EDGED OUT
SPATIAL MISMATCH AND SPATIAL JUSTICE
IN SOUTH AFRICA’S MAIN URBAN AREAS

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Well-located areas are unaffordable for the poor, but living on city edges, far from jobs, makes it more difficult to find a job. This creates a poverty trap whereby living on the periphery leads to poverty, while poverty ensures living on the periphery. Significant structural features of the South African economy make people poor and keep them so; peripheral location is one of these.

The market cannot resolve this problem, and strategic state intervention is required. However, one such prospect, the post-apartheid national housing subsidy programme, has entrenched poverty because of the peripheral location of subsidy housing projects.

The “Spatial Mismatch Hypothesis” (see text box 1) provides a theoretical basis for these assertions, and methods to empirically test for the existence of spatial mismatch. Applying these methods to the case of South Africa’s main urban areas results in a powerful, evidence-based case for recapturing the national housing subsidy programme as a pro-poor intervention, which can, and indeed should, contribute to reversing the jobs/housing mismatch prevalent in South Africa’s cities. The asset-based potential of ownership housing to reduce poverty is over-emphasised in current human settlements policy. More impact would be achieved were the programme to provide opportunities for poor people to live close to jobs.
The concept of Spatial Mismatch also contributes a rigorous, statistical research base for conceptualising an agenda for advancing spatial justice in South Africa’s cities, which is especially important in light of the legal centrality of spatial justice in the Spatial Planning and Land Use Management Act’s (SPLUMA’s) principles. Apartheid city structure embodies spatial injustice: undoing the jobs/housing mismatch must be central in SPLUMA-required spatial development frameworks, municipal bylaws and land development decisions. By quantifying the size of spatial mismatch, something new in the South African context, this research offers a benchmark against which progress towards one aspect of spatial justice can be measured.

While it is a widely-held assumption in the housing sector that spatial mismatch is a significant issue, there is little work which empirically investigates the existence and relative importance of spatial mismatch in South Africa’s cities. In 2015 and 2016 SERI undertook the research reported in this document in response to the lack of hard evidence on spatial mismatch in South Africa.

Using statistical analysis and national spatial data on local unemployment rates and the distribution of jobs, this report investigates spatial mismatch in South Africa’s major urban centres. We find that across South Africa’s largest cities and conurbations, a statistically significant relationship exists between physical proximity to jobs and local unemployment rates in the vast majority of cases. After controlling for the effects of a variety of confounding factors, we find that the further people live from areas with jobs, the higher their local unemployment rates. These spatial mismatch effects explain a sizable part of already-existing unemployment (although of course other factors remain important), suggesting that location is an important determinant of employment prospects.

Section 2 begins by providing some background on the predominant spatial form of South Africa’s “Apartheid cities”, discusses the resilience of this spatial form since 1994 and post-Apartheid commitments to reform, and then summarises key features of South Africa’s widespread poverty and intense inequality. The main spatial mismatch analysis is presented in Section 3, which introduces the methodology of our quantitative investigation, and then presents results for each urban area under consideration. The technical report contains a more in-depth presentation of method and results. Section 4 discusses the implications of our research for human settlements and planning policy, while Section 5 concludes.
Spatial Mismatch explores the link between economic welfare and city structure. South Africa’s “Apartheid cities” and dominant patterns of poverty and inequality in the country are therefore important context for our research.

2.1 City Structure

Apartheid city planning was explicitly designed to prevent urban black workers from living in well-located white areas, even though these workers may have been employed there. We do not unpack urban policy under Apartheid in detail here (see the technical report for some discussion and Maylam (1990), Wilkinson (1998), and Turok (2012), amongst others, for a more in-depth discussion), but Apartheid policy explains the origin of the “Apartheid City”, South Africa’s peculiar urban typology. Maylam (1990:57) describes the basic objective of Apartheid-era urban policy as attaining “labour-power without labourers”, and the Apartheid government instituted three key policies towards achieving this end: the expansion of existing pass laws, the peripheralisation of black urban enclaves, and the creation of the black “homelands”. This urban planning system ultimately broke down in the late 1980s as anti-
Apartheid resistance and economic and urbanising pressures became too great, but its effects have been long-lasting.

The legacy of Apartheid city planning is still evident in South Africa’s cities 22 years since the advent of democracy in 1994. A disproportionately white elite lives in relative comfort in well-located city cores, close to economic activity and the social life which defines cities. At the same time, black South Africans are disproportionately confined to urban peripheries in dense and poorly serviced settlements, have very low rates of homeownership, and sometimes live in extreme peripheral urban areas which without the Apartheid context seem to make no sense at all. The long-term effects of these policies also extend beyond urban form, as amongst other things peripheral areas by design tended to have fewer opportunities for education compared to well-located urban areas (Wilkinson, 1998), and prohibitions on black business ownership made the disconnects between residential and formal employment location all the more consequential (Turok, 2012). It is because of these characteristics, and the history which gave rise to them, that South Africa’s contemporary cities are frequently called “Apartheid cities” (Pieterse, 2009).

2.2 The resilience of Apartheid cities and commitments to advancing Spatial Justice

Redressing apartheid spatial planning legacies has long been on the agenda in the South African housing and planning sectors. The seminal post-apartheid housing policy framework, the 2004 Breaking New Ground (BNG) plan, recognises explicitly that “the inequalities and inefficiencies of the apartheid space economy [have] lingered on”, that “the existing spatial fabric has shown little change”, and that “[h]ousing for low-income urban dwellers is still provided on the periphery and very limited delivery has taken place in rural areas” (National Department of Housing, 2004:11). The plan then proposed a variety of measures to address these issues: improving access to land and land use schemes, ensuring equity in spatial development frameworks and policies, incorporating provisions in spatial planning mechanisms to enable redress, including flexible provisions for land use management systems, and ensuring that land development procedures accommodate access to tenure. It also recognised the importance of the Municipal Planning Tribunal in addressing these issues.

2 Of course the wealthy and white do not live only in central areas. Landman and Badenhorst (2012) for example discuss the growing popularity of exclusive security estates, or “security villages” in Johannesburg, which are frequently constructed on the city’s urban edge. Landman and Badenhorst (2012) argue that the primary motivation for this type of peripheral living is fear of crime and other insecurities, with residents quite intentionally choosing to escape “the city”, with its perceived risks and dangers. These affluent yet peripheral settlements are however the exception rather than the rule when it comes to location, race and wealth in South Africa’s cities.
of measures to “promote the achievement of a non-racial, integrated society through the development of sustainable human settlements and quality housing” (National Department of Housing, 2004:7).

A natural question concerns why South Africa’s Apartheid cities still exist as such over 20 years since the end of Apartheid, especially in the face of these government commitments to change. Apart from the direct and indeed physical legacies of Apartheid planning, which Cousins et al (2005) and Tissington (2011) argue have been made particularly difficult to undo because of the protections of private property guaranteed in South Africa’s Constitution, two major causes for the permanence of Apartheid cities are immediately evident.

Firstly, and unsurprisingly, private sector developers prefer to construct housing and commercial developments in already-established zones of economic and social activity, thus leaving poorer areas undeveloped and entrenching existing spatial divides (Pieterse, 2009; Todes, 2012). Municipal efforts to induce the private sector to invest in poor areas have generally been successfully resisted by developers in what is a concentrated and powerful industry, while property owners have organised into strong lobbies to protect their interests (Turok, 2012). Parts of municipal spending have sometimes been relatively well-targeted to poor areas, but this kind of spending cannot compete with the investments produced by the private sector (Pieterse, 2009).

However perhaps a more surprising cause of the prevailing city structure is post-Apartheid housing policy itself, which one would expect to be disrupting rather than entrenching of the Apartheid-designed status quo. A number of writers have argued that the post-1994 focus on establishing freehold titled housing amongst the poor, via the government’s ambitious RDP housing programme, has in fact entrenched peripheral development for the poor and prevailing spatial structures (Pieterse, 2009; Tissington, 2011; SACN, 2011; Turok, 2012). One cause is related to an (at times market-driven) belief that RDP housing is a kind of “asset” which can by itself facilitate poverty exit, and that the delivery of high numbers of RDP houses is therefore a legitimate policy priority. Breaking New Ground lists “[e]nsuring property can be accessed by all as an asset for wealth creation and empowerment” as only one of its key objectives (National Department of Housing, 2004:7), but this has in practice, for political as well as policy-led reasons, meant prioritizing the number of units delivered over issues such as location. This has led to an entrenching of Apartheid spatial forms, as construction and delivery of freehold housing is cheaper and easier to do at scale on peripheral green-field sites than it is in already built-up areas. At the same time, as an extensive literature review in the technical report makes clear, there is little evidence to suggest that state-subsidised housing, promoted as some kind of asset for the poor, has any systematic ability to facilitate poverty exit.

Partly in recognition of the failure of asset-based housing policy to transform South Africa’s cities, policy commitments have recently been made to more broadly advancing “spatial justice”.

A commitment to spatial justice constitutes the first development principle in the Spatial Planning and Land Use Management Act of 2013 (SPLUMA), thus creating a legal obligation that future spatial planning, land development and land use management must accord with the principle (detailed in Text Box 2), while the South African National Development Plan (NDP) (National Planning Commission, 2012) lists spatial justice as
one of its overarching principles for spatial development. In the NDP, spatial justice is explained as meaning that:

“The historic policy of confining particular groups to limited space, as in ghettoisation and segregation, and the unfair allocation of public resources between areas, must be reversed to ensure that the needs of the poor are addressed first rather than last.”

(National Planning Commission, 2012:277)

The concept of spatial justice has the potential to be politically powerful in South Africa, where both a justiciable state obligation and activist commitment to the concept may be used to transform Apartheid-era spatial forms. However, practical definitions of the concept remain elusive, which simultaneously renders the state unaccountable to this principle and hinders attempts to use the concept to concretely set policy agendas. The predominant academic understanding of the term (discussed more extensively
in the technical report) is that commitments to spatial justice should involve addressing links between spatial circumstances and unjust social phenomena, and vice versa (Marcuse 2009; Soja, 2009). The definition favoured by the South African government seems to be more historically-oriented, and about “righting the wrongs of the past”. If we are to go beyond narrow legal definitions, and give content to these definitions, interrogation of the academic and state-favoured definitions is required. Additionally, work such as is presented in this report, which presents new analysis about the prevailing social conditions in South African cities, may be useful for formulating new and practical definitions of spatial justice. In Section 4 we present a practicable definition of one aspect of spatial justice based on our research findings.

2.3 Poverty and Inequality

South Africa is a country where extreme wealth exists alongside widespread poverty, which is borne disproportionately by black people. Poverty in South Africa should not be seen as a transient phenomenon which is primarily the fault of individual failings. There are significant structural features of the economy which make people poor and keep them so. In particular, the South African labour market does not meet people’s needs.

South Africa is technically an upper-middle income country. And yet the country is beset with extraordinarily high levels of income poverty. The national statistics agency, Statistics South Africa (Stats SA), estimates that 53% of the South African population was income poor in 2011 (Statistics South Africa, 2015). Other academic work on this subject suggests that a more accurate figure is higher, at 63% poor (Budlender et al, 2015). Both papers agree that about 20% of South Africa’s population should be classified as “extremely poor”. South Africa is also exceptionally unequal, with a 2012 Gini coefficient of 0.67, making the country one of the most unequal in the world, if not the most unequal (Finn & Leibbrandt, 2013). While it is difficult to get reliable estimates of net wealth, it is likely to be more unequally distributed than income, especially between racial groups (Van der Berg, 2011). Daniels et al (2014), using 2010 data, estimate that the richest 5% of South Africans hold 79% of the country’s net wealth, while the net wealth Gini coefficient is exceptionally high at 0.9.

These aggregate figures, while very high, hide extreme racial differentiation: poverty rates are between 40 to 60 times higher amongst black Africans than they are amongst whites, depending on where the poverty line is drawn (Wilkinson, 2016). No matter where this line is drawn, however, poverty rates are highest for black Africans, followed by coloureds.

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3 A Gini coefficient is an inequality measure which is bounded by 0 and 1. The higher the Gini coefficient, the more unequal a particular sample is. A Gini coefficient of 0 would mean that everyone in a particular sample has the same income, and suggests perfect income equality. A Gini coefficient of 1 means that one person has all of the income in a particular sample while the other sample members have zero income; this suggests a scenario of perfect income inequality.
then by Indians/Asians, and lastly by whites (Leibbrandt et al, 2010), representing exactly the racial hierarchy imposed by the Apartheid state. In 2008 white mean income per capita was just under 8 times higher than black African mean income per capita, while white median income per capita was just over 11 times higher than the black African equivalent (Leibbrandt et al, 2012).

It is perhaps to be expected that a country which until recently had legislated Apartheid and centuries of colonialism before that, would have high levels of poverty and intense inequality between blacks and whites. What is particularly damning about contemporary South Africa, however, is that there has been virtually no progress made in decreasing income poverty and inequality in the post-1994 period. While Finn et al (2013) have shown that the post-Apartheid state has made significant gains when it comes to non-monetary measures of poverty, such as increased access to electricity and water, decreased child mortality, and vastly increased school enrolment, poverty in money terms remains stubbornly high. Leibbrandt et al (2010) show that income poverty has only very slightly declined between 1993 and 2008, while over this period income inequality measured by Gini coefficient has actually increased. The small decreases observed in income poverty are significantly due to the expansion of social grants, while a major driver of the increase in income inequality has been the increased share of income going to the richest 10% of the population in the post-Apartheid period (Leibbrandt et al, 2010).

A number of structural features of the South African economy make poverty exit exceedingly difficult, no matter how hard-working or enterprising an individual may be. Labour market outcomes (employment and wages) are the single most important determinant of individual and household incomes, and yet the labour market in South Africa is dysfunctional, caused both by deficient labour supply and deficient labour demand. It is the case that generally poor education and a lack of marketable skills are causes of unemployment, but another fundamental cause is the apparent inability of the South African economy to produce sufficient jobs. Poverty in South Africa is frequently chronic, and the country has very low rates of intergenerational mobility, meaning that people's incomes and poverty status are very likely to be the same or similar to those of their parents (Piraino, 2015). The South African evidence clearly points towards poverty largely being the result of inherited circumstances and structural issues which are beyond the control of poor individuals. One reason for this is the existence of a variety of structural “poverty traps”, which are circumstances where by virtue of being poor, someone is prevented from accessing the means or opportunities necessary for exiting poverty.

This research explores a poverty trap which is intricately linked to city structure and South Africa’s dysfunctional labour market: living in a badly-located area makes it more difficult to find a job but well-located areas are unaffordable for the poor. This is a quintessential poverty trap, which would require targeted and strategic state intervention to address.
3.1 Introduction

The existence of spatial mismatch is generally taken as given in South Africa.\(^4\) A substantial body of work exists which shows descriptively how jobs and economic opportunity are concentrated around city centres while the majority of the urban poor and unemployed live in dense settlements on the urban periphery (Turok, 2001; SACN, 2011; Sinclair-Smith & Turok, 2012; Todes, 2012; Turok, 2012; Gotz & Todes 2014; Wray et al, 2015). However, while these studies show that those living far from jobs are disproportionately the poor and unemployed, they typically do not attempt to determine whether this distance from jobs actually explains some part of existing unemployment in far-flung areas.

As far as we are aware, only two studies have attempted to test rigorously whether distance from jobs explains some part of unemployment in South Africa. Both present some descriptive analysis, but it is their regression analysis which makes these papers novel in the South African context. Rospabe and Selod (2006) present a sophisticated test for spatial mismatch in the City of Cape Town. They find that local job density (which is a measure of the number of jobs within the immediate proximity of survey respondents) cannot be said to affect

\(^4\) It is sometimes called the “jobs-housing mismatch” (City of Johannesburg, 2016).
unemployment probabilities, but that job distance (whether unemployment is related to the mean commuting time for workers in a survey’s respondent's census area) does, and that this result is statistically significant. They conclude that there is evidence which suggests spatial mismatch in Cape Town, but do not interpret the size or practical significance of the effect.

Naude’s (2008) main test for spatial mismatch relates black unemployment rates with distance to city centres, in South Africa’s (then 6) metropolitan municipalities. He does not indicate the size of the distance effects, but shows that they are highly statistically significant. He concludes that this analysis is strong evidence of spatial mismatch in South Africa’s metropolitan labour market.

While these original spatial mismatch studies in South Africa are undoubtedly useful, neither paper presents clear estimates for the size of the spatial mismatch effects they identify, thus making it difficult to evaluate how significant mismatch is for unemployment rates or individual unemployment probability. Secondly, the geographic coverage of this existing work is hardly all-encompassing. Lastly, and as identified by Gotz and Todes (2014), this work is now somewhat dated.

This report extends its analysis to all eight of South Africa’s legislatively determined metropolitan municipalities as well as two larger conurbations - Gauteng Province and the area of Johannesburg-Ekurhuleni-Tshwane. The results of this analysis, presented in Section 3.3 below, show that in 8 of the 10 areas we examine unemployment rates are significantly related to a “proximity to jobs” measure we construct, while controlling for the effects of various demographic characteristics. While two metropolitan municipalities do not show a significant correlation between unemployment and proximity to jobs, we discuss why this may be the result of data and methodological issues rather than being evidence for no spatial mismatch. The impact that proximity to jobs is estimated to have on local unemployment rates is also shown graphically for each area under investigation.

REGRESSION ANALYSIS

Regression analysis is a way of quantifying statistically the relationship between some phenomena. At its most basic, it is about deriving a “line of best fit” through the data under examination, and then interpreting what that line indicates about the underlying data. For example, a simple regression based on cities data may show that a 10% increase in job proximity is on average associated with an 8% decrease in unemployment rates, which would support the SMH. A first key point about regression is that it allows quantification of relationships.

A second advantage of regression analysis is that it allows quantification of relationships while holding some factors constant. In the example above, it is naïve to look at the relationship between job proximity and unemployment rates in isolation. The legacy of Apartheid planning means black people disproportionately live on city peripheries. For other reasons also to do with historical and present day injustices, black unemployment rates are higher than white unemployment rates. It may be that the relationship between unemployment rates and proximity to jobs is actually due to edge areas being mainly black while central areas are mainly white. Regression allows us to isolate and hold factors (such as race) constant in our analysis, and therefore remove the confounding effects these factors may have on our analysis.

In the above example, we may find that a 10% increase in job proximity is on average associated with a 5% decrease in unemployment rates, if race is held constant. We can hold any number of factors constant in our regressions, and thus better identify fundamental relationships between the variables we are interested in.
Research Framework

Seeing urban unemployment:
What does unemployment look like in South Africa’s cities?

Finding urban jobs:
Where are the jobs in these cities?

Creating a job proximity measure:
Which areas are close to jobs, and how close are they?

Visualising spatial mismatch:
What is the relationship between proximity to jobs and unemployment rates?
3.2 Method

3.2.1 Model

Following the literature on spatial mismatch in the United States (Kain, 1992; Ihlanfeldt & Sjoquist, 1998), our quantitative investigation makes use of regression analysis to estimate the effect that a derived “proximity to jobs” variable (explained below) has on broadly-defined unemployment rates, while controlling for a variety of demographic characteristics. These demographic characteristics are, for each census small area, the proportion of the population which is white people, the proportion female, the proportion who are defined as living in an urban area, the average age, and the total small area population. Regression allows us to isolate and quantify the relationship between distance and unemployment rates, by taking out the effects that the various demographic characteristics have on unemployment. For our spatial unit of analysis we use Stats SA’s census “small areas”. Refer to Appendix 1 of this report for a more detailed description of our model.

Our model weaknesses relate firstly to the exclusion of mean years of education from the regression analysis, due to its high correlation with proximity to jobs. Secondly, our method of regression analysis is undermined by the existence of any “endogeneity”, where people make choices about residential location which we cannot model or control for. This necessitates particularly careful analysis of metropolitan municipalities and regions which include rural areas, and general care when trying to draw causal links. This is one reason why we present an analysis of the Johannesburg-Ekurhuleni-Tshwane region separately from our analysis of spatial mismatch in Gauteng. While we merely identify some of our model weaknesses here, the technical report and Appendix 1 of this report contain more in-depth analysis of these issues and what their implications are likely to be for our results.

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5 In using broadly defined unemployment for our analysis we follow Kingdon and Knight (2006) and Posel et al (2014), who argue that broadly defined unemployment is a more appropriate definition for South Africa than unemployment according to the strict definition. The chief difference between the two definitions concerns “discouraged work seekers”, who want to work but have not actively sought employment recently. The strict definition of unemployment excludes these discouraged work-seekers from the count of the unemployed, while they are included in the broadly defined unemployment.
3.2.2 Data

For information on unemployment rates and demographic characteristics we use data from the 2011 South African National Census, made available by Statistics South Africa (Stats SA). We use small area level data as it is the most disaggregated level of data available from Stats SA. By way of example, Figure 1 presents small area boundaries for Johannesburg, showing that small areas are generally very small but that they are irregularly sized. Size depends chiefly on population density, with higher population density meaning small areas are smaller in size (i.e. smaller small areas). The small area census data provides the information we need on unemployment rates, race, gender, urbanity, mean age, and population density and totals.

Unlike demographic data, good quality data on the location and concentration of jobs below municipal level is exceedingly difficult to obtain. We make use of 2011 data produced by the Council for Science and Industrial Research (CSIR) for the collaborative “stepSA” project. The stepSA data is defined by geographic zones (created by the CSIR) called mesozones. These are analogous to the small areas defined by Statistics South Africa for its census data, but are larger and more uniformly-sized than these Stats SA zones (Mans, 2016). The principal advantage of the mesozones over the Stats SA equivalents is precisely this uniformity in size. While the mesozones are not uniformly shaped (they follow...
certain administrative and physical boundaries and avoid combining areas with vastly different population densities), they are all approximately 50 km² in size. Figure 2 demonstrates mesozone boundaries in the City of Johannesburg. Although a more detailed review and analysis of our data sources is contained in the Technical Appendix to the technical report, it is worth mentioning that all of the available jobs data sources (with perhaps the exception of the GeoTerralmage data described in the Technical Appendix, which has other major drawbacks) are restricted to formal sector jobs. The analysis undertaken in this report must therefore be understood as relating local unemployment rates to proximity to formal sector jobs. This is unfortunate but simply unavoidable. In addition, the jobs data we use for our analysis includes all types of jobs, rather than only looking at entry-level or lowly-skilled jobs. As explained in the technical report, this is likely best-practice given the data we have available, and in any case our choice is likely to bias our results against finding spatial mismatch to the extent that it has any significant effect.

Better quality data is always preferable, and in particular we would benefit from better jobs data and spatial individual-level data. The data we use nonetheless seems sufficient for our analysis, when compared to existing academic spatial mismatch analyses.
3.2.3 Descriptive graphics

Continuing with the use of Johannesburg to demonstrate our methodology, Figures 3 and 4 show unemployment rates and job concentration for the City of Johannesburg, at the small-area and mesozone levels respectively. The figures by themselves clearly suggest spatial mismatch, as areas of relatively high job concentration in the centre and north have low unemployment rates, while the high unemployment and high density areas of the south have high unemployment rates and few if any jobs. While these maps are a useful graphical tool, they cannot indicate the size of the spatial mismatch effect, and therefore how serious a policy priority the phenomena is. Additionally, this raw correlation does not constitute robust evidence for spatial mismatch. Regression analysis is required to control for potentially confounding factors such as race, and to quantify the size of the effect.

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6 Some small areas in Figure 3 are coloured grey, indicating that there is no data for those areas. These are small-area zones where fewer than 13 people were enumerated in the census, and as such Statistics South Africa does not report statistics for these areas. These areas are typically industrial and commercial zones, or features such as dams, mines, uninhabited mountains or nature reserves.
3.2.4 Creating a measure of proximity to jobs

Quantifying the relationship between small area unemployment rates and proximity to jobs requires a measure for every small area’s “proximity to jobs”. A number of different techniques for deriving such a variable are possible and we base ours on the approach used by Rogers (1997). This proximity to jobs measure incorporates all of the jobs data for a specific metropolitan municipality (or conurbation such as Gauteng or Johannesburg-Ekurhuleni-Tshwane) and creates an index out of 100 for job proximity for every small area within that municipality, where a score of 0 means an area is far away from jobs and an area of 100 means an area is close to jobs. For a specific small area, proximity to jobs is a function of the available jobs in every mesozone in the relevant municipality (or larger region), discounted by the distance between that small area and the relevant mesozone. Small areas which are close to mesozones with many jobs have a higher measure of proximity to jobs than small areas which are further away. Figure 5 graphically shows our proximity to jobs variable for the small areas of Johannesburg.

Further details of the specific methodology used to quantify proximity to jobs are given in the Technical Appendix to the technical report.
Edge areas have lower proximity to jobs than central areas, and there is a clear gradation as areas become more peripheral. Additionally, the northern suburbanization of jobs in Johannesburg is evident, as discussed by Todes (2012), showing clearly the advantage of a proximity to jobs measure based on data, rather than a measure which assumes the city centre is the only significant jobs centre of the municipality.\(^8\)

A necessary limitation of the method used to construct our proximity to jobs variable for each municipality is that it only considers proximity to jobs within that specific municipality. If there is a significant concentration of jobs just outside a municipal border, a small area close to that border likely has its real proximity to jobs underestimated.

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\(^8\) Some isolated darker spots (where the job proximity index is greater than 90) are evident. As discussed in the Technical Appendix to the technical report, these are statistical artefacts related to the methodology used to create the job proximity measure, and should not be interpreted substantively. The overall pattern and shape is more important than these isolated spots.
by our measures.\textsuperscript{9} Border issues may therefore be distortionary. Amongst other reasons, it is in order to address this issue that our study presents analysis for Gauteng Province as a whole, and for the Johannesburg-Ekurhuleni-Tshwane area specifically.

A significant unresolved weakness of the job proximity measure, however, is that it is based on straight-line distances between small areas and mesozones, as the crow flies. In reality, people must generally travel along roads or railways, and the straight-line distance is only an approximation of actual commuting time. This approximation is also likely to be systematically biased: people living on peripheries are disproportionately poorer than people living in central areas, and thus more likely to rely on public transport than private cars. This means that people living on peripheries not only have longer distances to travel to jobs centres than people in central areas, but are also more likely to use slower forms of transport (which our measure does not incorporate). This may cause the size of our spatial mismatch estimates to be underestimated (biased against finding spatial mismatch), but is unavoidable given the data constraints.

\textsuperscript{9} A case in point is Diepsloot, which in Figure 5 appears to be very badly-located when it comes to jobs, because it is far from the Johannesburg city centre and still somewhat distant from northern suburbs jobs centres. Diepsloot can probably not be called well-located, but the extent of its bad location is over-estimated here, because the major jobs centres of Tshwane metropolitan municipality to the north are not included in the Johannesburg job proximity measure. Diepsloot is in fact closer to the Pretoria city centre than it is to Johannesburg, and is only slightly closer to Midrand than the Tshwane jobs centre of Centurion. The issue of neighbouring municipalities is only particularly serious in Gauteng, however, because municipalities in other regions of the country are somewhat isolated. Gauteng, in contrast, contains 3 metropolitan municipalities which are all adjacent to each other, and contains other productive towns.
### 3.3 Overview of Results

Spatial mismatch is clearly evident across the majority of South Africa's metropolitan municipalities, and in the larger regions of Gauteng Province as well as in the Johannesburg-Ekurhuleni-Tshwane sub-region. Distance from jobs in these areas is correlated with higher unemployment rates, when controlling for a number of demographic characteristics. This relationship is practically important: even in regions with relatively small mismatch effects, these effects explain a significant part of existing unemployment in peripheral areas.

We use a method for measuring proximity to jobs which has not been applied in this country before, and present city by city spatial mismatch estimates for the first time. The result is strong evidence that living far away from work reduces people’s employment prospects, and this has significant policy implications (addressed in section 4 below).

While it may not be particularly surprising that spatial mismatch is identified quantitatively, given existing work which shows the general disconnect between jobs and where people live in South African cities, it is the size of the effect that is startling in some regions. The nuance that is gained by analysing each region individually is valuable, as there are differences between cities both in terms of the size of the estimated mismatch effect and in terms of how mismatch should be interpreted.

We do not find sufficient evidence to conclusively identify spatial mismatch in two metropolitan municipalities: Nelson Mandela Bay and Cape Town. In the case of Nelson Mandela Bay, we explain why this may mean there is genuinely not a relationship between proximity to jobs and unemployment in the municipality. However in Cape Town there are significant issues which exacerbate the weaknesses of our spatial mismatch model, and there is sophisticated existing work which finds spatial mismatch in the city. Therefore while we discuss our results and some of the prior work on Cape Town, we do not present a firm conclusion as to whether there is spatial mismatch in the city.
3.4 City by City Spatial Mismatch Results

1. THE CITY OF JOHANNESBURG

Our model suggests that job proximity is a significant determinant of unemployment in Johannesburg.

The City of Johannesburg is South Africa’s most populous municipality, and is also the country’s largest municipal economy. Harrison et al (2014) describe Johannesburg as South Africa’s “Premier City”, and while it is not an official national capital, it is the seat of the country’s highest court, the Constitutional Court. What started as a mining town is now South Africa’s financial capital, and the Johannesburg Stock Exchange is the largest stock exchange in Africa and amongst the largest in the world. The municipality is almost entirely urban, with only some small rural areas in the extreme north-west and south. Johannesburg exhibits a sharp geographic divide, where the south is typically poorer, disproportionately black, and lacking in infrastructure, while the north (with some notable exceptions such as Alexandra and Diepsloot) is typically wealthier, better-serviced, and disproportionately white. The northern centre of Sandton acts as a second city centre, and the stock exchange is located here, while the original Johannesburg city centre, though still the major economic hub, has undergone various cycles of urban growth, decay, and regeneration.

As shown in Figure 1.1, the distribution of unemployment in the City of Johannesburg has a stark spatial dimension. With the exception of Diepsloot on the extreme northern periphery and Alexandra in the centre, the City can be divided into two parts: the low-unemployment north, and the extremely high-unemployment south. The issue of uniformly high unemployment is especially evident in the south-west with Soweto, and in the extreme south in the areas of Orange Farm and Ennerdale. In contrast, the disproportionately white “northern suburbs” north of the Johannesburg CBD, and the economic nodes of Sandton and Midrand, exhibit low unemployment rates.

The concentration of jobs in Johannesburg, shown in Figure 1.2, is in many respects a mirror image of the unemployment picture.
Most jobs are concentrated in Johannesburg and Sandton, but the north of the municipality as a whole shows relatively large numbers of jobs. The south-west, and in particular the extreme south, have relatively few jobs. Compared to other South African municipalities, the City of Johannesburg exhibits a large amount of jobs across most of its area. This does not however address the relative distribution of jobs within the municipality.

Figure 1.3 presents what is expected when it comes to proximity to jobs in Johannesburg. Edge areas have lower proximity to jobs than central areas, and there is a clear gradation as areas become more peripheral. Additionally, it shows the northern suburbanization of jobs in Johannesburg, as discussed by Todes (2012). Border issues may be somewhat distortionary, given that Johannesburg neighbours the metropolitan municipalities of Tshwane and Ekurhuleni. A case in point is Diepsloot, which in Figure 1.3 appears to be very badly-located when it comes to jobs, because it is very far removed from the Johannesburg city centre and somewhat distant from northern suburbs jobs. Diepsloot can probably not be called well-located, but the extent of its bad location is over-estimated in Figure 1.3, because the major jobs centres of Tshwane metropolitan municipality to the north are not included in the Johannesburg job proximity measure.
INTERPRETING THE SIZE OF THE SPATIAL MISMATCH EFFECT

While Tables 1 to 10 show how a 1-unit or 10-unit change in job proximity is related to changes in unemployment rates, the practical meaning of these effects is not understandable without reference to maps which show what a 10-unit change in job proximity actually means. Figures 1.3 to 10.3, which show job proximity in each municipality or larger conurbation, are useful for this purpose. As the map legends indicate, each colour denotes a different 10-unit job proximity band. Moving across a colour band is therefore a good indicator of what a 10-unit change in job proximity means for each municipality or larger region.

More valuable for understanding the practical implications of results, however, are Figures 1.4 to 10.4. The figures show the unemployment rates predicted by our model if every small area within a given municipality or conurbation is given the average values for the demographic characteristics of that municipality or conurbation, but retains its real job proximity score. This effectively means we hold characteristics such as race or population size constant, and then see how unemployment rates change when the only small area characteristic allowed to vary is job proximity. Figures 1.4 to 10.4 graphically show the extent to which changes in unemployment can be explained by changes in job proximity, for a given municipality or conurbation. They allow us to see, in the case of Johannesburg for example, that the change in job proximity associated with a move between Orange Farm and the city centre correlates to a change in unemployment rate of between 6 and 12 percentage points.
The final results of our investigation into spatial mismatch are reported in Table 1 and Figure 1.4. The textboxes alongside provide guidance on how to interpret these results. Figure 1.4 shows that a substantial amount of the variation in unemployment rates in the City of Johannesburg can be attributed to changes in small area proximity to jobs. It is not just living in the city centre which is associated with lower unemployment rates: Johannesburg’s northern suburbs are also very well-located. Soweto has previously been noted as being unusually well-located for an erstwhile informal settlement (SACN, 2011), and this is borne out by this analysis, which shows that the unemployment rates associated with job proximity in Soweto are comparable to those in Roodepoort. Figure 6 suggests that Soweto’s much higher actual unemployment rates (as shown in Figure 1.1) are due primarily to factors other than physical location. It is the extreme periphery and south of the metropolitan municipality where proximity to jobs is related to high unemployment rates. Figure 1.4 suggests that a change in proximity to jobs associated with a move between Orange Farm and the city centre correlates to a change in unemployment rate of between 6 and 12 percentage points. Table 1 shows that a 10 unit increase in job proximity in Johannesburg is on average associated with a 4.5 percentage point decrease in small area unemployment rates, or equivalently a 10% increase in job proximity is associated with a 7.7% decrease in unemployment rates.
TABLE 1  City of Johannesburg

<table>
<thead>
<tr>
<th></th>
<th>(Spec. 1) GLM unit changes UNEMPLOYMENT RATE</th>
<th>(Spec. 2) GLM % changes UNEMPLOYMENT RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proximity to jobs (index)</td>
<td>-0.238*** (0.0153)</td>
<td>-0.771*** (0.0496)</td>
</tr>
<tr>
<td>Observations</td>
<td>5,791</td>
<td>5,791</td>
</tr>
</tbody>
</table>

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Control covariates not shown

FIGURE 1.4 City of Johannesburg spatial mismatch
2. CITY OF TSHWANE

Our model suggests that job proximity is a major determinant of unemployment in Tshwane.

Tshwane Metropolitan Municipality, to the north of Johannesburg, is a key part of the Gauteng urban economy. Unlike Johannesburg and Ekurhuleni, however, the Tshwane municipality includes significant rural land. The municipality is geographically very large. The “city proper” is predominantly in the west of the metropolitan municipality area, with small towns such as Bronkhorstspruit lying outside this area.

Figure 2.1 shows that with the exception of Atteridgeville to the south-west, the Pretoria city centre and the areas immediately around it exhibit very low unemployment rates. Centurion on the southern border of the City of Tshwane exhibits similar low unemployment rates. The highest unemployment rates in the municipality are evident in the semi-peripheral areas of Mamelodi and Atteridgeville, and in the extreme north-west of the municipality, made up of townships such as Soshanguve and Winterveld. A notable feature of the distribution of unemployment in Tshwane is the relatively low unemployment rates in the

FIGURE 2.1 City of Tshwane unemployment rates
periphery west of the municipality. These areas are largely rural, however, and these low rural unemployment rates are likely because of the endogeneity issue identified in our methods section and discussed in Appendix 1, rather than urban dynamics such as spatial mismatch.

Figure 2.2 shows that jobs are focused mainly in the Pretoria CBD and to its south, extending to the jobs centre of Centurion. The data suggests some employment pockets in the north-west, but shows that Tshwane is an economically monocentric city, with most of the formal economic activity focused around the city centre.

Job proximity, as shown in Figure 2.3, is what is to be expected based on the jobs data. It confirms that Tshwane is monocentric, with the Pretoria city centre being the most important node. The area of high job proximity is pulled slightly southwards due to areas such as Centurion, but not significantly so. It is worth noting that if jobs in Johannesburg were incorporated, it is likely that the job proximity score in the south below the Pretoria city centre would be higher. There is considerable commuting between Tshwane and Johannesburg which
is not captured by this model. The Gauteng region analysis is instead useful here.

Figure 2.4 is suggestive of strong spatial mismatch effects in Tshwane. It shows that across the Tshwane region, job proximity explains large variation in unemployment rates. For example, the change in job proximity from moving from Winterveld in the north to the Pretoria city centre is associated with a decrease in unemployment rates of between 9 and 15 percentage points. Table 2 shows that a 10 unit increase in job proximity in Tshwane is on average associated with a 3.2 percentage point decrease in small area unemployment rates, or equivalently a 10% increase in job proximity is associated with a 9.95% decrease in unemployment rates.
### TABLE 2 City of Tshwane

<table>
<thead>
<tr>
<th></th>
<th>(Spec. 1) GLM unit changes</th>
<th>(Spec. 2) GLM % changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proximity to jobs (index)</td>
<td>-0.320*** (0.0172)</td>
<td>-0.995*** (0.0530)</td>
</tr>
<tr>
<td>Observations</td>
<td>4,513</td>
<td>4,513</td>
</tr>
</tbody>
</table>

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Control covariates not shown

### FIGURE 2.4 City of Tshwane spatial mismatch

![Map of the City of Tshwane showing spatial mismatch](image)
3. EKURHULENI

Our model suggests that job proximity is a significant determinant of unemployment in Ekurhuleni.

The Ekurhuleni Metropolitan Municipality does not have one “city centre” – the separate areas of Edenvale, Bedfordview, Germiston, Boksburg, Benoni, Kempton Park and Alberton are all important when it comes to the area’s overall economic activity. The municipality is an agglomeration of economic centres, and because of this it is somewhat unclear how well it constitutes what is conventionally understood to be a single “city”. There is nonetheless a well-defined urban core in the central west of the municipality, where a number of the economic nodes mentioned above are clustered.

Ekurhuleni is a very urban municipality, with only a small part of the north east classified as rural. It is economically important in the Gauteng region, and is significantly integrated into the economy of Johannesburg.

Figure 3.1 presents a relatively clear picture of peripheral unemployment, with most unemployment concentrated in the peripheral north-west, east and south. Unemployment is comparatively low around the main nodes of
economic activity clustered in the centre-west of the municipality. The low unemployment rates of the extreme north-east are likely related to this area’s low population density and rurality.

Figure 3.2 confirms that jobs are concentrated in the municipality’s centre-west, but there is greater dispersion of jobs across this centre-west region than is typical of many other South African cities. The jobs data suggests that while Ekurhuleni may be relatively polycentric, these multiple centres are ultimately clustered quite closely together, in only one region of the municipal map. The data suggests that few jobs are located in the northern, eastern, or southern peripheries.

Figure 3.3 confirms that despite Ekurhuleni’s unusual polycentricity, the proximity of its various nodes creates its own urban core of high job proximity in the west which includes Edenvale, Bedfordview, Germiston and Boksburg. Actual job proximity is likely underestimated in the west of the municipality, where residents will have easy access to Johannesburg, but this is an area of high job proximity within Ekurhuleni in any case. Peripheral areas which show high
unemployment in Figure 3.1 are the same areas which show low job proximity in Figure 3.3.

Figure 3.4 shows that a substantial part of variation in unemployment rates in Ekurhuleni can be explained by changes in job proximity, but not to as great an extent as can be found in Tshwane, for example. The lesser effect of spatial mismatch may be due to the municipality’s polycentrism. A move from Tembisa or Vosloorus to a central area such as Edenvale is associated with a decrease in unemployment rates of between 3 and 9 percentage points, when only the effect of job proximity changes is examined. As per Table 3, a 10 unit increase in job proximity is on average associated with a 3.03 percentage point decrease in small area unemployment rates, or equivalently a 10% increase in job proximity is associated with a 7.35% decrease in unemployment rates.
TABLE 3  City of Ekurhuleni

<table>
<thead>
<tr>
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<th>(Spec. 1) GLM unit changes UNEMPLOYMENT RATE</th>
<th>(Spec. 2) GLM % changes UNEMPLOYMENT RATE</th>
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</thead>
<tbody>
<tr>
<td>Proximity to jobs</td>
<td>-0.303*** (0.0268)</td>
<td>-0.735*** (0.0651)</td>
</tr>
<tr>
<td>(index)</td>
<td></td>
<td></td>
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<tr>
<td>Observations</td>
<td>4,603</td>
<td>4,603</td>
</tr>
</tbody>
</table>

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Control covariates not shown

FIGURE 3.4 City of Ekurhuleni spatial mismatch
4. ETHEKWINI

Our model suggests that job proximity is a significant determinant of unemployment in eThekwini.

The eThekwini Metropolitan Municipality centre of economic activity is focused around Durban Harbour and the Durban city centre immediately to its north. Its coast is to the east. The municipality is adjacent to the Msunduzi municipality along its north-west border, which includes Pietermaritzburg, but economic integration between these municipalities is not comparable with what is found in the Gauteng conurbation. Turok (2012) notes that eThekwini exhibits a particularly fragmented spatial form, and attributes this jointly to Apartheid policies of separate development (Umlazi and KwaMashu were part of the KwaZulu Bantustan), and to eThekwini’s particular “regional topography of undulating hills and valleys which complicate coherent physical development” (Turok, 2012:25). The municipality contains rural areas to the north-west and south-west, but is largely urban.

The picture of unemployment shown in Figure 4.1 is not as clear cut as it is the Gauteng municipalities, due to rural areas with a mixture of high and relatively low unemployment rates.
but when looking at urban areas a pattern becomes more apparent. Low unemployment rates prevail along the coast, in the centre around Durban harbour, and in a corridor extending north-west towards the wealthy suburbs of Kloof and Hillcrest. High urban unemployment is found in extremely peripheral areas such as Tongaat and Mpumalanga, but also in areas which though slightly less peripheral are certainly not part of the urban core, such as Umlazi and KwaMashu.

The jobs data in Figure 4.2 presents a stark mirror image to the spatial distribution of unemployment. Jobs are concentrated around Durban Harbour and along the coast, and also in a jobs corridor which extends north-west to the predominantly white suburbs including Kloof and Hillcrest. The extreme periphery shows few signs of any jobs, and the semi-peripheral Umlazi and KwaMashu exist outside the main jobs corridor.

Figure 4.3 emphasises the importance of the Durban city centre for proximity to jobs, though proximity to jobs scores are pulled somewhat north-west in line with the jobs corridor discussed above. The job proximity index doesn’t seem to fully capture the jobs
corridor pattern, however, probably because this corridor is not significant enough relative to the jobs of Durban central. True job proximity in the north-west may be slightly underestimated due to the exclusion of Pietermaritzburg jobs, but this is unlikely to have a significant effect due to the distance and relatively small size of Pietermaritzburg compared to eThekwini.

Figure 4.4 shows that significant variation in unemployment is explained by proximity to jobs in eThekwini. The size of the spatial mismatch effect is more comparable to what is found in Ekurhuleni than the very large effect identified in Tshwane, but Figure 4.4 shows a clear relationship between proximity to jobs and unemployment in eThekwini. A move to the urban core from the extremely peripheral Tongaat or Mpumalanga informal settlements is associated with an unemployment decrease of between 6 and 10 percentage points, while a move from Umlazi is associated with a 4 to 8 percentage point decrease in unemployment rates. Table 4 shows that a 10 unit increase in job proximity is on average associated with a 2.23 percentage point decrease in small area unemployment rates, or equivalently a 10% increase in job proximity is associated with a 4.95% decrease in unemployment rates.
TABLE 4  eThekwini Metropolitan Municipality

<table>
<thead>
<tr>
<th></th>
<th>(Spec. 1)</th>
<th></th>
<th>(Spec. 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLM unit changes</td>
<td></td>
<td>GLM % changes</td>
<td></td>
</tr>
<tr>
<td><strong>UNEMPLOYMENT RATE</strong></td>
<td></td>
<td><strong>UNEMPLOYMENT RATE</strong></td>
<td></td>
</tr>
<tr>
<td>Proximity to jobs</td>
<td>-0.223***</td>
<td>-0.495***</td>
<td></td>
</tr>
<tr>
<td>(index)</td>
<td>(0.0262)</td>
<td>(0.0584)</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>4,780</td>
<td>4,780</td>
<td></td>
</tr>
</tbody>
</table>

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Control covariates not shown

FIGURE 4.4  eThekwini Metropolitan Municipality spatial mismatch
5. MANGAUNG

Our model suggests that job proximity is a significant determinant of unemployment in Mangaung, though care must be taken when interpreting the results for this municipality. Mangaung is a recent addition to South Africa’s legislatively determined metropolitan municipalities, having been added only in 2011. It is unusual when compared to the other metropolitan municipalities in that it is decidedly less dense: Mangaung is the 35th densest municipal area in South Africa, and it is by far the least dense of the eight metropolitan municipalities. Mangaung’s low aggregate density comes about because the vast majority of the municipal area is made up of rural land. The urban areas of Bloemfontein and Mangaung Township (distinct from Mangaung metropolitan municipality as a whole), which collectively make up the area that is commonly understood to be

**FIGURE 5.1** Mangaung Metropolitan Municipality unemployment rates
the city, are very small geographically. The densely populated townships of Botshabelo and Thaba Nchu (formerly incorporated into the Qwa Qwa and Bophutatswana Bantustans respectively) are a considerable distance from the city centre, but without any economic base of their own there is regular commuting between these areas and Bloemfontein proper (SACN, 2011). The SACN calls Botshabelo a “classic example of displaced urbanisation” (2011:6). The disparities between the city proper and these densely populated but isolated areas makes analysis of spatial mismatch in Mangaung difficult, especially because of the vast expanses of rural land which make up the municipality. Care must be taken when interpreting the relevance of spatial mismatch results for the metropolitan municipality as a whole.

FIGURE 5.2 Mangaung Metropolitan Municipality job concentration
Figure 5.1 shows unemployment rates to be highest in Mangaung Township and the towns of Botshabelo and Thaba Nchu. While Mangaung Township is relatively close to the Bloemfontein city centre, Botshabelo and Thaba Nchu are far removed. The well-located areas of central Bloemfontein and its suburbs have low unemployment rates. Similarly to Tshwane, lower unemployment rates in the large rural areas around Bloemfontein are likely unrelated to employment prospects in this regions, but are more due to the unemployed tending to leave these areas for informal settlements.

Figure 5.2 present a picture where jobs are only seriously concentrated in the Bloemfontein city centre, with some jobs in its immediate surrounds. Botshabelo and Thaba Nchu show slightly higher jobs prevalence than are evident in the townships’ immediate rural surrounds, but very few jobs nonetheless.

Figure 5.3 adds little to the analysis, confirming as it does that Manguang is very monocentric when it comes to jobs.
### TABLE 5  Mangaung Metropolitan Municipality

<table>
<thead>
<tr>
<th></th>
<th>(Spec. 1) GLM unit changes</th>
<th>(Spec. 2) GLM % changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proximity to jobs (index)</td>
<td>-0.466*** (0.0350)</td>
<td>-0.713*** (0.0529)</td>
</tr>
<tr>
<td>Observations</td>
<td>1,307</td>
<td>1,307</td>
</tr>
</tbody>
</table>

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Control covariates not shown

---

**FIGURE 5.4** Mangaung Metropolitan Municipality spatial mismatch
and that Botshabelo and Thaba Nchu are very poorly located. Mangaung Township, while relatively well-located, has slightly worse proximity to jobs than Bloemfontein and its suburbs. This last nuance should not be over-emphasised, as the small area of the city proper and consequently small number of mesozones may distort the real distribution of jobs within the urban centre.

The extreme rurality of Mangaung, combined with its peculiar spatial form defined by the “displaced urbanisation” of Botshabelo and Thaba Nchu, means our graphic depiction of spatial mismatch needs to be interpreted with care. While Figure 5.4 shows changes in unemployment due to changing job proximity in the areas immediately surrounding Bloemfontein, the lack of significant actual variation in unemployment rates around the Bloemfontein city centre suggests that the main drivers of the changes are the towns of Botshabelo and Thaba Nchu. The low-density rural area between Bloemfontein and these towns, where actual unemployment does not vary significantly, cannot be well represented by predictions from a regression which models change in unemployment as a smooth and linear function of proximity to jobs. Table 5 shows that a 10 unit increase in job proximity is on average associated with a 4.66 percentage point decrease in small area unemployment rates, or equivalently a 10% increase in job proximity is associated with a 7.13% decrease in unemployment rates. The issue of these being average estimates presents a particular problem in Mangaung, where the urban dynamic of mismatch is applicable only to small parts of the municipality, and non-contiguous parts of the municipality at that.

However if low-density rural areas are disregarded, there is useful analysis to be had about the extent to which high unemployment in Botshabelo and Thaba Nchu is explained by poor proximity to jobs. Figure 5.4 suggests that the change in job proximity associated with a move from Botshabelo to the Bloemfontein city centre is on average associated with a decrease in unemployment rates of between 10 and 20 percentage points. There is significant evidence for spatial mismatch in Mangaung as a whole, but it needs to be interpreted carefully. It seems that part of the unemployment of residents of Botshabelo and Thaba Nchu can be explained by poor proximity to jobs, but little can be said about the remaining areas of the municipality, which are predominantly rural or well-located urban areas.
6. NELSON MANDELA BAY

Our model does not find statistically significant evidence to suggest that job proximity is a determinant of unemployment in Nelson Mandela Bay.

Nelson Mandela Bay is bordered by the coast to the east and south, with the Port Elizabeth city centre on Algoa Bay close to the south-east corner of the municipality. The municipality is not one of South Africa’s main economic centres, but it contains significant heavy industry. The Coega Industrial Development Zone is located on the municipality’s east coast, while the town of Uitenhage contains large factories which produce heavy industry goods such as automobiles. The municipality contains large amounts of rural land, but the centre and south-east are predominantly urban.

Figure 6.1 shows that while areas of high unemployment in Nelson Mandela Bay are very clearly delineated and separated from areas of relatively low unemployment, the pattern of peripheralisation so evident in other South African cities is not immediately apparent when looking at the municipality as a whole. It is clear that areas of low unemployment are concentrated in the city centre and the predominantly white suburbs of southern Port Elizabeth and of Uitenhage. Contrastingly, the areas of iBhayi, Bethelsdorp, Motherwell, KwaNobuhle and the north-west of
Uitenhage are the areas of highest unemployment in the municipality. However many of these areas are relatively close to each other at least in terms of direct distance.

The jobs data presented in Figure 6.2 show that the municipality has two predominant jobs centres: a primary node around the Port Elizabeth city centre, and a secondary node around Uitenhage. There is some evidence for a small jobs corridor extending along the east coast, though these jobs should not be overstated. The jobs data suggests that the areas of highest unemployment mentioned above are not particularly far away from jobs. iBhayi and Bethelsdorp are relatively close to the jobs of the city centre and the job corridor which moves along the east coast, while KwaNobuhle is close to the jobs of Uitenhage. Motherwell is likely the worst-located out of these areas, but is still close to the jobs of the east coast and is not very far away the Port Elizabeth city centre compared to what is found in other South African cities.

Figure 6.3 confirms what is to be expected with regard to job proximity, with little variation in job proximity across the urban parts of Nelson Mandela Bay, and some additional evidence for municipal polycentricity. The proximity of Motherwell to the City Centre may be overstated by our job proximity measure, as the Swartkops River presents...
a geographic barrier between these areas which our straight-line distance measure cannot account for. Nonetheless the descriptive graphics do not seem to suggest a strong relationship between job proximity and unemployment rates.

The lack of statistical significance of our spatial mismatch effect (indicated in Table 6) means that the changes in unemployment due to job proximity predicted in Figure 6.4 are unreliable, and should not have any spatial mismatch interpretation attached to them. It is noticeable, however, that the predicted effect is small in any case, and across the majority of the municipality changes in job proximity do not have a noticeable effect on unemployment. Even if the mismatch estimates were statistically significant, they would suggest that a 10 unit increase in job proximity would on average be associated with only a 0.38 percentage point decrease in small area unemployment rates, while a 10% increase in job proximity would be associated with only a 0.65% decrease in unemployment rates.

Lack of statistical significance suggests that there is insufficient evidence to conclude that there is a spatial mismatch effect; this is not the same as evidence of no spatial mismatch. As discussed in Sections 2.2.2 and 2.2.4, and in Appendix 1, our job proximity measure may be biased against finding mismatch. Nonetheless, this regression result together with the descriptive evidence in Figures 6.1 and 6.2 does seem to suggest that spatial mismatch is not a significant issue in Nelson Mandela Bay.
TABLE 6  Nelson Mandela Bay Metropolitan Municipality

<table>
<thead>
<tr>
<th>(Spec. 1) GLM unit changes</th>
<th>(Spec. 2) GLM % changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proximity to jobs (index)</td>
<td>-0.0380 (0.0520)</td>
</tr>
<tr>
<td></td>
<td>-0.0654 (0.0895)</td>
</tr>
<tr>
<td>Observations</td>
<td>1,803</td>
</tr>
</tbody>
</table>

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Control covariates not shown

FIGURE 6.4 Nelson Mandela Bay Metropolitan Municipality spatial mismatch
7. **BUFFALO CITY**

Our model suggests that job proximity is a significant determinant of unemployment in Buffalo City, though care must be taken when interpreting the results for this municipality.

Like Nelson Mandela Bay, Buffalo City has a considerable industrial base, especially in automobile manufacturing. The municipality is bordered by the coast to the south-east, and predominantly rural areas inland (with the exception of the town of Stutterheim to its north-west). Buffalo City is a recent addition to the list of legislatively determined metropolitan municipalities; like Mangaung, it was only added to this list in 2011. It is the second least dense out of the 8 metropolitan municipalities, and includes significant rural land. The municipality contains some significant settlements disconnected from the city centre of East London, such as Mdantsane, King Williams Town, and Bisho. The geography of the municipality is also somewhat restrictive, in that central East London is surrounded by rivers to the north and south.

Similarly to Kwazulu-Natal, the picture of unemployment in Buffalo City presented in Figure 7.1 is complicated by the presence of sparsely populated rural areas which have
highly variable unemployment rates. When focusing on urban areas, it becomes clear that the areas of lowest unemployment are around the East London city centre, and in King Williams Town. The disconnected areas of Mdantsane, Zwelitsha and Bisho, in contrast, have high unemployment rates.

Figure 7.2 suggests a weak polycentricism when it comes to jobs in Buffalo City. Jobs are mainly concentrated around the East London city centre (and especially along the coast), but there is also a second small jobs node in King Williams Town.

Figure 7.3 confirms the relatively centralised spatial form of Buffalo City’s economic activity. Though there is some localised economic activity in King Williams Town, this is not significant in the broader municipal context. Mdantsane has better proximity to jobs than far-flung Bisho, but the north of the township is still significantly different from central East London areas. Any benefit that Mdantsane residents receive from proximity to King Williams Town is not significantly reflected in our job proximity measure.

Similarly to the case of Mangaung, care must be taken when interpreting the implications...
of Figure 7.4 for unemployment explained by job proximity when looking to the north and west of East London, as these are predominantly rural areas. Instead, it is useful to see that proximity to jobs explains a significant amount of the difference in unemployment between central areas and the far-flung Mdantsane and even more peripheral Bisho. Figure 7.4 suggests that a move from these areas to the East London city centre is associated with a decrease in unemployment rates of between 4 and 12 percentage points. Table 7 indicates that a 10 unit increase in job proximity is on average associated with a 3 percentage point decrease in small area unemployment rates, or equivalently that a 10% increase in job proximity is associated with a 3.34% decrease in unemployment rates.
**TABLE 7** Buffalo City Metropolitan Municipality

<table>
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<tr>
<td>GLM</td>
<td>unit changes UNEMPLOYMENT RATE</td>
<td>% changes UNEMPLOYMENT RATE</td>
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<tr>
<td>Proximity to jobs (index)</td>
<td>-0.300*** (0.0568)</td>
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<td>Observations</td>
<td>1,383</td>
<td>1,383</td>
</tr>
</tbody>
</table>

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1
Control covariates not shown

**FIGURE 7.4** Buffalo City Metropolitan Municipality spatial mismatch
8. CITY OF CAPE TOWN

Our model does not find statistically significant evidence to suggest that job proximity is a determinant of unemployment in the City of Cape Town, but we argue that are a number of factors which prevent us from drawing conclusions on spatial mismatch in Cape Town.

The City of Cape Town is a major economic hub in South Africa, and is the second most populous metropolitan municipality nationally. It has a particularly irregularly-shaped municipal boundary, constrained as it is by the coast to the south and west, and the Cape Winelands and mountain ranges to the east. It is a predominantly urban municipality. There are some rural areas north of Durbanville and Blouberg, though the extreme northern periphery includes the urban area of Atlantis. A significant geographical feature of the municipality is the mountain range which forms the spine of the Cape Peninsula, and culminates in the north with Table Mountain overlooking the Cape Town city centre. This mountain range intrudes significantly into the Cape Town urban landscape, and areas to the west of the mountain range such as Hout Bay are
URBAN JOBS

significantly isolated from the rest of the city.

Figure 8.1 shows that high unemployment in Cape Town is predominantly located in the south-east “Cape Flats”, made up areas such as Mitchells Plein, Khayelitsha, and Nyanga, and in the extreme north in Atlantis. The city centre, the Atlantic seaboard to the west of the city centre, the predominantly white “southern suburbs” which hug the eastern side of the Table Mountain range, and the “northern suburbs” of Blouberg and Durbanville all exhibit relatively low unemployment rates.

Figure 8.2 indicates that jobs are heavily concentrated in the Cape Town city centre, but also extend eastwards and south-west in two different jobs corridors. The eastwards jobs corridor includes areas such as Goodwood and Bellville, while the south-west corridor follows the contours of the Table Mountain range, into the southern suburbs. The areas of relatively low jobs intensity are the south-east Cape Flats, and in the peripheral north with Atlantis. Comparison with Figure 8.1 suggest that it is precisely these areas which have
disproportionately high unemployment rates relative to the rest of the municipality.

Figure 8.3 presents a picture where job proximity does not vary significantly across Cape Town except when looking at extreme peripheral areas such as Atlantis. This needs to be interpreted with caution. Cape Town’s natural geography confounds our straight-line measure. A straight line from Cape Town city centre to Mitchell’s Plain passes over the Devil’s Peak mountain, while a straight line from the city centre to Atlantis passes over Table Bay. Actual commuting patterns will, in many cases, be significantly longer than our straight-line distance. The Cape Town city centre is in reality relatively isolated from the rest of the municipality due to the mountain and coastal geography, which our jobs proximity measure cannot show.

Table 8 shows that a positive relationship between job proximity and unemployment rates is statistically significant below the 10% level, but not at the 5% level (and therefore not at the 1% level). In this case it is ambiguous as to whether the result should be accepted as statistically significant. The direction of the relationship is counter-intuitive and somewhat perplexing – it suggests that living close to jobs will increase unemployment rates.
### TABLE 8  City of Cape Town

<table>
<thead>
<tr>
<th>Proximity to jobs (index)</th>
<th>(Spec. 1) GLM unit changes UNEMPLOYMENT RATE</th>
<th>(Spec. 2) GLM % changes UNEMPLOYMENT RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.0278*</td>
<td>0.0963*</td>
</tr>
<tr>
<td></td>
<td>(0.0165)</td>
<td>(0.0571)</td>
</tr>
<tr>
<td>Observations</td>
<td>5,324</td>
<td>5,324</td>
</tr>
</tbody>
</table>

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Control covariates not shown

### FIGURE 8.4 City of Cape Town spatial mismatch
It is difficult to think of a plausible explanation for this effect, and it instead may be an indicator that our model does not work very well in Cape Town. It is not unusual for statistically insignificant results to have the “wrong” sign in applied empirical work, and this can be more indicative of limitations in the underlying model than it is of an inexplicable reality. However this question is somewhat moot, as according to the estimates from our model depicted in Figure 8.4, even if the relationship between proximity to jobs and unemployment is accepted as true and statistically significant, the size of the effect is very small. Figure 8.4 suggests that proximity to jobs plays essentially no role in explaining unemployment in Cape Town. Even if the results in Table 8 are taken to be statistically significant, they suggest that a 10 unit increase in job proximity would on average be associated with only a 0.27 percentage point increase in small area unemployment rates, while a 10% increase in job proximity would be associated with only a 0.96% increase in unemployment rates.

At face value however this research suggests that there is no reason to think that spatial mismatch manifests in Cape Town. However in light of the weaknesses of our job proximity variable (which will be
exacerbated by Cape Town’s irregular physical geography), and the significant existing work which suggests spatial mismatch in Cape Town (Turok, 2001; Rospabe & Selod, 2006; Sinclair-Smith & Turok, 2012), a prudent interpretation of our evidence is to remain agnostic about the existence of spatial mismatch in the city. It is true that the Cape Flats, where most unemployment is found in Cape Town, is actually in quite close physical proximity to the two Cape Town jobs corridors, relative to other major metropolitan municipalities. However this physical proximity may not be translating reliably into shorter commuting times, partly because of physical geography and secondly because highway systems accessible to Cape Flats residents do not travel directly to these corridors. Preliminary evidence for this is found in Rospabe and Selod (2006). Their measure of direct physical proximity to jobs (which they call “local employment density”) is not a significant predictor of unemployment rates in Cape Town (as we find in our work), but their measure of actual commuting distances (which we do not have in our work) is significantly related to unemployment probability, below the 10% significance level (which they accept as statistically significant). In their words:

“The effect of local employment density is not significant, whereas the average commuting distance of workers surveyed in the ‘migration study’ and living in the EA [Enumerator Area, a Census area similar to our small areas] plays a positive and significant role in the unemployment probability. This means that controlling for all other variables, individuals who reside in EAs where employed workers occupy jobs far away are more likely to be unemployed.”

(Rospabe & Selod, 2006:278)

This suggests that commuting distances are not well approximated by straight-line distances in Cape Town, and that longer actual commuting distances are indeed related to higher unemployment rates. The result of our analysis is to find no evidence for spatial mismatch in Cape Town, but given past evidence on mismatch in the city and the identified weaknesses of our measure (which seem to be particularly consequential in Cape Town), we remain undecided about the extent to which spatial mismatch manifests in the city. It seems that data on actual commuting times may be necessary for a full analysis of mismatch in Cape Town.
9. RESULTS FOR GAUTENG PROVINCE

Our model suggests that job proximity is a major determinant of unemployment in Gauteng Province.

Gauteng Province constitutes the economic centre of South Africa. Despite being the smallest province geographically, it is the only province to contain more than two metropolitan municipalities. It is by far the most urban province, and many of these urban areas are significantly connected to each other, despite being in separate municipalities. The municipalities of Johannesburg and Ekurhuleni could quite easily be seen as one (very large) city, and this may extend to including Tshwane. In any case, Gauteng is certainly a large conurbation, and given the inability of our job proximity variable to take into account jobs in neighbouring municipalities when examining one municipality at a time, there is use in evaluating Gauteng Province as a whole. Despite being the most urban province in South Africa, Gauteng still incorporates significant rural land, in the north-east, south-east, and the periphery of the south-west.

The areas of lowest unemployment depicted in Figure 9.1 are concentrated mainly around the centre of the municipality. Low unemployment rates are evident in the centre-east in the urban...
centres of Ekurhuleni, and extend northwards from the Johannesburg city centre to the city’s northern suburbs, and through Sandton and Midrand to Pretoria. Though there are pockets of high unemployment within this region, such as Diepsloot, it is mainly the “semi-peripheral” areas which surround the economic centre which have very high unemployment rates, such as Randfontein, Soshanguve, and Daveyton. The extreme rural periphery of the province has somewhat lower unemployment rates than the semi-periphery, but this is likely related to the endogeneity issue outlined in Appendix 1, where the extremely peripheral unemployed will move to the easily accessible semi-periphery in search of jobs.

Figure 9.2 shows that jobs are concentrated in the centre of Gauteng, specifically around Johannesburg, its northern suburbs, and the job centres of Ekurhuleni. However a significant jobs corridor extends northwards from Johannesburg through Midrand to Pretoria. Outside of this jobs corridor and the central Johannesburg-based jobs, there is relatively little else to be found in the province, and there is a sharp contrast between the jobs of the centre and the lack of jobs evident in the semi-periphery.
Figure 9.3 confirms the centrality of Johannesburg and its northern suburbs when it comes to job proximity, but also shows the northern jobs corridor discussed above. It is interesting that our jobs proximity measure implies somewhat similar proximity to jobs for Soweto and the Pretoria city centre. As mentioned above Soweto is relatively well-situated for a major South African township, but this similarity in proximity to jobs is likely more an indication of the limitations in our jobs proximity measure than indicative of any substantive comparability. The issue identified in Section 3.2.4, where Diepsloot’s proximity to jobs was underestimated in our Johannesburg-specific analysis, is better resolved in this Gauteng-wide picture - its measured proximity to jobs is much higher here, now having taken into account jobs to the north.

Figure 9.4 shows clearly the effect of job proximity on unemployment, and it shows that this effect is large in practical terms. A move from Orange Farm or Soshanguve to the Johannesburg city centre is associated with a decrease in unemployment rates of between 8 and 14 percentage points. Table 9 shows that a 10 unit increase in job proximity is on average associated with a 3.04 percentage point decrease in small area unemployment rates, or equivalently a 10% increase in job proximity is associated with an 8.99% decrease in unemployment rates.
<table>
<thead>
<tr>
<th></th>
<th>(Spec. 1) GLM unit changes</th>
<th>(Spec. 2) GLM % changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proximity to jobs (index)</td>
<td>-0.304***</td>
<td>-0.899***</td>
</tr>
<tr>
<td></td>
<td>(0.00912)</td>
<td>(0.0270)</td>
</tr>
<tr>
<td>Observations</td>
<td>17,806</td>
<td>17,806</td>
</tr>
</tbody>
</table>

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Control covariates not shown

FIGURE 9.4 Gauteng Province spatial mismatch
10. RESULTS FOR JOHANNESBURG-EKURHULENI-TSHWANE

The possibility that urban mismatch is underestimated in Gauteng, because of outlying rural areas, motivates for an analysis which looks only at its major interconnected urban centres of Johannesburg, Ekurhuleni, and Tshwane. As mentioned above, these municipalities can potentially be seen as one large city, or at least as one large conurbation. They comprise 3 of the top 5 most populous municipalities in South Africa and are significant economic centres. Their adjacency means they are significantly interconnected, with for example the high-speed Gautrain serving only these 3 municipalities, and with plans for line extensions not extending beyond the Johannesburg-Ekurhuleni-Tshwane region. Large rural areas in the east of Tshwane mean that the north-east of the Johannesburg-Ekurhuleni-Tshwane region contains significant rural land, but it is nonetheless a very urban area as a whole.

Figure 10.1 shows that similarly to the case of Gauteng Province as a whole, unemployment rates are very low in central areas of Johannesburg, in Ekurhuleni’s main urban areas, and in a corridor which extends north-south between Johannesburg and Pretoria. Semi-
FIGURE 10.2 Johannesburg-Ekurhuleni-Tshwane job concentration

Peripheral surrounding areas such as Soweto, Katlehong, Tembisa and Soshanguve have very high unemployment rates. The extreme periphery, which is predominantly rural land, has intermediate levels of unemployment, likely due to the ease of urban in-migration discussed in Appendix 1.

Figure 10.2 depicts Johannesburg-Ekurhuleni-Tshwane jobs as concentrated around Johannesburg’s city centre and its northern suburbs, and then extending upwards in a jobs corridor to Pretoria. To the immediate east of Johannesburg, the jobs of Ekurhuleni’s major urban centres are also apparent. The semi-peripheral south and east show few jobs, as does the north-west of Tshwane. The few jobs in the extremely peripheral north-east of Johannesburg-Ekurhuleni-Tshwane are to be expected, given the region’s rurality, but indicate little about the conurbation’s urban structure.

Job proximity as shown in Figure 10.3 reflects what is to be expected based on the underlying data, and is similar in its pattern to Gauteng-wide job proximity shown in Figure 9.3. The areas of highest proximity to jobs are Johannesburg and its northern suburbs, but there is a clear
skewness of job proximity upwards towards Pretoria. Areas of high unemployment such as Tembisa and Diepsloot have good proximity to jobs according to this measure, while more peripheral urban areas such as Soshanguve, Orange Farm, and Katlehong have low proximity.

Figure 10.4 shows that there is a significant negative relationship between job proximity and unemployment rates in Johannesburg-Ekurhuleni-Tshwane. This indicates firstly that Gauteng municipalities outside the region seem to add little in the way of jobs compared to the Johannesburg-Ekurhuleni-Tshwane municipalities, and secondly that the potential for underestimating spatial mismatch due to extremely peripheral areas may not be as great as previously discussed. Similarly to what is suggested in our Gauteng analysis, a move from Orange Farm or Soshanguve to the Johannesburg city centre is associated with a decrease in unemployment rates of between 9 and 15 percentage points. This is slightly higher than what is predicted when looking at Gauteng as a whole, but is nonetheless very similar. Table 10 shows that a 10 unit increase in job proximity is on average associated with a 3.17 percentage point decrease in small area unemployment rates, or equivalently a 10% increase in job proximity is associated with a 9.92% decrease in unemployment rates.
TABLE 10  Johannesburg-Ekurhuleni-Tshwane

<table>
<thead>
<tr>
<th></th>
<th>(Spec. 1) GLM unit changes</th>
<th>(Spec. 2) GLM % changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proximity to jobs (index)</td>
<td>-0.317*** (0.0104)</td>
<td>-0.992*** (0.0323)</td>
</tr>
<tr>
<td>Observations</td>
<td>14,907</td>
<td>14,907</td>
</tr>
</tbody>
</table>

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Control covariates not shown

FIGURE 10.4  Johannesburg-Ekurhuleni-Tshwanespatial mismatch
3.5 Conclusion

The city by city analysis presented in this section shows that there is strong evidence that living far away from work reduces people’s employment prospects in most of South Africa’s main urban centres, as well as in the larger regions of Gauteng Province and Johannesburg-Ekurhuleni-Tshwane. Distance from jobs in these areas is correlated with higher unemployment rates, when controlling for a number of demographic and other characteristics. This relationship is practically important: even in regions with relatively small mismatch effects, these effects explain a significant part of existing unemployment in peripheral areas.

The results are summarised opposite in Table 11. The nature of our job proximity variable means that the sizes of the effects reported in the first two “Effects” columns cannot be compared between different municipalities or regions. A one-unit or 10-unit (or indeed a 1% or 10%) change in job proximity will mean something different in each municipality or broader region, and therefore the sizes of the effects are not directly comparable. As discussed in Text Boxes 5 and 6, in order for these numbers to be given meaning, they need to be read in conjunction with maps of the areas they represent. Table 11 shows that we find significant evidence of spatial mismatch in the majority of South Africa’s metropolitan municipalities, and in Gauteng Province and the Johannesburg-Ekurhuleni Tshwane region.
We use a method for measuring proximity to jobs which has not been applied in this country before, and present city by city spatial mismatch estimates for the first time. The clear evidence for spatial mismatch has potential policy implications across a number of sectors. In the proceeding section we focus on the housing and planning implications that we derive from the research findings.

### Table 11: Effects: Proximity to Jobs on Unemployment Rates

<table>
<thead>
<tr>
<th>City/Region</th>
<th>Unit Changes</th>
<th>% Changes</th>
<th>Evidence of Spatial Mismatch?</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Johannesburg</td>
<td>-0.238***</td>
<td>-0.771***</td>
<td>Yes</td>
</tr>
<tr>
<td>City of Tshwane</td>
<td>-0.320***</td>
<td>-0.995***</td>
<td>Yes</td>
</tr>
<tr>
<td>City of Ekurhuleni</td>
<td>-0.303***</td>
<td>-0.735***</td>
<td>Yes</td>
</tr>
<tr>
<td>eThekwini Metropolitan Municipality</td>
<td>-0.223***</td>
<td>-0.495***</td>
<td>Yes</td>
</tr>
<tr>
<td>Mangaung Metropolitan Municipality</td>
<td>-0.466***</td>
<td>-0.713***</td>
<td>Yes</td>
</tr>
<tr>
<td>Nelson Mandela Bay Metropolitan Municipality</td>
<td>-0.0380</td>
<td>-0.0654</td>
<td>No</td>
</tr>
<tr>
<td>Buffalo City Metropolitan Municipality</td>
<td>-0.300***</td>
<td>-0.334***</td>
<td>Yes</td>
</tr>
<tr>
<td>City of Cape Town</td>
<td>0.0278*</td>
<td>0.0963*</td>
<td>No, but inconclusive</td>
</tr>
<tr>
<td>Gauteng Province</td>
<td>-0.304***</td>
<td>-0.899***</td>
<td>Yes</td>
</tr>
<tr>
<td>Johannesburg-Ekurhuleni-Tshwane</td>
<td>-0.317***</td>
<td>-0.992***</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*** p<0.01, ** p<0.05, * p<0.1

Control covariates not shown

For further detail see Tables 1 to 10
The research undertaken in this report suggests that housing location is an important determinant of employment prospects. Living closer to jobs seems to increase people’s chances of finding employment, but well-located areas are unaffordable for the poor. Peripheral location is therefore a type of poverty trap, as peripheral location, itself partly caused by poverty, makes poverty exit more difficult. The national housing subsidy scheme, were it more strategically deployed, is an example of how state intervention could make significant inroads into resolving this problem, something which the private sector cannot do. Ironically, the peripheral location of subsidy housing projects means that one effect of the housing subsidy programme has instead been to entrench poverty.

The spatial mismatch research findings presented in this report make a case for recapturing the national housing subsidy programme as a pro-poor intervention. Human settlements policy currently over-emphasises the asset-based potential of ownership housing to exit poverty. A more important poverty reducing objective would be to contribute to reversing the jobs/housing mismatch prevalent in South Africa’s cities, requiring a renewed emphasis for the programme on providing opportunities for poor and working class people to live close to jobs. This conclusion by itself however still allows for a wide variety of policy conclusions: chapter 4 seeks to
address two key policy questions raised by the analysis contained in the report. Firstly, what kind of urban spatial form and spatial policy is best-suited for matching housing with jobs? Secondly, what are some of the key characteristics required of affordable housing policy?

4.1 Intensive vs extensive development

While the spatial mismatch hypothesis suggests that housing policy’s poverty-reducing emphasis should be to reduce unemployment by aiming to ensure that housing and jobs are near to each other, what it does not indicate by itself is that if given the dysfunctional spatial form which exists in South Africa’s cities, whether job-housing matching is better achieved by creating new housing close to existing jobs, or creating new jobs close to existing housing. In practical terms, choosing between a “housing to jobs” or “jobs to housing” approach in South Africa means choosing between intensive or extensive urban development respectively.

Intensive development entails focusing policy on already-developed and well-located parts of the city, to take advantage of the infrastructure and economies which already exist in these places. Development here is about creating new housing close to the urban core, increasing densities, and improving public transport between residential and employment centres (Turok, 2016). Extensive development means development on the periphery, far from the urban milieu and the vested interests and idiosyncrasies which characterise already built-up areas. Extensive developments typically occur on unused “green-field” sites, and theoretically allow for the construction of well-structured urban settings starting from a blank slate.

In reality, however, extensive developments in South Africa are very unlikely to result in functional urban forms which resolve issues of spatial mismatch. The agenda of extensive development in South Africa is embodied in a recent push by the National Department of Human Settlements, as well as some provincial governments and private developers, for housing “mega-projects”, where massive housing developments are to be constructed on green-field sites mainly on urban peripheries. The logic of these developments is firstly that they will deliver housing units more quickly and efficiently
than could be done in already built-up urban areas, and secondly that by attracting significant private investment they will become economically self-sufficient, and thus resolve any issues of mismatch or high transport costs.

There is, however, very little reason to think that these mega-projects will in practice end up any different from the RDP dormitory settlements which are so indicative of the failure of post-1994 housing policy. As is detailed in the technical report government attempts to redirect private sector investment spatially have consistently failed throughout South Africa’s history, and the lack of any coherent plan to achieve this goal in the case of mega-projects makes the mega-projects visions all the more implausible. Other criticisms have been levelled at the strategy of extensive development generally and mega-projects in particular, with the National Treasury, the National Department of Cooperative Governance and Traditional Affairs (COGTA), and a broad range of South African academics and planners arguing that even if mega-projects could be implemented successfully (and they argue that this is extremely unlikely), the spatial form entailed by extensive development is undesirable from a household, economic, transport, environmental, and financial point of view (Cirolia, 2014; City of Johannesburg, 2016; Royston & Shawkat, 2015; Turok, 2015; 2016).

An intensive development and consolidation agenda, focused on opening up existing well-located areas to the poor, is the more preferable strategy. This would entail brown-field development, which can be more complicated to implement than is the case with green-field projects, but has much greater potential for long-term payoffs. South Africa’s well-located urban centres generate a variety of economic and social benefits, or what Turok (2016) calls an “urban premium”, and housing policy should seek to expand access to these benefits. There is little reason to believe that mega-projects built on city peripheries will successfully be able to attract jobs and industry, and it is likely that they will instead simply entrench peripheral poverty and disconnectedness. Housing policy which moves people closer to the city, in contrast, will by definition improve proximity to jobs, and social amenities.
4.2 Well-located affordable housing

Countering spatial mismatch will be best accomplished by opening up housing opportunities for the poor in existing well-located areas, close to jobs. A necessary question concerns what policies are necessary to open up access to housing in this way. This section notes some aspects of affordable housing policy which are important in the South African context (discussed more fully in the technical report).

In the popular discourse around well-located housing in large cities such as Johannesburg, the conventional emphasis is on provision of affordable rental accommodation in the inner city. This is well justified, as our spatial mismatch analysis shows that central city regions are generally close to jobs and on average will be associated with lower unemployment rates. The value of living in the inner city is reiterated by inner city residents themselves, who say that the primary advantage of the region being able to find work more easily and paying low (or no) transport costs (Mayson & Charlton, 2015). These advantages of the inner city are contrasted with an extreme shortage of affordable accommodation, at least in Johannesburg (Tissington, 2013). Formal private rental accommodation excludes a vast part of the city’s population, while even social housing is often too expensive. Where formal housing is affordable, it is under-supplied. The implication is that more formal affordable accommodation needs to be developed in Johannesburg’s inner city and likely the inner cities of other major metropolitan municipalities.

While this report focuses mostly on the economic dimensions of location, the concept of well-located housing when it comes to policy must go significantly beyond this. It is of course the case that well-located housing will be close to jobs, but it should also be close to social amenities and public spaces which allow for recreation in the city. As inner cities across South Africa have declined, the best-serviced and most beneficial areas of the cities have become the suburbs (Pieterse, 2009; Turok, 2012). These suburbs however remain overwhelmingly white and wealthy, and indeed a number of quasi-legal mechanisms are employed by suburban residents to keep these enclaves separate from the rest of the city. Housing policy should focus on
providing affordable housing in inner cities and other areas close to economic activity, but this does not mean it should shy away from more direct attempts at mixed-income developments in well-off suburbs, which are almost invariably close to jobs and have better-than-average social amenities. Mixed-income development in general is important, to avoid ghettos which may be relatively well-located but have little local investment and no cross-subsidisation.

While its affordability for poor residents is still unclear (a major issue), a promising initiative in this vein currently underway is the City of Johannesburg’s “Corridors of Freedom” project, which seeks to connect disparate parts of the city by efficient public transport, and then develop mixed-income housing and various commercial activities at specific nodes along these transport corridors.

The City of Johannesburg (2013), in its Inner City Transformation roadmap, acknowledges the urgent need for a rental sector which provides formal housing at between R300 and R600 per month. SERI’s view is that the large-scale provision of affordable rental accommodation requires publicly-provided rental accommodation (SERI, 2016). Rental accommodation will be a key part of any kind of city densification strategy, but the private market and social housing sector cannot provide rental housing at the scale needed for poor residents. Public rental accommodation will need to have a variety of rental charges and typologies which cater to more than just the top end of the affordable-housing market, will need flexible administrative processes which can make allowances for the reality of precarious incomes, and, importantly, will need to be based on public ownership of housing stock. Public rental accommodation is an ambitious political target in a time when many state functions are increasingly outsourced (PARI, 2014), but there is little alternative if South Africa’s cities are going to perform the developmental role they need to in reducing poverty and stimulating growth and mobility.
4.3 Spatial justice and urban planning

Our research findings also have urban planning implications, particularly for how to understand the concept of spatial justice. Whether one uses the social/spatial relations definition of spatial justice favoured by academics, or the historically-centred definition favoured by the South African state, this research shows that spatial mismatch is a straightforward example of spatial injustice. Spatial mismatch as a poverty trap clearly entrenches and produces unjust social outcomes, while the genesis of spatial mismatch in deliberately anti-black and segregationist Apartheid urban policy creates an historical imperative for reform.

Undoing the jobs/housing mismatch should be central to any efforts that provincial and municipal governments make at applying the “spatial justice” principle in SPLUMA, in spatial development frameworks, municipal bylaws and land development decisions. Matching jobs and housing should be a cornerstone of a spatial justice definition. By quantifying the size of spatial mismatch, something new in the South African context, this research offers a benchmark against which progress towards one aspect spatial justice can be measured.

If new work, using data from some time in the future, finds no statistically significant spatial mismatch effect in cities which currently show evidence of mismatch, this provides some evidence of progress towards spatial justice. Similarly, if future work finds that the size of the spatial mismatch effect becomes smaller over time, this may constitute evidence of progress towards spatial justice. Conversely, future work which shows persistence of statistically significant spatial mismatch with a large effect size, would be evidence of entrenched and unchanged spatial injustice.

It is of course the case that while matching housing and jobs may be a necessary condition for spatial justice, “spatial matching” cannot by itself be seen as a sufficient condition. This report focuses on access to economic opportunities, but it is not just this which is unequally distributed across South Africa’s cities. Access to social amenities such as schooling, healthcare, policing services and recreation areas are also sharply delineated across various class, racial and spatial boundaries, and a full definition of spatial justice will be sensitive to the need for equity in these areas too. Nonetheless, we conclude that our spatial mismatch findings can contribute to defining spatial justice, and thus the development of criteria for holding the state and private sector to account.

The development of a justiciable commitment to spatial justice opens up new opportunities for activists and advocacy organisations to push further for spatial transformation. Without knowing what spatial justice means, legal and policy commitments to the principle lose much of their potential. We conclude that the eradication of spatial mismatch is a prerequisite for the establishment of spatially just cities in South Africa, and that state policy committed to spatial justice must reflect this policy agenda.
Section 5 Conclusion

The primary contribution of this research is in statistically quantifying the effect that distance between housing location and job location has on unemployment rates. A significant part of existing unemployment in most of South Africa’s cities can be explained by distance from jobs. This is not a surprising finding, but it is the first national and city-specific study of its kind in South Africa, and is the first to attempt to quantify the size of the effect that location has on unemployment rates.

South African poverty is often chronic and particularly difficult to exit, with substantial evidence showing that there are significant structural causes which keep poor people poor. Our analysis of spatial mismatch suggests that across almost all of the urban areas we examine, city structure is one of these determinants of chronic poverty, and spatial mismatch, caused by city structure, is a quintessential poverty trap. Spatial mismatch is of course just one determinant of poverty in South Africa. Our analysis suggests that it is a substantial determinant, but poverty in South Africa has many structural causes and is difficult to escape. An argument for the importance of location, which this paper puts forward, should not be misconstrued as a silver bullet for issues
of unemployment and poverty. Spatial mismatch is nonetheless an important factor in explaining South African unemployment and therefore poverty.

The National Housing Programme has the potential to make a significant contribution to undoing spatial mismatch, were it to be based on city densification and intensive development, rather than extensive development which by design will increase urban sprawl. In this context we conclude that housing mega-projects and new towns development should be opposed, both because the spatial form they envision is undesirable, and because they are likely to fail and entrench peripheral housing for poor and black people. Instead, housing policy should focus on the implementation of well-located affordable public rental and ownership accommodation, in inner cities and city suburbs. We argue that this strategy will make an important contribution towards fulfilling the vision of spatial justice contained in post-apartheid law and policy. We conclude that spatial mismatch is a significant starting point for defining the principle of spatial justice and for developing an indicator against which progress towards spatial justice should be measured.

This research should also be understood as a starting point. The maps and quantitative work presented here in effect provide a base layer upon which more detailed and context-specific themes can be investigated. It may be useful, for example, to investigate municipal Spatial Development Frameworks and examine what the implications of our spatial mismatch findings are for each of those plans. It would be interesting to examine the location of existing RDP settlements in the context of this analysis, and similarly it would be useful to see how the planned Gauteng mega-projects fit into our Gauteng results. Overlaying other data such as land prices, education levels, and poverty incidence onto our spatial mismatch maps may also provide interesting insights. Ultimately, there is certainly scope for this work to be used in more localised analysis of city or region-specific conditions and practices.

Over twenty years into democracy, much more needs to be done to reverse the spatial mismatch effect. Policy tools, like the National Housing Subsidy Programme, and legally-binding development principles, such as spatial justice, already exist. Spatial mismatch is a measure to hold the state accountable in one area of structural poverty that traps people on the margins of the economy and keeps them on the outskirts of our cities.
REFERENCES


APPENDIX 1

Model details

Our models are estimated using Papke & Wooldridge’s (1996) fractional logistic regression, which is a type of Generalized Linear Model (GLM). This GLM is our preferred specification primarily because our dependent variable (the broadly defined unemployment rate of each small area) is bounded by the values of 0% and 100%, which makes standard Ordinary Least Squares (OLS) regression inappropriate. The estimates presented in Tables 1 to 10 are “marginal effects at the mean.”

The covariates we control for are the percentage of the small area which is white, the percentage female, the percentage of residents who live in a defined urban area, mean age in the small area, the square of mean age, and total small-area population. The effects we estimate for the “proximity to jobs” variable are therefore the part of broadly defined small-area unemployment explained by proximity to jobs when race, sex, urbanity, age and size of population are held constant across the region of interest (for example Johannesburg). The effects associated with these covariates are not reported in our regression results, but are included in all of our regressions.

Model weaknesses

There are deficiencies in our model which must be considered. Firstly, we exclude mean years of education in the small area from our regressions. This variable must be excluded because it is highly correlated with proximity to jobs across the areas we examine. This leads to the technical problem of multicollinearity, which renders the effects associated with our proximity to jobs variable nonsensical or impossible to determine. The most straightforward way to deal with multicollinearity is to remove the variable which causes the issue, and we therefore do not include mean years of education as one of our control covariates. This is not an ideal solution.

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10 We nonetheless present estimates using OLS regression for the sake of comparison with our GLM estimates in our technical report.
11 Full regression results are available in the Technical Appendix to our technical report.
12 The intuition behind why multicollinearity is a problem is that if education and proximity to jobs are highly correlated, it becomes difficult to estimate the effect that proximity to jobs will have on unemployment while education remains constant, because the correlation between education and proximity to jobs means education doesn’t stay constant while proximity to jobs changes.
solution, but we are nonetheless left with little choice in this matter. If it is the case that peripheral areas tend to have lower education levels on average than central areas, and if lower levels of education are related to higher unemployment rates, the exclusion of education from our model may cause us to overestimate the effects of spatial mismatch. These are two very plausible assumptions. However if it is the case that areas far from jobs have low education because peripheral areas tend to lack decent social amenities such as good schools (another plausible assumption), we may not want to control for the effect that education has on unemployment rates, as this is a spatial consequence which can be seen as part of the mismatch phenomenon.\textsuperscript{13} An examination of these causal mechanisms and their policy implications requires further work which is beyond the scope of this report.

A second and likely more fundamental issue concerns the method of regression analysis. Ihlanfeldt and Sjoquist (1998) note that spatial mismatch models typically face a number of constraints which cause mismatch effects to be underestimated in the United States. A primary issue related to this which is relevant in the South African context concerns what is called “endogeneity”. In the South African context this may manifest in at least two ways. Rural areas, which are generally extremely peripheral in the context of metropolitan municipalities, tend to have lower unemployment rates than informal settlements, which can be considered “semi-peripheral” to urban centres. However lower unemployment rates in these extremely peripheral rural areas cannot plausibly be caused by better employment prospects than there are in “semi-peripheral” urban areas.\textsuperscript{14} A more likely cause is that the rural unemployed know that there are extremely limited job opportunities in the extreme periphery, and thus if looking for work they are better served by moving to semi-peripheral informal settlements. Unlike moving to well-located formal areas, which as explained above is very costly and difficult, moving to semi-

\textsuperscript{13} We do find that even when controlling for mean household income, percentage white, percentage female, percentage urban, mean age and mean age squared, our proximity to jobs variable is still a statistically significant determinant of mean years of education in the vast majority of our areas of analysis.

\textsuperscript{14} Rural-specific but not distance-related issues such as the increased prevalence of subsistence farming and therefore self-employment should be captured and controlled for in the “proportion urban” variable we include in our regression model.
peripheral informal settlements is relatively cheap, and South Africa's informal settlements absorb significant rural in-migration (Turok & Borel-Saladin, 2016). This will cause unemployment rates to be higher in the semi-periphery than in the extreme periphery, but not because extremely peripheral areas have better employment prospects. It will rather be because the unemployed disproportionately choose to be in informal settlements (rather than the extreme periphery). We cannot statistically control for this phenomenon, and this will cause spatial mismatch effects to be underestimated in regions with large peripheral rural areas, as it undermines the distance-employment prospects effect we try to isolate.

There may, conversely, be an endogeneity effect which works in the opposite direction. If it is the case that the people in informal settlements who get jobs tend to move to better-located areas after finding work, the negative relationship we find between unemployment rates and job proximity may not fully be because people who are far from jobs struggle to find employment, but simply because those who have jobs have moved away from these distant locations, leaving behind disproportionately the unemployed. This would cause our mismatch effects to be overestimated. This issue is unlikely to be as serious as the underestimation mentioned above, however, because it remains quite difficult for people to move “up a housing ladder” in South Africa, as discussed in detail in the technical report. Additional constraints such as racial discrimination in the urban formal housing market and persistent effects of Apartheid urban planning (Rospabe and Selod, 2006) will likely also reduce housing mobility for low-income black people, thus mitigating the seriousness of this effect. Ultimately, cross-sectional regressions, like those we use in this report, cannot identify causal mechanisms. They can identify empirical relationships, which then, either through theory or qualitative work, can be given causal interpretations.
Data weaknesses

That South African census data is available only at an aggregated level prevents us from modelling or controlling individual-level characteristics such as an individual’s probability of unemployment or an individual’s age. This is an unavoidable limitation of our data, but it is not an unusual limitation in the context of empirical work on spatial mismatch (Kain, 1992; Ihlanfeldt & Sjoquist, 1998).

Unlike demographic data, good quality data on the location and concentration of jobs below municipal level is exceedingly difficult to obtain. As is discussed in the technical report, we are forced to use CSIR data which only looks at formal sector jobs, and which does not allow us to focus on low-skilled jobs (which is sometimes preferred in the United States literature). While it is difficult to anticipate the effect of our focus on formal sector jobs, our use of all jobs rather than focusing on specific sectors does not seem to have much effect on our results. Another issue with our jobs data concerns its disaggregation within municipalities. The CSIR’s mesozones are substantially larger than Statistics South Africa’s small areas, and we have to construct our job proximity variable in a way which mitigates distortions caused by these large mesozones. One effect of these adjustments (detailed in the technical report) is to render our job proximity variable less sensitive to distance than would be ideal, and likely biases our results in the direction of under-estimating spatial mismatch.
EDGED OUT
SPATIAL MISMATCH AND SPATIAL JUSTICE IN SOUTH AFRICA'S MAIN URBAN AREAS

Jonathan Torgovnik