation of promoting export-led growth and increased foreign direct investment. Edwards (2005) describes the transformation of trade policy, which involved limiting approximately 98 percent of tariff lines at the Harmonized System (HS) eight-digit level and simplifying the tariff range to six categories. Furthermore, the transformation of policy includes rationalizing tariff lines and placing tariffs of quantitative restrictions on agricultural products. Lastly, the proposal involved allowing special provisions for textile, clothing and motor industries, which included extension of the adjustment period and increased upper bound tariff rates. Thereafter, in 1996, the paper suggests

that the New Tariff Rationalization Process (TRP) was formulated, which included the reduction of tariff lines and peaks and the conversion of formula and specific duties into ad-valorem rates.

The onset of the twenty-first century was marked by increased trade liberalization negotiations, whereby SA was involved in various prominent trade liberalization agreements, which we will now consider in some detail. Importantly, SA signed the Southern African Development Community (SADC) Free Trade Protocol, which was implemented in 2000 and achieved 85 percent duty-free trade in 2008, as recorded by DTI (2017). The publication describes the SA-EU Trade, Development and Cooperation Agreement (TDCA) of 2000, which by 2010 accommodated the EU's offer to liberalize 95 percent of its duties on SA sourced goods by 2010 and was reciprocated by SA in 2012 with an offer to liberalize 86 percent of its duties on EU sourced goods. Furthermore, in 2000, the African Growth and Opportunity Act (AGOA) allowed special access to US originated products. In addition, in 2002, the SACU Agreement was renegotiated, which comprised of Botswana, Lesotho, Namibia, South Africa and Swaziland, and was followed by the SACU-Mercosur Preferential Trade Agreement of 2004. Lastly, in 2006, the European Free Trade Association (EFTA)-SACU Free Trade Agreement was established, which came into effect in 2008. Hence, over the period, 2000 to 2011, there was a sudden, unanticipated increase in trade integration of SA with the rest of the world. The manner in which the SA labour force has assimilated these shocks will be analyzed further in the next sections.

Table 1 presents the industry specific changes in tariff rates in SA. Specifically, the results indicate that while tariff protection on mining, in which SA has a comparative has been almost entirely removed, the largest tariff changes in manufacturing has occurred in metal products and machinery, followed by fuel, petroleum and chemical products, and lastly textiles, clothing and footwear, where we can expect the largest reallocation of labour to occur towards other sectors.

Table 1: The change in simple average tariff rates by industry, 1990–2011.

	Simple average tariff rates (percentages)			Percentage point decrease
	1996	**2001**	**2011**	**1996 - 2011**
Agriculture, forestry and fishing	22,8	18,9	15,7	7,1
Mining	9,9	1,1	0,3	9,7
Food; beverages and tobacco products	13,7	1,1	9,9	3,8
Textiles; clothing and footwear	40,8	23,5	18,7	22,1
Wood products	9,1	6,8	4,8	4,2
Fuel; petroleum and chemical products	9,6	4,1	3,7	6,0
Non-metallic products	7,3	4,1	4,0	3,3
Metal products and machinery	7,6	4,0	2,8	4,9
Electrical machinery	12,8	7,1	6,3	6,5
Electronic products	4,6	1,6	3,0	1,6
Transport equipment	12,3	8,0	6,2	6,1
Furniture and recycling	21,6	16,9	15,4	6,3
Mean	14,3	8,1	7,5	6,8

Source: Author's own calculations, using simple average tariff data

3 Methodology

3.1 Theoretical Motivation and Empirical Approach

3.1.1 Theoretical Foundation

This study seeks to determine how trade reform that has induced increases in SA's imports by SA, has affected the distribution or movement of labour across SA local labour markets. In order to achieve this end, I use the empirical approach in the study by

Baldàrrago and Salinas (2017), which was conducted on the Peru local labour market. Under the framework outlined by the study, region d, the local labour market region of interest, is treated as a small open economy within a monopolistic competition model. In particular, we assume that the economy is open to both trade in goods and the inter-regional/ inter-sectoral movement of labour; however, we do not assume perfect mobility of labour. The central premise underlying this framework is that we expect incomplete redistribution of labour in response to trade shocks. The aim is then to determine how tariff liberalization affects migration across regions, controlling for the changes in various economic conditions.

3.1.2 Empirical Method

The analysis hinges on constructing a weighted import tariff at the regional level that represents the industrial structure and level of protection, provided to industries in that region. The aim is then to use regressions at the regional level to derive the relationship between the changes in the estimated regional tariff indicator and the changes in the number of migrant flows across regions d. To achieve this end, we construct a tariff indicator to relate the SA simple average tariffs at the industrial level to the municipal level as follows:

$$T_{dt} = \frac{\sum_k L_{d,k,1996}\, T_{kt}}{TL_{d,1996}} \tag{1}$$

In this expression we consider the manufacturing goods sectors, which comprise industries k. Furthermore, $L_{d,k,1996}$ denotes the number of employees at the local municipal district d, employed in industry k in year 1996, T_{kt} is the simple average tariff linked to industry k, and $TL_{d,1996}$ is the total number of employees at municipality d in year 1996. In general, equation 1 is the mean of the tariffs linked to industry k at each municipality d, weighted by the share of employees in each industry in year 1996, the initial period of observation.

Variation in infrastructure across municipalities is expected to strongly influence the

decision to migrate. Municipalities with better basic service delivery would attract more migrants and hence we need to control for this impact in the regression to remove variation in the empirical model, not attributed to tariff reform. In this study, we use principle component analysis to derive a measure of infrastructure intensity per household that includes access to sanitation, toilet facilities and heating/lighting. This measure controls for changes in the environment that are likely to provide a strong push/pull factor with respect to migration in that we expect migration to flow towards areas of improving infrastructure.

At the same time, to isolate the effects of tariff reform on migration, we need to control for the changes in regional size, that may independently affect the level of migration over time. Consequently, we control for the changes in population size, household income (proxy for GDP), employment level and the number of firm entrants in the empirical model, which are used as measures of the change in regional magnitude and development that if ignored in the empirical model, may spuriously imply a link between trade reform and migration. We also account for the initial manufacturing share of total employment to control for technological changes that are likely to have occurred over the period of study and furthermore, we consider the interaction between initial manufacturing share and the tariff indices in order to observe the significance of this simultaneous effect on migration. The premise is that initial tariffs were high in manufacturing sectors, compared to other sectors and thus the labour reallocation effect may be more responsive to initial manufacturing shares.

3.2 Estimation and Specification

3.2.1 Estimating the Gravity Model

$$\Big(\frac{\sum M_{ij,2001-2011}}{\overline{P}_{i,2001-2011}}\Big) - \Big(\frac{\sum M_{ij,1996-2001}}{\overline{P}_{i,1996-2001}}\Big) = \alpha_t + \beta_1\Big[ln\big(1+T_{i,2011}\big) - ln\big(1+T_{i,1996}\big)\Big]$$
$$+ \beta_2\Big[ln\big(1+T_{j,2011}\big) - ln\big(1+T_{j,1996}\big)\Big] + \gamma\Big[ln\big(\overline{X}'_{i,2001-2011}\big) - ln\big(\overline{X}'_{i,1996-2001}\big)\Big]$$
$$+ \lambda\Big[ln\big(\overline{X}'_{j,2001-2011}\big) - ln\big(\overline{X}'_{j,1996-2001}\big)\Big] + e_{ijt} \tag{2}$$

We begin by examining the relationship between tariff reform and internal migration at the municipal level by means of an OLS model specification (2). In more detail, the paper measures the effect of a change in the regional tariff on bilateral migration flows across regions (ie. from municipality i to j at time t), using a gravity model of migration. importantly, the study focuses on deriving a fairly parsimonious model, while uncovering the mechanisms through which tariff reform may induce internal migration across regions.

In this expression, i and j are the origin and destination municipality of interest and t is the observed year. M_{ijt} denotes the bilateral migration measure used, which represents the aggregate number of migrants, who moved from origin (or previous) municipality i to destination (or residing) municipality j for the periods, 1996 to 2001 and 2001 to 2011. This data are extracted from the 2001 Census and 2011 Census, respectively. Then, the aggregate level of migrants in each of the two periods is taken to construct the change in bilateral migration between 1996 to 2001 and 2001 to 2011; this measure is then normalized by the mean population in each period at the origin municipality and the duration of each period to create the dependent variable of interest, $\Delta\frac{M_{ijt}}{\overline{P_{it}}}$, denoted the annualized migration rate. Furthermore, T_{dt} is the municipal level tariff specified in equation 1 at period t, which we use to construct the change in the tariff measure over the full period, 1996 to 2011.

The estimate of interest, β_1 and β_2 are thus the estimated relations between the

change in the municipal level tariff at the origin and destination municipalities, respectively, and and the change in the bilateral internal migration flows between regions. Additionally, the vectors $\Delta ln\overline{X}'_{it}$ and $\Delta ln\overline{X}'_{jt}$ contain, in most specifications, a set of controls for the municipalities' change in the mean (ie. the difference in mean of 2001-2011 and 1996-2001) infrastructure intensity per household, population size, household income, employment and the number of firm entrants across municipalities. These variables are constructed to account for changes in regional size that might independently affect migration. Specification 2 can be written in simpler terms, as described below in (3).

$$\Delta\frac{M_{ijt}}{\overline{P_{it}}} = \alpha_t + \beta_1\Delta ln\big(1+T_{it}\big) + \beta_2\Delta ln\big(1+T_{jt}\big) + \gamma\Delta ln\overline{X}'_{it} + \lambda\Delta ln\overline{X}'_{jt} + e_{ijt} \qquad (3)$$

Consider specification 3, we expect that for the period, 1996 to 2011, β_1 should be negative, implying that an increase in tariff protection in the origin municipality corresponds with a decrease in migration outflows or labour reallocation. On the other hand, we expect that β_2 should be positive, suggesting that an increase in tariff protection in the destination municipality is associated with an increase in migration inflows towards more protected regions.

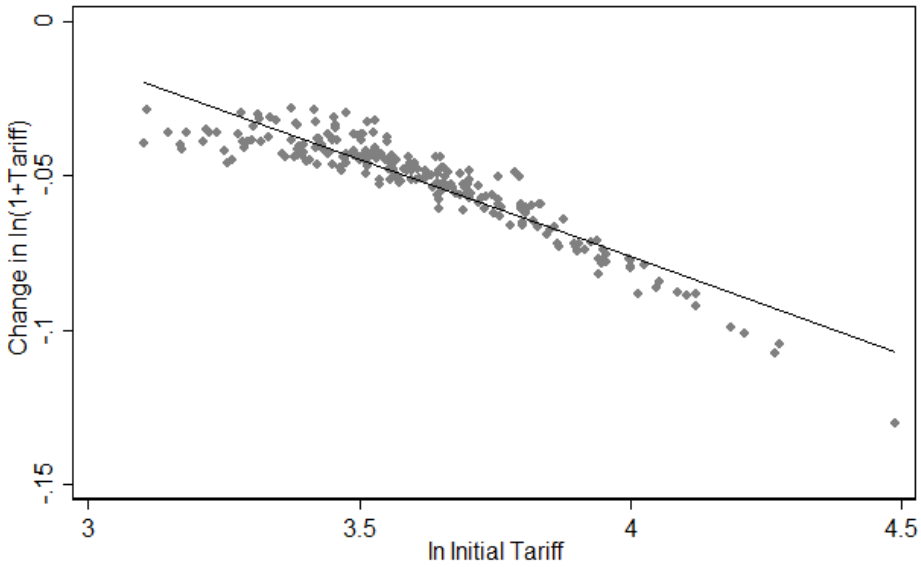
$$\begin{aligned}\Delta\frac{M_{ijt}}{\overline{P_{it}}} &= \alpha_t + \beta_1\Delta ln\big(1+T_{it}\big) + \beta_2\Delta ln\big(1+T_{jt}\big) + \beta_3\Delta ln\big(1+T_{it}\big)xMS_{it} \\ &+ \beta_4\Delta ln\big(1+T_{jt}\big)xMS_{jt} + \gamma\Delta ln\overline{X}'_{it} + \lambda\Delta ln\overline{X}'_{jt} + e_{ijt}\end{aligned} \qquad (4)$$

Furthermore, when we consider the interaction between the initial share of manufacturing in total employment and the tariff measure in the respective origin and destination municipalities, we expect that β_3 will have a negative sign, indicating that the simultaneous effect of an increase in tariff protection and initial manufacturing share of employment is expected to be associated with an decrease in the number of leaving migrants. The reverse coefficient signs are expected in the case of destination related variables, where we expect that β_4 should be positive, indicating that municipalities with increased tariff protection should experience an increase in the frequency of new entrants. Importantly, we consider specification 3 as the main regression of interest.

3.2.2 Methodological Concerns and Instrumental Variable Strategy

Before conducting our analysis, we examine some methodological concerns that may arise from specification 3. A key economic question arises: are there political incentives that may lead to an indirect link between changes in tariff levels and changes in socioeconomic factors that might independently affect migration. There is evidence that turns to (i) the influence of lobbyist and other pressure groups on trade policy decisions, (ii) the incentive of policymakers to provide some support to sluggish industries and lastly (iii) the incentive of government to maximize tariff revenues that may distort the change in the tariff levels across manufacturing sectors (Findlay and Wellisz 1982). In particular, the endogeneity in the tariff level may attenuate the effect of a change in tariff level on bilateral migration flows. Furthermore, with respect to the phasing down of tariffs, negotiated under WTO, part of the process was simplifying the tariff structure, reducing tariff dispersion and removing tariff peaks, which is reflected in a negative relationship between the change in tariffs and the initial tariff levels.

In this paper, we address this endogeneity problem outlined previously, by constructing an instrumentation strategy, which considers initial regional tariff levels, as performed by Cheng (2015), Topalova (2010) and Baldàrrago and Salinas (2017). This strategy arises from the premise that tariff changes are linearly related to initial tariffs: the higher the initial tariff, the larger the tariff cut. Since initial tariff rates are only correlated with labour mobility through the relationship between initial tariff levels and the change in tariffs, as described, this may be considered an appropriate instrument. Figure 1 presents the inverse relationship between the change in tariffs from 1996 to 2011 and the regional initial tariff levels in 1996.



Notes: The tariff measure used only includes tradeable (manufacturing) sectors. The change in the tariff is constructed over the full period, 1996-2011 and the regional intial tariff is derived at 1996

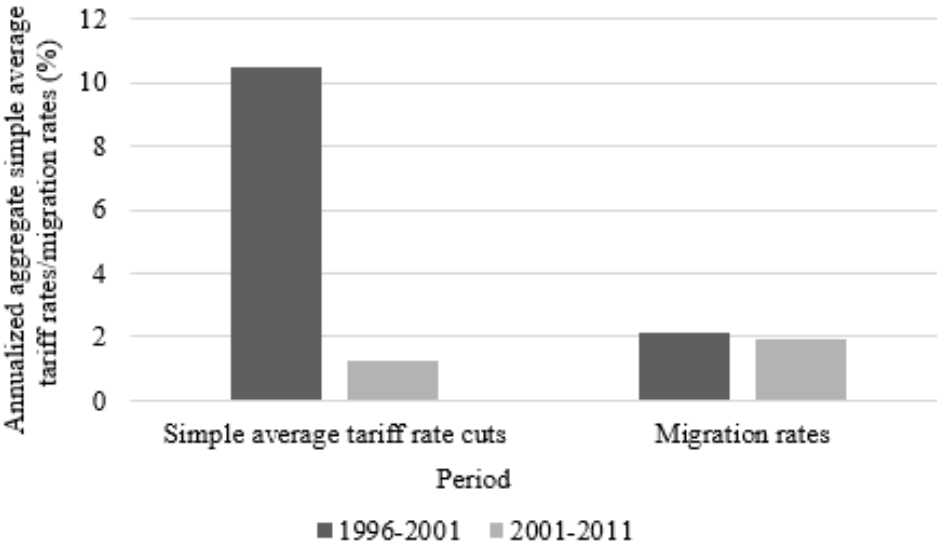
Source: Author's own calculations, using SA Census and simple average tariff data.

Figure 1: The relationship between the change in the tariff measure and the regional initial tariff measure, 1996–2011

3.3 Data and Stylized Facts

We use data from the ten percent SA Census for the years, 1996, 2001 and 2011 at the (one-digit) SIC level for 234 local municipalities to obtain migration, employment and regional data. A challenge that arose in this study lay in accounting for changes in municipal demarcations between 2001 and 2011. To address this problem, the study made use of ArcGIS to aggregate data at a main place level in 1996 and district level in 2001 to the 2011 municipality level using the union tool. In more detail, to obtain the bilateral migration measure at the municipal level, a union ratio was applied to achieve consistency in the number of municipalities from 262 in 2001 to 234 in 2011 and to convert the 1996 main place codes to the 2011 municipal classification of 234 municipalities. Furthermore, we use annual data on simple average tariff rates linked to economic activities at the (two-digit) SIC level for the years 1996 to 2011. We construct

the municipal level tariffs in equation 1, based on weighted average tariffs that take into account preferential tariffs that SA applies to imports from several countries. We then link tariffs to economic activities in each municipality by matching tariff codes with industrial codes in the merged census data set.



Notes: Both the decrease in the simple average tariff rates and the percentage of total migrants/total working age population have been normalized by the number of years in each period to create an annualized measure. In addition, the mean working age population in each period is used to normalize the total number of migrants in each period to avoid an upward bias in this measure.

Source: Author's own calculations, using SA Census and simple average tariff data.

Figure 2: The aggregate number of migrants (left scale) and the aggregate simple average tariff rates (right)

Figure 2 presents the total number of migrants, normalized by the mean origin population, according to year moved, and the aggregate simple average tariff rates across industries and time. Post-apartheid, from 1996 to 2001, the number of migrants rose, while the simple average tariff rates fell. However, when we consider the annualized rates, we notice that there has been a slight decrease in the rate of migration in the second period relative to the initial period, while simple average tariff rates fell by a large margin in the first period and a much smaller margin in the second period, as dis-

played in Figure 2. This is because the initial tariff reform was fairly aggressive from 1996 to 2001, whilst the subsequent period was marked by gradual reduction in tariffs and ultimately tariff stabilization. Critically, there is a structural break at 2001, where the stabilization of the simple average tariff rates coincided with a decrease in the rate of migration.

Table 2 presents the composition of migrants and the migrant rates according to demographic characteristics. In terms of the pattern of migration by gender, although from 1996 to 2001, there was relative gender equality of migration, the period post 2001 was marked by a slightly larger increase in the number of male migrants relative to their female counterparts. Furthermore, the migration rate for males and females was 1.9 and 1.7, respectively in the first period, followed by a uniform reduction in the second period across gender groups. The skills distribution of migrants reveals that there is a trend towards greater mobility of skilled individuals as skilled migration rates were the highest with 3.7 and 2.3 in the two periods of study, while unskilled and semi-skilled individuals were less mobile. Migration rates fell particularly sharply for these groups in the period post 2001, which is consistent with the international literature. The underlying premise is that the less skilled individuals are the least mobile and with increased skills upgrading in the workplace, these individuals may be less likely to relocate between industries and regions. This is also evident from the rise in the proportion of skilled migrants from 13.9 to 20 percent and a fall in the share of unskilled migrants from 17.7 to 10.3 percent in the two periods. In terms of the share of migrant workers, there has been a distinct rise in the number of employed migrants from 49 to 60 percent between the two periods of study, which reflects current work status.

Critically, young adults (between 15 and 35 years of age) contribute the greatest share of migrants with 66.9 and 64.2 percent between the periods, 1996 to 2001 and 2001 to 2011, respectively. Overall, young adults have higher migration rates, namely 2.2 and 0.9, respectively, across the two periods, while middle-aged adults, between 36

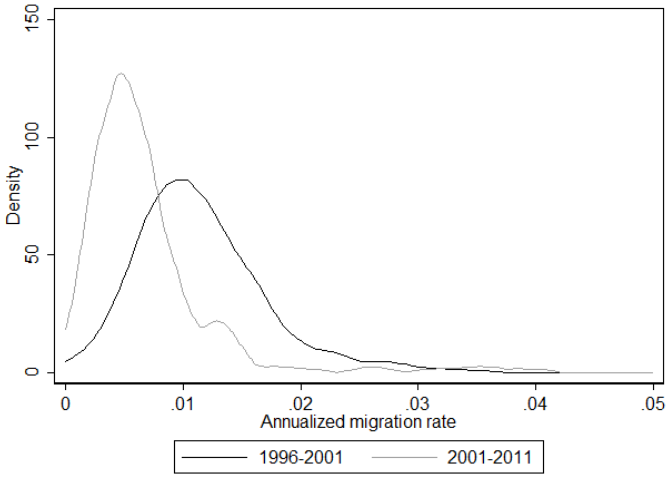
Table 2: The migrant share as a composition of total migrants and the migrant share of total group population, according to demographic and economic status

Migrants by population group	Migrant share as a composition of total migrants (%)		Annualized migrant share (within groups) of total (mean over period) working age population (%)	
	1996-2001	2001-2011	1996-2001	2001-2011
Aggregate			**1,8**	**0,8**
Gender				
female	50,3	48,6	1,7	0,7
male	49,7	51,4	1,9	0,9
Skill level				
skilled migrants	13,9	20,0	3,7	2,3
semi-skilled migrants	60,8	65,9	3,4	0,9
unskilled migrants	17,7	10,3	0,8	0,4
(unspecified)	7,6	3,8	-	-
Race group				
African migrants	68,5	70,2	1,7	0,6
Coloured migrants	8,5	6,7	2,9	1,0
Indian migrants	2,7	3,5	2,3	2,1
White migrants	20,2	17,9	3,6	2,2
(unspecified)	-	1,7	-	-
Age cohort				
young adult migrants	66,9	64,2	2,2	0,9
adult migrants	28,0	30,1	1,5	0,7
mature adult migrants	5,1	5,7	0,7	0,4

Notes: All migrant shares are calculated as a composition of total migrants (ie. Aggregate to 1 hundred approximately, allowing for unspecified observations.) Migrant rates are calculated as the ratio of migration by group, normalized by the group's total working age population and annualized by the duration of each period of study. Source: Author's own calculations, using SA Census data.

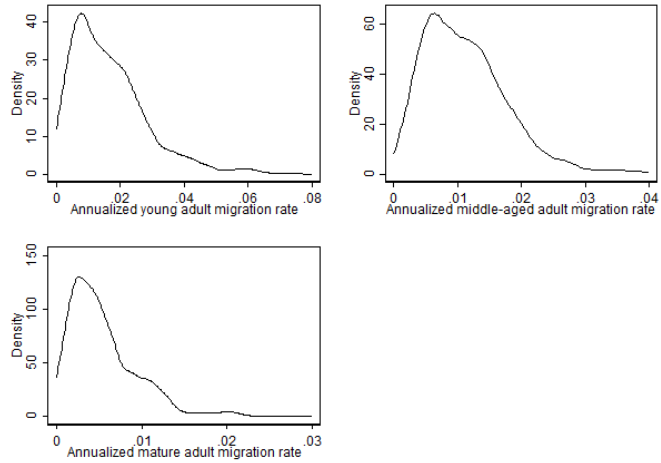
and 55 have lower relative migration rates at 1.5 and 0.7, respectively. In terms of the pattern in migration by race group, Africans constitute the largest share of migrants with approximately 68.5 and 70.2 percent over the two respective periods of study, followed by White migrants with approximately 20.2 and 17.9 percent. Notably, when we consider the migration rates, we notice that migration rates are higher for White migrants at 3.6 and 2.2, across the two periods, which is supported by the literature. The underlying premise is that White South Africans, previously advantaged, may have better access to knowledge and resources required in relocation, compared to other racial groups. There are also cultural and social considerations that play a role in the lower mobility of Africans and other racial cohorts.

For consistency, we consider Bells and Charles-Edwards (2013), which outlines the internal migration rates for 33 countries across several continents. The paper considers the aggregate net migration rates (ANMR), computed as the net annual migration flows at the regional level, divided by the total regional population. Importantly, the study finds that in 2000, the migration rate was estimate to be 1.4 percent for SA, which was higher than other Africa countries, namely Senegal, Ghana and Mauritius with approximately 0.6, 0.6 and 0.5 percent, respectively. More broadly, relative to SA, the internal migration rate was reported to be higher for China at 1.7 percent, lower for Brazil at 0.5 percent, but in line with Malaysia and Greece at 1.4 percent. This implies that our estimate of 1.8 percent seems slightly higher than the estimated migration rate of 1.4, reported in the study by Bells and Charles-Edwards (2013). This may be attributed to the full period, 1996 to 2001, which was utilized in constructing the annualized measure in this study.



Source: Author's own calculations, using SA Census data

Figure 3: Kernel density plot of the annualized out-migration flow rates across origin municipalities, 1996–2011

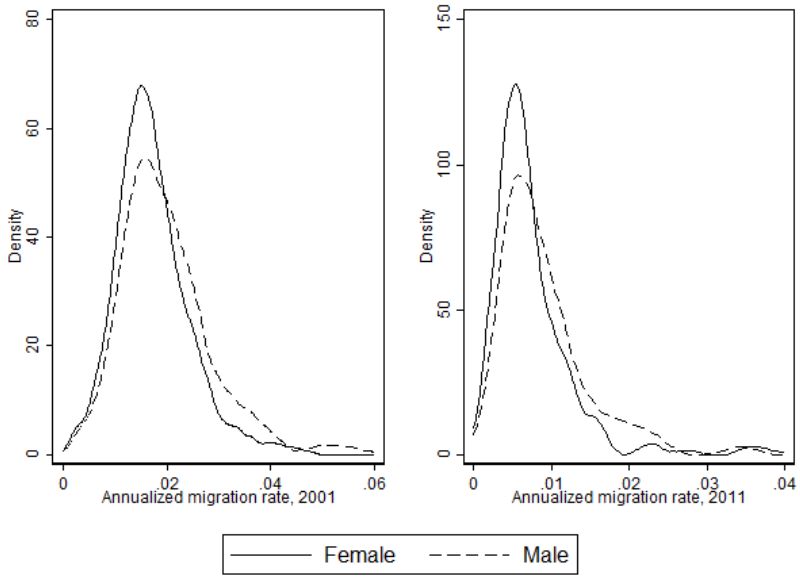


Source: Author's own calculations, using SA Census data

Figure 4: Kernel density plot of the annualized out-migration flow rates across origin municipalities according to age cohort, 1996–2011

Figure 3 shows kernel densities for the annualized migration rates across both periods of study, which is constructed to display the dispersion across regions and the changes over time. From 1996 to 2001, the internal migration rates have higher dispersion and a higher mean, while in the latter period, the migration rate density shows a

distinct leftward shift, indicative of lower mobility in the second period, 2001 to 2011. Furthermore, when we consider the life-cycle characteristic of migrants in Figure 4, a prominent feature arises whereby young adult migrants have higher mean migration rates, followed by middle-aged adults and lastly mature adults as theory predicts that young adults are the most likely to migrate due to their adaptability to new environments and their willingness to align themselves with positions that arise in the labour market, thus it is expected that for young adults there is a high correlation between migration rates and labour market opportunities (Ferreira Filho and Horridge 2010).

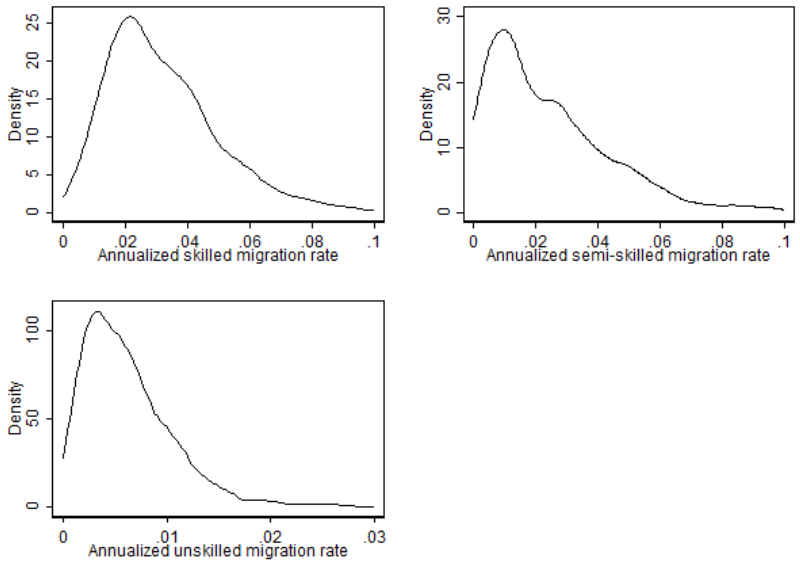


Source: Author's own calculations, using SA Census data

Figure 5: Kernel density plot of the annualized out-migration flow rates across origin municipalities according to gender, 1996–2011

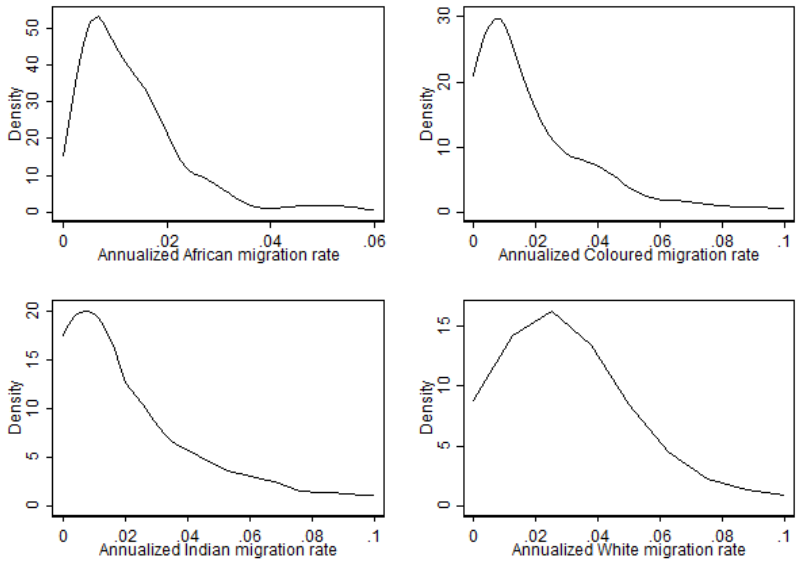
Figure 5 presents the kernel densities by gender and importantly, there is very little observed difference in the probability distributions of the migration rates by gender; although males are slightly more mobile by a small margin relative to their female counterparts. Consistent with the theory of skills biased migration frictions, Figure 6 indicates that skilled migrants are the most mobile, although there exists high disper-

sion, followed by semi-skilled and lastly unskilled migrants, who may be considered the least mobile. A possibility is that with higher education attainment, individuals may be more aware of labour market opportunities in other regions. Figure 7 presents the kernel densities by race group. Importantly, we notice that white migrants have the highest mean migration rates, followed by Indian, Coloured and lastly, African migrants.



Source: Author's own calculations, using SA Census data

Figure 6: Kernel density plot of the annualized out-migration flow rates across origin municipalities according to skill level, 1996–2011



Source: Author's own calculations, using SA Census data

Figure 7: Kernel density plot of the annualized out-migration flow rates across origin municipalities according to race group, 1996–2011

4 Results

In this section, we quantify the effects of trade reform on SA internal migration with a focus on the indirect manufacturing employment effects thereof. We present our results as follows: First, the paper discusses the effects of trade reform on the change in the internal migration rate by using an OLS regression, using specification (3). Then we conduct a 2SLS regression where we instrument the change in the tariff measure with the initial regional tariff level in 1996. A prominent feature is that there is a slight positive relationship between the destination tariff and the destination migration rate, while there is very little relationship thereof observed for the origin municipality.

Table 3: Tariff reform and the change in bilateral migration flows from $origin_i$ to $destination_j$ municipalities, 1996–2011: OLS Estimates

I. OLS Estimates, Dependent Variable: Annualized $\Delta\frac{M_{ijt}}{\overline{P}_{it}/1000}$							
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
$\Delta ln(1+Tariff_{it})$	-0.337*	-0.120	-0.0892	-0.0755	-0.101	0.330	-0.0495
	(0.196)	(0.214)	(0.216)	(0.224)	(0.216)	(0.304)	(0.577)
$\Delta ln(1+Tariff_{jt})$	1.358***	1.539***	1.494***	1.520***	1.548***	1.167***	-0.177
	(0.288)	(0.286)	(0.288)	(0.282)	(0.289)	(0.267)	(0.548)
$\Delta ln(Infrastructure_{it})$		0.101***	-0.0906**	-0.0903**	-0.0810**	-0.0737**	-0.0733*
		(0.0208)	(0.0387)	(0.0388)	(0.0377)	(0.0375)	(0.0375)
$\Delta ln(Infrastructure_{jt})$		0.0635***	0.122***	0.120***	0.110***	0.107***	0.108***
		(0.0114)	(0.0252)	(0.0242)	(0.0243)	(0.0241)	(0.0243)
$\Delta ln(Income_{it})$			-0.203***	-0.191***	-0.198***	-0.181***	-0.178***
			(0.0554)	(0.0479)	(0.0501)	(0.0483)	(0.0495)
$\Delta ln(Income_{jt})$			0.0560***	0.0881**	0.0937***	0.0731**	0.0829**
			(0.0195)	(0.0363)	(0.0354)	(0.0359)	(0.0377)
$\Delta ln(Employed_{it})$				-0.0163	-0.00719	-0.0192	-0.0230
				(0.0267)	(0.0260)	(0.0271)	(0.0274)
$\Delta ln(Employed_{jt})$				-0.0457	-0.0551	-0.0346	-0.0455
				(0.0366)	(0.0345)	(0.0368)	(0.0390)
$\Delta ln(Entry_{it})$					-0.0183*	-0.00996	-0.00866
					(0.00979)	(0.00994)	(0.0104)
$\Delta ln(Entry_{jt})$					0.0264**	0.0170	0.0209*
					(0.0127)	(0.0118)	(0.0114)
$\Delta ln(1+Tariff_{it})xMS_{i,1996}$							5.252
							(5.957)
$MS_{i,1996}$						0.418***	0.736*
						(0.138)	(0.406)
$\Delta ln(1+Tariff_{it})xMS_{j,1996}$							18.08***
							(6.803)
$MS_{j,1996}$						-0.402***	0.639
						(0.116)	(0.434)
Constant	-0.00441	-0.0921***	0.109	0.0940	0.0965	0.0981	-0.00223
	(0.0172)	(0.0234)	(0.0713)	(0.0648)	(0.0634)	(0.0607)	(0.0656)
Observations	15,027	15,027	15,027	15,027	15,027	15,027	15,027
R-squared	0.002	0.007	0.014	0.014	0.015	0.017	0.017

Notes: Robust standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table 3 presents the results from estimation of equation (3). First, the migration rate is highly significant and positively related to the change in the tariff measure for the destination municipality for most specifications; however, while we observe a negative sign on the tariff measure estimate for the origin municipality, this is not significant at the 5 percent level as expected. According to the estimate in model (1), a 10 percent increase in the differential tariff in the destination municipality implies a 13.6 percentage point increase in the migration rate or 13.6 more migrants per 1000 individuals in the originating region, which is significant at the 1 percent level. On the other hand, a 10 percent increase in the differential tariff in the origin municipality is associated with a 3.4 percentage point decrease in the migration rate, which is only significant at the 10 percent level.

In model (2), infrastructure intensity is included. The coefficient on the destination tariff remains significant and increases slightly, but the coefficient on the origin tariff loses significance. Tariffs also affect income in the region through changes in employment and wages. To control for these potential effects, we include household income in (3). Firstly, income is shown to reduce out-migration and increase in-migration. The coefficient on the destination tariff, however remain unaffected. In column (4) and (5), additional controls for changes in economic activity are included, namely change in employment in (4) and change in firm entry in (5). The tariff coefficient on destination remains significant with a slight increase in size. A rise in firm entry is shown to reduce out-migration and encourage in-migration.

Importantly we control for the initial manufacturing share of employment in model (6), and uncover that a higher share of manufacturing within a municipality in 1996 implies an increase in the migration rate for the origin municipality, while the reverse is true for the destination municipality. Model (7) includes the interaction between the tariff measures and the initial manufacturing share of employment for the respective origin/ destination municipalities. importantly, we observe that the simultaneous effect of a 10

percent increase in the differential tariff and the initial manufacturing share of employment is associated with an 18.7 more migrants per 1000 individuals in the originating region. Crucially, migrants were more likely to exit regions with a high manufacturing share of employment and were less likely to enter regions with a high manufacturing share of employment. As we would expect, the coefficient on tariff (destination) falls as the change in manufacturing tariff would have had a disproportionate effect on regions where municipalities accounted for a high share of employment.

The estimates show a systematic pattern, broadly consistent with our theoretical predictions. Nevertheless, the analysis also uncovers empirical puzzles. Overall, push effects are estimated to be insignificantly different from zero in Table 3. One possibility is that push factors are nullified due to the effect of poverty, skill and life-cycle considerations in the origin municipality, but that higher tariffs in certain regions have a significant pull effect, inducing an inflow of migrants as economically active individuals relocate in search of higher income jobs, better infrastructure and towards expanding industries with relatively higher tariff measures.

We now turn to the 2SLS regressions to control for potential endogeneity of the tariff indices. Table 4 presents the 2SLS results, whereby the initial tariff is used as an instrument for the change in tariff level, considered previously. The results are more consistent with expectations and the systematic breakdown of the empirical models suggest that while there is a significant negative effect of origin differential tariffs on the migration rate, the reverse is also highly significant and positive, as shown in model (1), highlighting the existence of push and pull effects, underlying the theory of trade induced migration and labour market restructuring. In particular, a 10 percent increase in the differential origin tariff is associated with a 2.7 percentage point decrease in the migration rate, while a 10 percent increase in the differential destination tariff implies a 5.6 percentage point increase in the migration rate, which is more than triple the magnitude of the opposing effect observed in the origin municipality. Nevertheless, the other model

Table 4: Initial tariff levels and the change in bilateral migration flows from $origin_i$ to $destination_j$ municipalities, 1996–2011: 2SLS Estimates

I. OLS Estimates, Dependent Variable: Annualized $\Delta\frac{M_{ijt}}{\overline{P}_{it}/1000}$							
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
$\Delta ln(1+Tariff_{it})$	-0.267***	-0.230	-0.225	-0.213	-0.240	0.173	-1.228
	(0.0726)	(0.200)	(0.198)	(0.204)	(0.199)	(0.288)	(0.911)
$\Delta ln(1+Tariff_{jt})$	0.558***	1.767***	1.723***	1.747***	1.774***	1.456***	4.500***
	(0.106)	(0.276)	(0.277)	(0.276)	(0.279)	(0.277)	(0.872)
$\Delta ln(Infrastructure_{it})$		0.100***	-0.0902**	-0.0897**	-0.0803**	-0.0731*	-0.0733*
		(0.0207)	(0.0389)	(0.0389)	(0.0378)	(0.0377)	(0.0378)
$\Delta ln(Infrastructure_{jt})$		0.0669***	0.128***	0.125***	0.116***	0.112***	0.115***
		(0.0116)	(0.0254)	(0.0243)	(0.0245)	(0.0243)	(0.0247)
$\Delta ln(Income_{it})$			-0.202***	-0.192***	-0.198***	-0.183***	-0.181***
			(0.0553)	(0.0481)	(0.0504)	(0.0491)	(0.0488)
$\Delta ln(Income_{jt})$			0.0581***	0.0910**	0.0967***	0.0781**	0.0729**
			(0.0195)	(0.0365)	(0.0357)	(0.0369)	(0.0363)
$\Delta ln(Employed_{it})$				-0.0142	-0.00495	-0.0165	-0.0179
				(0.0265)	(0.0258)	(0.0268)	(0.0270)
$\Delta ln(Employed_{jt})$				-0.0468	-0.0563	-0.0382	-0.0308
				(0.0371)	(0.0349)	(0.0379)	(0.0371)
$\Delta ln(Entry_{it})$					-0.0187*	-0.0109	-0.00993
					(0.00985)	(0.0101)	(0.0101)
$\Delta ln(Entry_{jt})$					0.0266**	0.0182	0.0165
					(0.0127)	(0.0115)	(0.0117)
$\Delta ln(1+Tariff_{it})xMS_{i,1996}$							-11.74*
							(6.953)
$MS_{i,1996}$						0.391***	0.429***
						(0.138)	(0.140)
$\Delta ln(1+Tariff_{it})xMS_{j,1996}$							26.55***
							(6.572)
$MS_{j,1996}$						-0.358***	-0.446***
						(0.123)	(0.120)
Constant	-0.0159**	-0.0888***	0.107	0.0918	0.0942	0.0966	0.141**
	(0.00741)	(0.0235)	(0.0710)	(0.0643)	(0.0629)	(0.0598)	(0.0638)
Observations	41,101	15,027	15,027	15,027	15,027	15,027	15,027
R-squared	0.001	0.008	0.015	0.015	0.016	0.017	0.018

Notes: Robust standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1

specifications display the same pattern as shown previously, whereby the effect of the origin differential tariff is nullified with the inclusion of appropriate controls. However, the 2SLS estimates indicate a larger positive effect of the differential destination tariff on the bilateral migration rate, compared to the OLS results, considered previously. Hence, a key feature is that the endogeneity of tariffs attenuate the effect of trade reform on migration flows.

Model (2) includes infrastructure intensity and indicates that an increase in the differential destination tariff corresponds with a relatively larger increase in the migration rate, compared to the corresponding OLS estimates. Furthermore, with the inclusion of income, employment and firm entry in columns (3) to (5), the signs on the destination tariff estimates adjust in line with expectations and are larger in size than the corresponding OLS results. In addition, when we consider the initial manufacturing share of employment in model (6), it is evident that an increase in the differential destination tariff corresponds with a rise in the migration rate. Furthermore, model (7) presents more consistent estimates than the corresponding OLS model thereof, as we observe that a 10 percent increase in the differential destination tariff is associated with an increase of 4.5 migrants per 1000 individuals of the origin municipality's population; furthermore, we observe a negative sign on the estimate for the change in the origin tariff measure, although this estimate is not significant. The simultaneous effect of a 10 percent increase in the destination tariff and the initial destination manufacturing share implies 26.6 more migrants per 1000 individuals in the origin. Conversely, a 10 percent rise in the origin tariff and the initial origin manufacturing share corresponds with an 11.3 percentage point decrease in the migration rate. A possibility is that, in practice, migrants may be more likely to leave regions of high initial manufacturing share of employment and relocate towards regions of lower initial manufacturing shares, perhaps services.

The asymmetry in the magnitude and significance of push and pull factors may be attributed to i.) the age or life-cycle stage of migrants, which may determine whether

tariff changes in the origin municipality are sufficient to induce out-migrations, taking into account asset accumulation and the number of dependents and ii.) the skill level of migrants, which may determine the level of awareness of economically active individuals to opportunities in other regions and secondly, the ease with which these individuals may transfer their skills across regions.

We now consider these age group and skill biased rigidities, as shown in Tables 5 to 8 in the Appendix. Crucially, when we disaggregate migrants by age and skill level, we observe that the origin tariff is negative and highly significant in most specifications. In terms of age group, we observe a stronger positive/negative influence of increased trade protection on the destination/origin tariffs for young adults relative to middle-aged and mature adults. When we consider skill level, there seems to be a stronger positive/negative effect increased trade protection on the destination/origin tariffs for skilled individuals. This is in line with the theory that young, skilled individuals are the most mobile, while older less qualified individuals may experience more barriers to mobility, which has consequences for welfare. Given the abundance of unskilled labour in SA, we can expect that there may be substantial frictions to migration across sectors and regions, which may exacerbate the negative effect of trade reform on overall welfare. Furthermore, these negative effects may fall disproportionately on unskilled, more mature individuals in the labour markets.

A limitation of the data used lies in the development of the census questionnaire, whereby participants are asked when they last moved; it is possible that individuals that moved within the census period of study are very mobile, hence these estimates may conservatively estimate the impact of trade reform on migration. In addition to this recency bias outlined, there may be a recollection bias as individuals may be less likely to accurately state when they relocated as time passes and thus we can expect that within each period of data collection, migration may ”spike” at the end of each period, which may bias estimates.

We compare these results to the empirical evidence found for other countries in Bells and Charles-Edwards (2013) as described in Section 3.3. The authors considered aggregate net migration rates (ANMR), as described in section 3.3. Within the African context, we notice that our estimates of the pull effects on migration are slightly larger than estimates found for Senegal with an ANMR of 1.4. However, our estimates are slightly smaller in magnitude to that Ghana with an ANMR of 1.9. Within BRICS, our estimates were larger than that of Brazil with and ANMR of 0.5, but less than China with an ANMR of 1.7. Although, a challenge in comparing estimates for migration rates to other countries is that there is a gap in the literature that considers trade liberalization and internal migration flows within the same framework.

5 Conclusion

In this paper, I empirically test the hypothesis of the existence of trade-induced migration within SA. The importance of this study lies in the observation that in a realistic model without perfect labour mobility and in the presence of trade openness (and increased import competition), labour reallocation may occur unevenly across sectors and regions. The results suggest that higher relative tariffs faced by district producers are associated with a rise in bilateral migration rates towards more protected industries and importantly away from industries with high initial manufacturing share of employment. Furthermore income and infrastructure play a significant role as push and pull factors in the migration decision, while employment reflects nuanced results. Importantly, there is asymmetry in the magnitude and significance of push and pull factors induced by tariff reform, as in most specifications, the effect of origin tariff changes were negative but insignificant, while the change in the destination tariff was found to have a highly significant positive effect on the annualized migration rate.

Appendix

Table 5: Tariff reform and the change in bilateral migration flows from $origin_i$ to $destination_j$ municipalities, according to age group, 1996–2011: OLS Estimates

I. OLS Estimates, Dependent Variable: Annualized $\Delta\frac{M_{ijt}}{\overline{P}_{it}/1000}$									
	Young Adults			Middle-aged Adults			Mature Adults		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
$\Delta ln(1+Tariff_{it})$	-1.666***	-1.600***	-1.996**	-0.885***	-0.790***	-1.212**	-0.516***	-0.481***	-0.760**
	(0.353)	(0.366)	(0.945)	(0.224)	(0.235)	(0.594)	(0.154)	(0.158)	(0.371)
$\Delta ln(1+Tariff_{jt})$	3.640***	4.343***	0.255	2.038***	2.338***	0.0294	0.809***	0.913***	0.205
	(0.499)	(0.511)	(0.688)	(0.301)	(0.308)	(0.507)	(0.218)	(0.227)	(0.435)
$\Delta ln(Infrastructure_{it})$		-0.0974**	-0.0723*		-0.0384	-0.0281		-0.00112	0.00109
		(0.0398)	(0.0394)		(0.0253)	(0.0252)		(0.0205)	(0.0204)
$\Delta ln(Infrastructure_{jt})$		0.429***	0.418***		0.184***	0.180***		0.0510***	0.0494***
		(0.0327)	(0.0321)		(0.0216)	(0.0214)		(0.0152)	(0.0150)
$\Delta ln(Income_{it})$		-0.167***	-0.103*		-0.0878**	-0.0589		-0.0510**	-0.0473**
		(0.0574)	(0.0580)		(0.0365)	(0.0366)		(0.0241)	(0.0233)
$\Delta ln(Income_{jt})$		0.418***	0.352***		0.131***	0.113***		0.0429**	0.0319*
		(0.0447)	(0.0452)		(0.0290)	(0.0291)		(0.0177)	(0.0168)
$\Delta ln(Employed_{it})$		0.0353	-0.0155		0.0190	-0.00504		0.0290	0.0265
		(0.0452)	(0.0469)		(0.0302)	(0.0306)		(0.0228)	(0.0232)
$\Delta ln(Employed_{jt})$		-0.235***	-0.170***		-0.0523*	-0.0361		-0.0255	-0.0144
		(0.0416)	(0.0442)		(0.0271)	(0.0283)		(0.0157)	(0.0150)
$\Delta ln(Entry_{it})$		-0.0501***	-0.0189		-0.00699	0.00695		-0.00540	-0.00389
		(0.0155)	(0.0159)		(0.0101)	(0.0105)		(0.00773)	(0.00794)
$\Delta ln(Entry_{jt})$		0.0982***	0.0679***		0.0395***	0.0309***		0.0142**	0.00961
		(0.0187)	(0.0182)		(0.0114)	(0.0112)		(0.00653)	(0.00693)
$\Delta ln(1+Tariff_{it})xMS_{i,1996}$			23.07**			13.38**			3.928
			(9.602)			(5.780)			(3.741)
$MS_{i,1996}$			2.639***			1.340***			0.252
			(0.615)			(0.368)			(0.252)
$\Delta ln(1+Tariff_{it})xMS_{j,1996}$			33.74***			23.41***			5.928
			(9.654)			(6.088)			(4.443)
$MS_{j,1996}$			0.292			0.752**			0.0689
			(0.545)			(0.343)			(0.250)
Constant	-0.0667**	-0.383***	-0.609***	-0.0316*	-0.129**	-0.282***	-0.0212	-0.0404	-0.0753*
	(0.0278)	(0.0782)	(0.0938)	(0.0189)	(0.0532)	(0.0616)	(0.0141)	(0.0382)	(0.0388)
Observations	14,954	14,954	14,954	14,940	14,940	14,940	14,931	14,931	14,931
R-squared	0.006	0.026	0.036	0.005	0.014	0.018	0.002	0.004	0.005

Notes: Robust standard errors are in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 6: Initial tariff levels and the change in bilateral migration flows from $origin_i$ to $destination_j$ municipalities, according to age group, 1996–2011: 2SLS Estimates

I. OLS Estimates, Dependent Variable: Annualized $\Delta\frac{M_{ijt}}{P_{it}/1000}$									
	Young Adults			Middle-aged Adults			Mature Adults		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
$\Delta ln(1+Tariff_{it})$	-0.336***	-1.520***	-1.726	-0.208***	-0.741***	-1.031	-0.260***	-0.484***	-0.662
	(0.0995)	(0.333)	(1.480)	(0.0664)	(0.216)	(1.128)	(0.0587)	(0.168)	(0.958)
$\Delta ln(1+Tariff_{jt})$	1.125***	4.816***	11.32***	0.637***	2.586***	5.710***	0.291***	0.944***	1.319*
	(0.151)	(0.523)	(1.292)	(0.0900)	(0.306)	(0.846)	(0.0709)	(0.230)	(0.740)
$\Delta ln(Infrastructure_{it})$		-0.0959**	-0.0698*		-0.0375	-0.0270		-0.00133	0.000608
		(0.0398)	(0.0395)		(0.0254)	(0.0253)		(0.0206)	(0.0208)
$\Delta ln(Infrastructure_{jt})$		0.443***	0.437***		0.191***	0.190***		0.0534***	0.0515***
		(0.0333)	(0.0332)		(0.0218)	(0.0218)		(0.0154)	(0.0155)
$\Delta ln(Income_{it})$		-0.166***	-0.112*		-0.0875**	-0.0642*		-0.0513**	-0.0496**
		(0.0575)	(0.0574)		(0.0366)	(0.0365)		(0.0243)	(0.0238)
$\Delta ln(Income_{jt})$		0.426***	0.332***		0.135***	0.101***		0.0440**	0.0289*
		(0.0451)	(0.0436)		(0.0291)	(0.0284)		(0.0178)	(0.0167)
$\Delta ln(Employed_{it})$		0.0362	-0.00209		0.0196	0.00273		0.0294	0.0291
		(0.0450)	(0.0462)		(0.0301)	(0.0307)		(0.0227)	(0.0230)
$\Delta ln(Employed_{jt})$		-0.237***	-0.138***		-0.0535**	-0.0173		-0.0255	-0.00982
		(0.0419)	(0.0422)		(0.0272)	(0.0276)		(0.0158)	(0.0149)
$\Delta ln(Entry_{it})$		-0.0495***	-0.0218		-0.00667	0.00524		-0.00534	-0.00450
		(0.0155)	(0.0158)		(0.0101)	(0.0105)		(0.00773)	(0.00794)
$\Delta ln(Entry_{jt})$		0.0988***	0.0590***		0.0398***	0.0252**		0.0142**	0.00818
		(0.0186)	(0.0179)		(0.0114)	(0.0111)		(0.00651)	(0.00673)
$\Delta ln(1+Tariff_{it})xMS_{i,1996}$			-13.01			-7.346			-1.582
			(11.96)			(9.259)			(7.261)
$MS_{i,1996}$			1.331***			0.580***			0.0227
			(0.179)			(0.120)			(0.0760)
$\Delta ln(1+Tariff_{it})xMS_{j,1996}$			68.82***			31.49***			5.425
			(9.871)			(6.744)			(5.887)
$MS_{j,1996}$			-1.775***			-0.649***			-0.283***
			(0.184)			(0.117)			(0.0806)
Constant	-0.0185**	-0.372***	-0.178**	-0.0136**	-0.123**	-0.0440	-0.0150***	-0.0414	-0.0210
	(0.00901)	(0.0772)	(0.0873)	(0.00604)	(0.0522)	(0.0615)	(0.00494)	(0.0365)	(0.0399)
Observations	54,216	14,954	14,954	54,202	14,940	14,940	54,193	14,931	14,931
R-squared	0.002	0.028	0.038	0.001	0.015	0.019	0.001	0.005	0.005

Notes: Robust standard errors are in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 7: Tariff reform and the change in bilateral migration flows from $origin_i$ to $destination_j$ municipalities, according to skill level, 1996–2011: OLS Estimates

I. OLS Estimates, Dependent Variable: Annualized $\Delta\frac{M_{ijt}}{P_{it}/1000}$									
		Skilled			Semi-skilled			Unskilled	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
$\Delta ln(1+Tariff_{it})$	-3.698***	-3.978***	-6.158***	-3.166***	-3.436***	-4.407***	-0.755***	-0.737***	-0.900
	(0.704)	(0.739)	(1.737)	(0.627)	(0.632)	(1.542)	(0.169)	(0.187)	(0.550)
$\Delta ln(1+Tariff_{jt})$	8.105***	9.565***	2.385*	7.672***	9.278***	1.351	0.860***	1.029***	-0.291
	(0.966)	(0.987)	(1.421)	(0.922)	(0.942)	(1.103)	(0.229)	(0.230)	(0.470)
$\Delta ln(Infrastructure_{it})$		-0.232***	-0.193***		-0.169***	-0.117**		-0.0578*	-0.0499*
		(0.0585)	(0.0583)		(0.0594)	(0.0588)		(0.0299)	(0.0297)
$\Delta ln(Infrastructure_{jt})$		0.798***	0.783***		0.945***	0.920***		0.107***	0.104***
		(0.0695)	(0.0687)		(0.0620)	(0.0605)		(0.0152)	(0.0154)
$\Delta ln(Income_{it})$		-0.333***	-0.227**		-0.103	0.0266		-0.123***	-0.0986**
		(0.0944)	(0.0958)		(0.0853)	(0.0898)		(0.0443)	(0.0436)
$\Delta ln(Income_{jt})$		0.879***	0.777***		0.903***	0.748***		0.0855***	0.0759**
		(0.0824)	(0.0787)		(0.0749)	(0.0711)		(0.0279)	(0.0318)
$\Delta ln(Employed_{it})$		0.247***	0.161*		0.0422	-0.0603		0.0235	0.00304
		(0.0953)	(0.0945)		(0.0829)	(0.0875)		(0.0228)	(0.0234)
$\Delta ln(Employed_{jt})$		-0.567***	-0.465***		-0.520***	-0.368***		-0.0481	-0.0398
		(0.0642)	(0.0620)		(0.0584)	(0.0575)		(0.0321)	(0.0368)
$\Delta ln(Entry_{it})$		-0.0511	0.00134		-0.146***	-0.0825***		-0.0362***	-0.0244***
		(0.0354)	(0.0355)		(0.0281)	(0.0289)		(0.00860)	(0.00857)
$\Delta ln(Entry_{jt})$		0.223***	0.177***		0.232***	0.163***		0.0170	0.0119
		(0.0214)	(0.0207)		(0.0260)	(0.0253)		(0.0125)	(0.0117)
$\Delta ln(1+Tariff_{it})xMS_{i,1996}$			54.53***			48.68***			9.313*
			(17.69)			(15.89)			(4.888)
$MS_{i,1996}$			5.067***			5.448***			1.050***
			(1.190)			(1.044)			(0.282)
$\Delta ln(1+Tariff_{it})xMS_{j,1996}$			61.70***			59.87***			13.54**
			(18.11)			(17.11)			(5.413)
$MS_{j,1996}$			0.817			-0.182			0.444
			(0.968)			(0.912)			(0.353)
Constant	-0.0454	-0.691***	-1.160***	-0.114**	-1.037***	-1.458***	-0.0536***	-0.0391	-0.139***
	(0.0555)	(0.144)	(0.179)	(0.0508)	(0.138)	(0.171)	(0.0140)	(0.0461)	(0.0466)
Observations	14,218	14,218	14,218	14,964	14,964	14,964	14,967	14,967	14,967
R-squared	0.009	0.032	0.039	0.009	0.041	0.054	0.002	0.011	0.014

Notes: Robust standard errors are in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 8: Initial tariff levels and the change in bilateral migration flows from $origin_i$ to $destination_j$ municipalities, according to skill level, 1996–2011: 2SLS Estimates

I. OLS Estimates, Dependent Variable: Annualized $\Delta\frac{M_{ijt}}{P_{it}/1000}$									
		Skilled			Semi-skilled			Unskilled	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
$\Delta ln(1+Tariff_{it})$	-0.730***	-3.256***	-0.113	-0.517***	-3.193***	-2.852	-0.186***	-0.737***	-1.566**
	(0.206)	(0.677)	(2.778)	(0.180)	(0.591)	(2.594)	(0.0451)	(0.151)	(0.743)
$\Delta ln(1+Tariff_{jt})$	2.365***	10.16***	19.28***	2.262***	9.835***	19.48***	0.290***	1.234***	3.531***
	(0.286)	(0.995)	(2.501)	(0.289)	(0.990)	(2.284)	(0.0602)	(0.206)	(0.672)
$\Delta ln(Infrastructure_{it})$		-0.228***	-0.186***		-0.167***	-0.112*		-0.0578*	-0.0502*
		(0.0584)	(0.0582)		(0.0594)	(0.0592)		(0.0299)	(0.0298)
$\Delta ln(Infrastructure_{jt})$		0.827***	0.819***		0.972***	0.953***		0.110***	0.110***
		(0.0703)	(0.0700)		(0.0633)	(0.0622)		(0.0155)	(0.0159)
$\Delta ln(Income_{it})$		-0.330***	-0.245**		-0.102	0.00793		-0.123***	-0.102**
		(0.0946)	(0.0964)		(0.0854)	(0.0887)		(0.0445)	(0.0430)
$\Delta ln(Income_{jt})$		0.894***	0.745***		0.916***	0.713***		0.0879***	0.0686**
		(0.0830)	(0.0772)		(0.0755)	(0.0689)		(0.0282)	(0.0303)
$\Delta ln(Employed_{it})$		0.243**	0.187*		0.0434	-0.0325		0.0241	0.00766
		(0.0951)	(0.0953)		(0.0827)	(0.0857)		(0.0226)	(0.0235)
$\Delta ln(Employed_{jt})$		-0.568***	-0.408***		-0.522***	-0.310***		-0.0494	-0.0290
		(0.0645)	(0.0597)		(0.0586)	(0.0548)		(0.0325)	(0.0352)
$\Delta ln(Entry_{it})$		-0.0490	-0.00366		-0.145***	-0.0890***		-0.0361***	-0.0254***
		(0.0354)	(0.0356)		(0.0280)	(0.0288)		(0.00865)	(0.00852)
$\Delta ln(Entry_{jt})$		0.224***	0.159***		0.233***	0.147***		0.0173	0.00875
		(0.0214)	(0.0197)		(0.0259)	(0.0243)		(0.0124)	(0.0119)
$\Delta ln(1+Tariff_{it})xMS_{i,1996}$			8.959			-19.85			-11.40*
			(21.98)			(20.65)			(6.327)
$MS_{i,1996}$			1.960***			2.675***			0.534***
			(0.338)			(0.314)			(0.0955)
$\Delta ln(1+Tariff_{it})xMS_{j,1996}$			100.1***			111.7***			22.24***
			(20.83)			(16.92)			(5.306)
$MS_{j,1996}$			-2.944***			-3.865***			-0.367***
			(0.325)			(0.316)			(0.0970)
Constant	-0.0131	-0.658***	-0.281*	-0.0261	-1.029***	-0.690***	-0.0165***	-0.0327	-0.00357
	(0.0181)	(0.141)	(0.164)	(0.0167)	(0.136)	(0.152)	(0.00413)	(0.0458)	(0.0483)
Observations	53,480	14,218	14,218	54,226	14,964	14,964	54,229	14,967	14,967
R-squared	0.002	0.033	0.040	0.002	0.043	0.056	0.001	0.011	0.014

Notes: Robust standard errors are in parentheses*** p<0.01, ** p<0.05, * p<0.1

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