

https://dspace.org/

Immigration Internal Migration and Crime in South Africa A multilevel model analysis

Kollamparambil, U

2019-09
Wiley Online Library
https://hdl.handle.net/10539/28454
Steven Gordon, et al .2019 The Popularity of State Discourses on Anti-Immigrant Violence in South Africa, The Round Table, 10.1080/00358533.2019.1658345, (1-12), (2019). Crossref

Downloaded from a DSpace repository. https://dspace.org/

Received: December 2017 | Accepted: April 2018

DOI: 10.1111/dpr.12382

ARTICLE

Immigration, internal migration and crime in South Africa: A multi-level model analysis

Umakrishnan Kollamparambil

School of Economic and Business Sciences, University of Witwatersrand, Johannesburg, South Africa

Correspondence
Umakrishnan Kollamparambil
Email: uma.kollamparambil@wits.ac.za

Abstract

A review of South African literature on crime confirms the lack of a study that considers the impact of migration on the crime rate in the country. The high levels of crime in South Africa aside, additional motivation behind the study has been the increasing rhetoric in media and by politicians insinuating the prominent role of foreign immigrants in the high crime levels of the country. While this is the first attempt to study this relationship in the South African context, it also stands apart from existing studies undertaken in the developed countries by accounting for both internal migrants as well as foreign immigrants. Further, the study claims the use of multi-level regression estimations as an improvement from the existing studies on the issue by accounting for variance clustering across different spatial levels. In all the estimated models, internal migrant ratio came out as being positively and significantly related to crime rates across five different crime categories, with the sole exception of sexual crime rate. There was no evidence of foreign immigrant ratio impacting on crime rate in any of the crimes analysed except crime relating to property. Further, income inequality and sex ratio figure as determining factors across most types of crime in South Africa.

KEYWORDS

crime, foreign immigration, income inequality, internal migration, multi-level model, South Africa

© The Authors 2018. Development Policy Review © 2018 Overseas Development Institute

1 | INTRODUCTION

Crime in South Africa is a much discussed and well-researched subject. This is not surprising as South Africa is considered one of the most crime-prone societies in the world, with a homicide rate of 33.8 per 100,000 population in 2015 as compared to world average of 6.2 (UNODC, n.d.). The research on crime in South Africa primarily investigates the role of economic factors like high economic inequality and lack of economic opportunities in the country in explaining its high crime rate (Luiz, 2001; Brown, 2001; Demombynes & Özler, 2005; Bhorat, Lilenstein, Monnakgotla, Thornton, & van der Zee, 2017). This is expected as South Africa is known for having both one of the highest unemployment rates and income inequality levels in the world (Kingdon & Knight, 2004; Leibbrandt, Finn, & Woolard, 2012).

This article takes the discussion beyond economic factors and seeks to look at the role of internal migrants and foreign immigrants in explaining the high crime levels of the country. A lack of analysis of this nature is surprising given that both the media and politicians have been insinuating that foreign immigrants (pointing to the porous national borders) are responsible for the high crime rate in the country (Facchini, Mayda, & Mendola, 2011). This, among other reasons, has been fuelling xenophobic attacks on immigrants in recent years, especially among the marginalized communities (Danso & McDonald, 2001). Against this backdrop, the study uses police station crime data at the local municipality level and analyses it with both local municipality and provincial level variables to draw conclusions as to the major determinants of crime in South Africa. The study is also significant in that it makes use of multi-level modelling to determine the role of both local and provincial level variables in explaining crime at the local level. Henceforth, the use of the term migrant/migration includes both internal migrant/migration and foreign immigrant/immigration.

While no econometric study exists in the South African context that seeks to explore the possible relationship between crime and migration, international literature on the impact of immigrants on the crime rate of the receiving areas is based on developed countries, especially the US. Most of these studies fundamentally assume that the impact is through the role of immigrants as perpetrators of crime (Facchini, Mayda, & Mendola, 2011). Borjas (1995) also points to the possibility of the presence of immigrants creating more intense labour market competition for the locals, leading to the latter perpetrating more crime. The indication is thus that, although immigrants may not directly contribute to crime, they indirectly impact on crime even though they need not be perpetrators themselves. The third possibility which very few studies have alluded to is that increase in crime could be because of crime against immigrants, who are the most vulnerable especially, among the marginalized communities in the developing country context. McDonald (1997) points out that it is rarely noted that crime associated with immigration may be the result of higher rates of immigrant victimization rather than of offending. Goodey (2003) is one of the few studies which focuses on crime and exploitation of immigrants in Europe. Therefore, at the outset, this study makes it clear that the causation between migrants and crime brought out in the analysis cannot with certainty implicate them as perpetrators of crime. Rather, the analysis simply seeks to understand whether the presence of migrants increases the crime rate in a region. This may be through direct impact as perpetrators or victims of crime, and/or indirectly through labour market impact. Nevertheless, we explain the emerging relationships based on the assumption of the role of migrants role as the perpetrator of crime.

Aside from being the first attempt in the context of South Africa, the study also stands apart from other existing literature in that it seeks to understand the role of not just foreign immigrants but also that of internal migrants within the country in determining the crime rate. Almost all literature that exists in the developed country context focuses on immigrants and does not consider internal migrants. Internal migration is a very dominant phenomenon in a country like South Africa with rural regions

having higher unemployment rates (Kingdon & Knight, 2004). There is large scale migration from rural to urban areas in search of employment which has resulted in urbanization of two-thirds of the population of South Africa since the lifting of influx control in 1986 (Kollamparambil, 2017b). While Mabtha and Roodt (2014) have shown that migration increases the probability of being employed for the migrant in South Africa, Nontenja and Kollamparambil (2018) have shown that the unemployment rates are highest among the internal migrants as compared to local residents and foreign immigrants. Therefore, the possibility of internal migrants resorting to crime as a means of survival in the absence of other economic opportunity is very plausible. The indirect role of the foreign immigrants as explained by Borjas (1995) is also countered by Budlender (2014) who finds that foreign immigrants not only have the lowest unemployment rate but find employment through creating informal self-employment opportunities rather than through displacement of South Africans in formal or informal jobs. According to Budlender (2014) a higher proportion of foreign immigrants in South Africa are employers as compared to local or internal migrants. Given these facts, there is a need to include internal migrants while investigating the role of foreign immigrants in South Africa's crime rate.

The objective of the study is to analyse the impact of in-migration, internal and foreign, on crime rates in South Africa. The study uses data from the South African Police Service (SAPS) (SAPS, 2016, 2018) and supplements it with data from multiple sources to create a two-period local municipality level panel. The findings of the multi-level analysis indicate that all types of crime analysed are indeed impacted positively by in-migration, but only internal in-migration and not foreign immigration. The level of misconception that exists in the media and political rhetoric against foreign immigrants is exposed by the analysis.

The rest of the article is structured as follows: Section 2 explores the conceptual relationship between migration and crime followed by a review of empirical literature in section 3. This is followed by a discussion of the data and variables used in the analysis in section 3. Section 4 details the methodology followed by a discussion of empirical results in section 5. Section 6 concludes.

2 | MIGRATION AND CRIME: CONCEPTUAL RELATIONSHIPS

The conceptual analysis of crime has been modelled on the basis of economic theories or more broadly under the interdisciplinary approach that includes demographic, sociological and psychological approaches. The economic theory based on Becker (1968) considers crime to be a rational choice that is made by an individual after considering the costs and benefits of the action. Whether immigration will lead to a higher crime rate under this framework is primarily determined by the labour market opportunities of the migrant in relation to the locals. When migrants enjoy positive prospects in the labour markets there is no reason to expect increased crime rate due to their presence. On the other hand, migrants with negative self-selection have a lower probability of finding legal employment and hence look for diversionary activities leading to higher crime rate (Lee, Martinez, & Rosenfeld, 2001; Mears, 2002; Reid, Weiss, Adelman, & Jaret, 2005). Another indirect channel is when migrants displace the locals who then have to fall back to illegal activities to sustain livelihoods (Beck, 1996; Waldinger, 1997). A rational individual's decision on crime is also determined by the costs associated with it, which is fundamentally the probability of being apprehended and convicted for the crime.

Ousey and Kubrin (2009) highlight the role of immigration in leading to demographic transitions that in turn affect crime rate. By increasing the share of younger males in the total population, immigration raises the share of the population with a “crime-prone” demographic profile. This assertion is

based on studies that have found offending rates to be highest among male teenagers and male young adults (Hirschi & Gottfredson, 1983). Thus, to the extent that immigration increases the percentage of the population that is young and male, it is argued that the crime rate will increase (Ousey & Kubrin, 2009).

The second demographic transition argument draws from the social disorganization theory (Shaw & McKay, 1969) that contends that crime rate will rise when rapid social change breaks down social control (Ousey & Kubrin, 2009). Immigration being a major driver of population change and residential mobility may thus be regarded as a critical factor behind the breakdown of informal social control leading to increases in crime rate (Bankston, 1998; Lee, Martinez, & Rosenfeld, 2001; Lee & Martinez, 2002; Mears, 2002; Reid et al., 2005). Counter-arguments, however, have been put forth by Lee and Martinez (2002), Martinez and Valenzuela (2006) and others, who assert that immigration fosters social control as immigrants tend to concentrate in ethnic enclaves that preserve culture, promote social networks and bolster informal social control.

Mears (2001) draws attention to the cultural deviance theory in conceptualizing the relationship between crime and immigrants. The cultural deviance theory, based on Sutherland's (1934) pioneering work on acculturation, highlights the idea that certain communities are more accepting of criminal behaviour based on their cultural norms (Akers, 1999; Empey, Stafford, & Hay, 1999; Tonry, 1997a). Migrants from such communities, it is argued, can lead to an increased crime rate. There is, however, little research or evidence that supports this theory (Mears, 2001).

The interesting point that emerges from the conceptualization of crime is that it applies equally to internal as well as foreign immigration. Yet none of the empirical studies that analyse the effect of immigration on crime consider the issue of internal migration. This study thus stands apart in considering both internal and foreign immigrants in the analysis.

3 | REVIEW OF LITERATURE

Empirical literature on the relationship between crime and migrants is rich in the context of the US. Unfortunately, the same cannot be said of the South African context. In fact, a review of literature reveals that empirical analysis of crime in South Africa has neglected the relationship in all econometric analyses of crime. So, we briefly discuss literature on foreign immigrants and crime from other country contexts in the next section. Following this we focus on South African specific literature on other determinants of crime.

3.1 | Immigration and crime

At a broader level the impact of immigration on crime can be placed within the context of literature on the impact of in-migration on the immigrant receiving areas. Most of the studies in this area focus on the labour market impact of immigration (Borjas, 1995; Friedberg & Hunt, 1995; Zimmermann & Bauer (Eds.), 2002; Card, 2005). Borjas (1987) reasons that in the event of negative self-selection being present among migrants, they could resort to illegal activities given the lack of legal labour market opportunities. The perception that migrants are responsible for the higher crime rate in the US is refuted by the evidence (Butcher & Piehl, 1998a, 1998b; Rumbaut, 2008). Rumbaut (2008) and Butcher and Piehl (1998b) found the incarceration rate to be lowest among foreign-born immigrants even though they had low levels of education. MacDonald, Hipp and Gill (2013) go so far as to assert that immigrant concentration has the opposite effect from common perception and in fact lowers the crime rate in neighbourhoods. The study controls for endogeneity using two-stage least squares

instrumental variable (2SLS) regressions to rule out the possibility of safer neighbourhoods being selected for foreign immigrants for residential purposes. Similar findings are put forth by Ousey and Kubrin (2009) who report that cities that experienced increases in immigration from 1980–2000 experienced a significant decrease in serious crime rate. The study however finds family structure/social capital theoretical framework to play an important role in determining serious crime.

A relevant analysis on whether immigrants cause crime can be found in the Italian context where Bianchi, Buonanno and Pinotti (2012) analyse the question at the provincial level using panel data for 1990–2003.The findings of the instrument variable regressions indicate that after accounting for endogeneity, immigration is not found to have a significant impact on total crime. Immigration, however, is seen to impact positively on the rate of robberies, but because it forms a very small fraction of crimes, they do not find an effect on total crime rate.

A recent paper by Piopiunik and Ruhose (2017) finds that the increase in immigrants from the ex-USSR significantly increased crime in Germany. The study notes that the crime impact was larger in regions with high pre-existing crime levels, a high percentage of foreigners, high unemployment and high population densities. A study by Boers, Walburg and Kanz (2017) demonstrated that the prevalence rates of violent as well as repeat offenders in the 1990s and 2000s were higher among youths from immigrant families than among juveniles of German origin. The study, however, admits that most of these differences could be explained by social and educational disadvantage and a lack of social recognition.

None of the above cited studies have considered internal migrants and the mobility of crime perpetrators into account in their analysis. This study is hence an improvement by using a multi-level model and including internal migrants in the analysis.

3.2 | Determinants of crime in South Africa

In one of the earliest post-democracy analyses, Brown (2001) included many non-economic variables and highlighted the relevance of demographic factors. The study analyses crime in South Africa within the framework of occupational choice theory and finds that the probability of punishment and years of education to be negatively correlated with crime, while the proportion of young population was positively correlated with crime. The empirical analysis undertaken is very preliminary and the robustness of results are questionable. Blackmore (2003) undertakes a panel data analysis of different crime categories at provincial level over the period of eight years from 1994–2001. The study presents evidence in favour of an interdisciplinary model of criminal behaviour that emphasizes the role of economic, social and demographic variables in its design. However, the study is severely limited in not taking into account endogeneity issues.

A more sophisticated multivariate analysis is presented by Demombynes and Özler (2005) who examine the effects of inequality on property and violent crime in South Africa using 1996 population census data and SAPS crime data for the same year. The main contribution of the study has been in acknowledging that criminals could travel outside of their precinct and in incorporating the "catchment" area for crime beyond the police precinct. The lowest geographical level of analysis is therefore not the optimal level of analysis and underlines the need for a multi-level analysis that the current study adopts.

The most recent analysis of determinants of crime in South Africa by Bhorat et al. (2017) looked at a range of socioeconomic variables, but again excluded the role of migrants. The study finds that, while property crime increases and then decreases with income and inequality, it is not impacted by labour markets. Both Demombynes and Özler (2005) and Bhorat et al. (2017) use cross-section analysis and are thus not able to account for police precinct time-invariant heterogeneity effectively.

A review of South African literature on crime confirms the absence of a study that considers migrants in determining the crime rate in the country.

4 | METHODOLOGY

4.1 | Methodological concerns

This section raises the issues encountered in estimation of the regressions. The literature argues that, while migrants can contribute to the crime levels of a region, the crime levels of the region may also determine the migrants' decision to migrate to the region. Also, there is concern regarding measurement errors with regard to crime as well as migration statistics which can also lead to endogeneity issues. Under-reporting of crime is a real and relevant issue. According to Stats SA (2017) only 53% of burglaries and 66% of home robbery incidents in 2015–2016 were reported to the police. The study also highlighted that a white-headed household had higher probability of reporting housebreaking to the police compared to a black/African-headed household. The under-reporting issue, however, is likely to be more in relation to non-serious crimes as against serious crimes, including homicides. We therefore consider the data on serious crimes to be more reflective of reality and as indicating the relationships more accurately.

Nevertheless, we acknowledge that we have first to investigate for possible endogeneity arising from reverse causality, measurement errors and misspecification. In the presence of endogeneity, a standard single equation estimator such as ordinary least squares (OLS) estimation will be inconsistent. Presence of endogeneity is tested through instrumental variable two-stage least squares regression with province level clustered variance. Following this we choose between fixed effects OLS estimation and instrument variable estimation with province level clustered variance as a precursor to multi-level modelling.

4.2 | Multi-level modelling

Multi-level modelling (also known as hierarchical linear models, nested models or random coefficients models) is a method by which researchers can account for cluster variance rather than ignoring it (Steele, 2008). When variance clustering is not efficiently accounted for, estimation will yield biased standard errors for regression coefficients, making hypothesis testing unreliable. Random coefficient models are able to simultaneously test variables at different levels without needing to aggregate or disaggregate data, as is necessary in regression. The model takes into account the fact that what is true of one level is not necessarily true of the other (Garson, 2013). The random coefficient model remedies many issues observed with other estimation methods. Unspecified heterogeneity is accounted for and explored by allowing the random intercept and random slope to co-vary (Steele, 2008: Drzewoszewska, 2015; Kwok et al., 2008). Heteroscedasticity is no longer a violated assumption to be corrected but an estimation of within-group effects.

The need for this method of estimation arises from hierarchical data, where data is classified under an individual level and further group levels. For the purpose of this article, the crime rate in South Africa is considered at the local municipality level which forms level 1 in the analysis. However, some of the explanatory variables of interest, for example migration, are considered at the provincial level. Such variables can be considered level 2 variables. It is important for a more complex structure to estimate crime as crime statistics within a local municipality are expected to be more same. Similarly, crime statistics within a province are expected to be more alike compared to those across different provinces. Thus, a model able to account for such correlations is necessary.

To justify the need for multi-level modelling, we compare fixed coefficients model with random coefficient models. When using random coefficient models the researcher first needs to determine if between-group effects are present between the provinces to justify the use of the methodology. To test this, a single-level fixed coefficients model, also known as the null model, is compared to a simple multi-level model without explanatory variables. The null model:

$$Crime_i = \beta_0 + e_i \tag{1}$$

$Crime_i$ is the crime rate for the *i*th municipality for (i=1,…,n), β_0 is the overall mean of *Crime* across the entire population and e_i is the residual for the *i*th municipality. The simple multi-level equation which allows for random intercepts is as follows:

$$Crime_{ij} = \beta_0 + \mu_j + e_{ij} \tag{2}$$

Where β_0 in eq (2) is the grand mean across all provinces, μ_j is the difference between the province mean for province *j* and the grand mean, e_{ij} is the difference in the *i*th municipality's *Crime* –value and the *i*th municipality's province mean. The multi-level model allows for group differences in the estimated mean of crime and does so by splitting the residual term in two, the province level and the municipality-level residuals, both of which are normally distributed with zero means:

$$\mu_j \sim N\left(0, \sigma_\mu^2\right) / e_j \sim N\left(0, \sigma_e^2\right) \tag{3}$$

With σ_μ^2 representing the between province variance, which is based on the difference in the province means from the overall/grand mean and σ_e^2 represents the within-province variance, which is based on the difference between municipality mean and the province means.

Finally, the presence of province effects can be tested using the likelihood ratio test and comparing the obtained test statistic with a critical chi-squared distribution with the degrees of freedom equal to the difference in the number of parameters in the two models. If the null is rejected, it indicates the need for multi-level modelling.

The two random coefficient models considered are: random intercepts model and random intercepts and slopes model. The random coefficient model, which allows both the slope and intercept to vary, is specified as:

$$Crime_{ij} = \beta_0 + \beta_1 x_{ij} + \mu_{0j} + \mu_{1j} x_{ij} + e_{ij} \tag{4}$$

This can be rewritten as:

$$Crime_{ij} = \beta_{0j} + \beta_1 x_{ij} + e_{ij} \tag{5}$$

$$\beta_{0j} = \beta_0 + \mu_{0j} \tag{6}$$

$$\beta_{1j} = \beta_1 + \mu_{1j} \tag{7}$$

where "$\beta_{0j} = \beta_0 + \mu_{0j}$" represents the province intercept and "$\beta_{1j} = \beta_1 + \mu_{1j}$" represent the province slope. The explanatory variables for *I* municipality in *j* province are summarized as x_{ij}. These include the variables of interest, internal migration and foreign immigration, as well as the economic, demographic and institutional control variables discussed at length in the next section. The random effect follows a normal distribution with zero means, and variance and covariance as specified in (5.3) and (5.4) respectively:

$$\mu_{0j} \sim N\left(0, \sigma^2_{0\mu}\right) \text{ and } \mu_{1j} \sim N\left(0, \sigma^2_{\mu 1}\right) \tag{8}$$

$$\sigma_{\mu 01} \tag{9}$$

The likelihood ratio test is applied to test if the effect of the slope of the specified variable varies across province. In this case the random intercepts and slopes model will be compared to the random intercepts model to choose the preferred model.

5 | DATA AND VARIABLES

SAPS data1 from 1,141 police stations were compiled and mapped to the 231 municipalities based on their location. The primary unit of analysis of crime is hence the 231 local municipalities for each of the years 2011 and 2016. The reason for using municipality level as opposed to police station is primarily because crime is often perpetrated by individuals across police station precincts. It may be argued that crime may be committed also beyond municipal precincts. For this reason, the study considers it important to include province level variables in explaining crime at the municipality level.2 Nevertheless, the dependent variable crime is captured at the local municipality level given that there are only nine provinces in South Africa making it infeasible for a two-period study at the provincial level. Inclusion of multiple levels of variables makes it necessary to undertake a multi-level modelling approach to account for heterogeneity in variances across these levels. Another reason to undertake the study at the municipality level is the availability of population and income data at the municipality level based on the 2011 census and 2016 community survey data. Reliable data for many of the control variables is difficult to come by at the police precinct level.

In deciding upon the control variables to be included in the estimation, we are guided by the theoretical and empirical literature. Crime is perpetrated if the returns to the crime is seen to be higher than the threat of being held accountable. The need to include the level of efficiency of the institutional structures in holding perpetrators of crime is hence essential. Statistics of this nature would ideally include successful arrests, prosecution rate and incarceration sentences meted out. However, both provincial-level and municipality-level data on these variables are difficult to come by and instead we use a proxy variable for police efficiency in the form of response time of police, the number of police vehicles as well as recovery rate of stolen vehicles. Crime is hence expected to be positively related to response time and inversely related to the number of police vehicles and vehicle recovery rate. Other variables like the average geographical area covered by a police station within each municipality and average size of population policed by each station were also tried as alternate variables for police efficiency.

[1]Bhorat (2017) provides a detailed description of the SAPS crime statistics dataset and highlights the issues relating to under-reporting. This apart, the data may be considered to suffer from a downward bias given the political pressure for the SAPS to be seen as being effective in fighting crime. This bias is likely to persist in the absence of an independent source of collection of crime statistics. Nevertheless, for the period of the study, this bias is assumed to be similar across municipalities and not suffering from any systematic bias.

[2]It needs to be acknowledged that, just as perpetrators of crime can move across municipalities, they can do so across provinces as well. Nevertheless, given that there are only nine provinces in South Africa, the probability of inter-provincial mobility is lower than movement across the local municipalities.

Inclusion of the level of inequality as an explanatory variable is the most obvious choice given the highly unequal structure of South African society. As explained in Bhorat (2017) higher economic inequality within the precinct of crime would increase the returns to crime within the precinct as against committing the crime outside the precinct. In keeping with this we expect income inequality as measured by Gini coefficient at the local municipality level to have a positive effect on crime.

Mean income level of the municipalities is an important variable to understand if crime is more prevalent in richer or poorer communities. Previous studies have found this variable to be significant in the South African context (Blackmore, 2003). Demombynes and Özler (2005) as well as Bhorat et al. (2017), however, found a non-linear effect of household expenditure with crime.

We include population of the municipality to comprehend if there is a size effect of population on the rate of crime in municipalities. A positive relationship is expected between population and level of crime, but the direction of relationship between population and crime rate is ambiguous and may be positive or negative. The density of population is also included to further dissect the relationship between population and crime.

The poverty rate and unemployment rate are further tried in turn (due to a high correlation between the two, see Table A5) as control variables in keeping with the theory that crime is perpetrated in circumstances of deprivation and desperation. Bhorat (2017) included the unemployment variable but found it to be insignificant. We further include demographic variables such as sex ratio (male–female ratio), proportion of youth (15–35 years age) in the total population to control for the demographic theory discussed in the conceptual section.

Our key variables of interest are internal and foreign immigrant ratios. These are included as provincial level variables as it is feasible for individuals to travel easily across municipalities and crime may be perpetrated in a municipality different from the one of their residence. The expectation is that the coefficient would be positive if there is negative self-selection and negative if there is positive self-selection among migrants.

Lastly, the time variable is included to capture any discernible trend in crime.

The various aspects of crime are segregated and separately analysed as serious crime, robbery, drug-related crime, sexual crime and property-related crime. Municipality-level crime rates are estimated by normalizing the number of crimes against the population of the municipality. The reason for separately considering the determinants of crime is to account for the possible differences in their drivers.

The definition of all the variables together with their data sources are included in Table A1 in the Online Supplementary Material (OSM).

6 | EMPIRICAL ANALYSIS

6.1 | Descriptive statistics

The foreign immigrant to population ratio has risen across all nine provinces over the period 2011–2016 (Table 1). Foreign immigrants are observed to account for over 35% of Western Cape, 30% of Northern Cape and 23% of Gauteng population. The province with the smallest percentage of foreign immigrants is North West with less than 1% of the total population. North West, on the other hand, is a popular destination for internal migrants. As far as internal migration is concerned, the provinces that attracted highest internal migration are Gauteng and Western Cape.

While a marginal reduction in the number of serious and sexual related crimes is reported, there has been a dramatic increase in drug-related crimes as well as incidents of property-related crime (Table 2). Drug-related crimes increased by 51% in the period 2011–2016. An increase of 39% is

TABLE 1 Population According to Migration and Local Municipalities

	Total population, nos.		Local municipality, nos.	Internal migration to population ratio		Foreign immigrant to population ratio	
Province	**2011**	**2016**	**2016**	**2011**	**2016**	**2011**	**2016**
Eastern Cape	6,562,052	6,996,976	39	0.265	0.168	0.036	0.042
Free State	2,745,590	2,834,714	20	0.609	0.442	0.055	0.073
Gauteng	12,272,265	13,399,725	10	2.424	5.342	0.197	0.233
Kwa-Zulu-Natal	10,267,301	11,065,241	51	0.613	0.479	0.071	0.082
Limpopo	5,404,870	5,799,090	25	0.310	0.249	0.070	0.080
Mpumalanga	4,039,938	4,335,963	15	0.886	0.943	0.036	0.042
North West	3,509,952	3,748,434	27	1.190	1.294	0.007	0.008
Northern Cape	1,145,861	1,193,780	19	0.784	0.634	0.255	0.306
Western Cape	5,822,734	6,279,732	25	2.496	5.515	0.300	0.350
Total	51,772,574	55,655,670	231	0.998	1.558	0.113	0.134

Source: Author calculations based on Stats SA and SAPS data.

reported in property-related crime across the country. Incidences of robbery are also seen to have increased over the period 2011–2016. The increased rate of drug-related crime is evident even after adjusting for the increase in population (Table 3). Other forms of crime rates have declined marginally over the period. Although Gauteng reported the highest number of serious crimes, this is attributed to the large population of the Province. It had one of the smallest serious crime rates. Northern Cape, followed by Free State and Western Cape, registered the highest rate of serious crime. Correlation matrices of the variables included in the multivariate regression are presented in the OSM (Table A5).

6.2 | Tests of endogeneity

As a first step towards identifying the appropriate multivariate regression method to use, we present the tests for endogeneity that were undertaken using 2SLS regressions. The instrument variables used for internal and foreign migrant variables at the provincial level are provincial level gross domestic product (GDP) and per capita income. These two instruments are considered appropriate because they are not expected to contribute to crime directly but are identified as significant contributors to attracting both internal and foreign migrants. Table 4 presents the results for endogeneity tests using 2SLS. The results of 2SLS regression undertaken assuming internal migration and foreign immigration to be endogenous variables are presented in the OSM (Table A2). The post-estimation test fails to reject the null hypothesis of exogeneity for all type of crime except drug-related crime. Hence, we continue to treat migration variables as exogenous for all analysis except drug-related crime.

6.3 | Fixed effects and mixed regression estimations

We present in Table 5 results of fixed effects (FE) estimation undertaken with variance clustered at province level. FE estimation controls for time-invariant heterogeneity of local municipalities. In addition, we present the IV 2SLS estimation results for drug crime as endogeneity was not rejected for this type of crime. The internal migrant variable is seen to be positive and significant across the board

TABLE 2 Crime Levels According to Province (in numbers)

	Serious crime		Robbery		Drug		Sexual crime		Property related	
Provinces	**2011**	**2016**	**2011**	**2016**	**2011**	**2016**	**2011**	**2016**	**2011**	**2016**
Eastern Cape	4,061	3,588	13,762	12,947	1,330	1,390	1,096	1,104	10	44
Free State	3,334	3,012	13,058	2,427	894	1,766	971	810	20	15
Gauteng	9,875	9,802	69,436	73,676	5,136	13,904	2,458	1,949	61	96
Kwa-Zulu-Natal	3,248	3,278	16,343	16,279	3,249	4,102	1,089	812	11	14
Limpopo	3,171	2,963	12,354	13,299	1,036	2,300	1,125	849	12	16
Mpumalanga	4,875	4,070	25,006	23,255	1,384	2,928	1,364	1,156	26	26
North West	3,827	3,699	15,190	15,625	1,896	2,879	1,214	1,125	26	16
Northern Cape	1,870	1,939	4,325	4,935	534	746	348	309	7	7
Western Cape	4,807	5,442	40,500	44,459	12,774	14,705	1,502	1,209	43	45
Total	4,197	4,096	22,394	23,124	3,322	5,029	1,216	1,011	22	30
Growth rate %	−2.4		3.3		51.4		−16.8		38.8	

Source: Author calculations based on SAPS data.

TABLE 3 Per Capita Crime Rate According to Province, %

	Serious crime %		Robbery		Drug		Sexual crime	
Provinces	**2011**	**2016**	**2011**	**2016**	**2011**	**2016**	**2011**	**2016**
Eastern Cape	0.529	0.441	1.712	1.480	0.182	0.208	0.138	0.135
Free State	0.793	0.736	0.793	0.736	0.222	0.451	0.240	0.195
Gauteng	0.469	0.443	3.171	3.149	0.220	0.586	0.043	0.088
Kwa-Zulu-Natal	0.339	0.320	1.394	1.342	0.274	0.314	0.107	0.081
Limpopo	0.296	0.260	1.177	1.173	0.106	0.212	0.105	0.073
Mpumalanga	0.370	0.289	1.906	1.649	0.106	0.205	0.103	0.081
North West	0.446	0.416	1.615	1.591	0.198	0.273	0.143	0.127
Northern Cape	0.840	0.838	1.805	2.010	0.272	0.368	0.160	0.135
Western Cape	0.669	0.703	3.786	4.053	1.297	1.462	0.180	0.142
Total	0.517	0.484	2.163	2.154	0.336	0.456	0.142	0.116
Growth rate %	−6.2		−0.4		35.6		−18.1	

Source: Author calculations based on SAPS data

for all crimes except sex crime. Foreign immigrant variable is not seen to contribute positively to crime except for the drug-related crime rate in the FE results. When accounting for endogeneity, this relationship ceases to be statistically significant as seen in the IV-2SLS results. Apart from internal migration, no other variable comes out as a consistent contributor across crimes in South Africa in the FE estimations.

In order to establish the need for multi-level modelling of crime we first run a basic multi-level model (MLM) regression with just the intercept to compare it against the single-level linear model. The likelihood ratio (LR) test in Table 6 rejects overwhelmingly the null of no province level effect on

TABLE 4 Test of Endogeneity

VARIABLES	Serious crime	Robbery	Drug related	Sexual crime	Property-related crime
Robust regression F(2,8) Adjusted for 9 provinces within 228 municipalities	2.83952 (0.1170)	4.63104* (0.0636)	5.2516** (0.0349)	0.980235 (0.4161)	2.0929 (0.1858)

Notes: Ho: variables are exogenous
Instrumented variables: Internal migrants, foreign migrants
Instruments used: Provincial GDP, provincial per capita income
Probability in parenthesis
** p<0.05, * p<0.1

Source: Author estimated

all six crime rates. The variance partition coefficient (VPC) for serious crime is 0.479 indicating that 48% of the variance in serious crime rate can be attributed to differences between provinces. VPC is seen to be high for all types of crime clearly indicating the need for a multi-level analysis.

Having decided on MLM as the appropriate methodology, we turn to LR tests once again to decide between the fixed effects, random intercept, and random intercepts and slopes models. Table 7 indicates that the random intercept model is our preferred model to estimate serious crime, sexual crime and drug-related crime. Fixed methods were the preferred estimation for robbery and property-related crime. The preferred models are presented in Table 8.

As seen in Table 8, the most evident result coming out at high levels of confidence of multi-level estimations is the positive contribution of internal migrants towards crime across the board. The only exception relates to sexual crime where no significant relationship is found. The level of contribution is highest to serious crime followed by property-related crime. A 1% increase in internal migrant to population ratio increases drug-related crime rate by almost 0.7%. Similarly, property-related crime increases by 0.41% for a 1% increase in internal migrant ratio. Serious crime rate and rate of robbery increase by 0.13% and 0.28% respectively. All estimations indicate that foreign immigrants do not contribute to any of the crime categories except property-related crime. This is consistent across random intercept, random slope and fixed effects estimations. To further check the validity of this finding, estimations were undertaking omitting the internal migrant variable. The foreign immigrant variable continued to be insignificant even in estimations without the internal migrant variable for all types of crime except robbery and property-related crime (Table S4). Therefore, the analysis validates the social disorganization theory to the extent of internal migration but not foreign immigration. The reason for this can be explored in terms of positive self-selection among the latter and negative self-selection among the former. In a study based on Gauteng province in South Africa, Nontenja and Kollamparambil (2018) establishes the positive observable and unobservable characteristics of foreign immigrants as compared to internal immigrants and locals.

The victim of crime survey findings on the perceptions of victims regarding the perpetrators of crime are closely aligned to the findings of the study (Stats SA, 2017). According to the study, just under 6% believed foreign immigrants to be the perpetrators of the crime. The high unemployment rate among internal migrants (Kollamparambil, 2017), together with low levels of deterrence, may perhaps explain the higher crime rate among internal migrants. The need for human capacity building among internal migrants to enable them to contribute constructively to the economy and society comes out strongly from our findings

Internal migration, as well as income inequality, are observed to contribute positively and significantly to all forms of crime analysed, except sex crime. Youth proportion, on the other hand, is seen

TABLE 5 Fixed Effects Results (Standard Errors Clusters at Province Level)

Variables	Serious crime	Robbery	Sexual crime	Drug-related crime	Drug-related crime nos.	Property-related crime
Internal migrant	0.00737***	0.000705***	−0.000218**	0.00144***	0.00149**	0.00225***
	(0.00172)	(0.000149)	(7.86e-05)	(8.52e-05)	(0.000590)	(0.000620)
Foreign immigrant	−0.000369	−7.37e-05**	−1.98e-05	0.000244***	7.40e-06	4.17e-05
	(0.000353)	(3.41e-05)	(2.38e-05)	(2.08e-05)	(0.00148)	(0.000121)
Poverty	0.000574**	1.04e-05	−1.54e-05	0.000190***	0.000163	8.42e-05
	(0.000283)	(2.85e-05)	(1.65e-05)	(3.11e-05)	(0.000197)	(0.000101)
Income inequality	0.0324	0.00682**	−0.00270	0.0160*	0.0165*	0.00561
	(0.0254)	(0.00288)	(0.00205)	(0.00806)	(0.00976)	(0.00895)
Average income	4.53e-09	9.56e-11	8.52e-10**	7.43e-10	1.10e-09	−3.77e-09
	(9.47e-09)	(1.33e-09)	(2.86e-10)	(7.05e-10)	(4.23e-09)	(5.12e-09)
Average income squared	−0	−0	−0**	−0	−0	0
	(0)	(0)	(0)	(0)	(0)	(0)
Population density	−1.66e-07	−4.21e-08*	−2.43e-08***	7.56e-08	6.83e-08	−6.37e-08
	(1.37e-07)	(2.51e-08)	(7.11e-09)	(5.13e-08)	(8.03e-08)	(5.05e-08)
Sex ratio	−0.0180	−0.00308**	−0.00220**	0.00442	0.00280	−0.00421
	(0.0196)	(0.00152)	(0.000745)	(0.00243)	(0.0110)	(0.00823)
Youth proportion	0.283	0.00350	0.0131	0.0711	0.0691	0.0683
	(0.193)	(0.0128)	(0.00863)	(0.0720)	(0.0574)	(0.0753)
Population	−2.84e-08***	−3.71e-10	0	−1.69e-09	−1.79e-09	−1.06e-08***
	(6.17e-09)	(1.03e-09)	(2.90e-10)	(1.23e-09)	(2.56e-09)	(2.86e-09)
Police response	−0.00122	−0.000339	−0.000177	−3.58e-06	−0.000463	−0.000956
	(0.00258)	(0.000274)	(0.000112)	(0.000183)	(0.00294)	(0.00113)
Time	0.000426***	8.06e-05***	−6.28e-05***	0.000431***	0.000399*	0.000189***
	(0.000157)	(1.46e-05)	(1.12e-05)	(2.54e-05)	(0.000207)	(5.92e-05)
Constant	−0.815**	−0.160***	0.132***	−0.881***		−0.364***
	(0.321)	(0.0303)	(0.0233)	(0.0538)		(0.119)
Observations	456	456	456	456	456	456
R-squared	0.268	0.313	0.470	0.558	0.543	0.219
Number of local municipalities	228	228	228	228	228	228
Underidentification test					0.856	
(Anderson canon. Corr. LM stat)					0.3548	
Chi-sq(1) P-val					0.00	
Sargan statistic (overidentification test of all instruments)					Equation exactly identified	

*** p<0.01, ** p<0.05, * p<0.1, Probability in parenthesis

No. Instrument variable estimation using xtivreg2 stata command with std errors clustered at Province level. Instrumented: Foreign immigrants, Internal migrant. Instruments: Provincial GDP, provincial per capita income

Source: Author estimated

TABLE 6 Testing for Province Effects

Variables	Serious crime	Robbery	Drug-related crime	Sexual crime	Property-related crime
Constant	0.0382***	0.0022***	0.0038***	0.0013***	0.1***
	(0.0045)	(0.00038)	(0.0013)	(0.00009)	(0.001)
Observations	462	462	462	462	462
Number of groups	9	9	9	9	9
LR test vs. linear regression: chibar2	243.42***	127.52***	424.42***	111.72***	114.5***
Between Province variance (level 2)	0.0134 (0.00325)	0.00111 (0.00028)	0.0038 (0.00091)	0.00026 (0.000065)	0.003 (0.0007)
Within Province between municipality variance (level 1)	0.0145 (0.0004)	0.0012 (0.00004)	0.0028 (0.00009)	0.00047 (0.00002)	0.0047 (0.00016)
Variance partition coefficient	0.479	0.481	0.576	0.356	0.610

Notes: Standard error in parenthesis, *** p<0.01, ** p<0.05, * p<0.1

Source: Author estimated

to contribute positively to drug crime and negatively to robbery. Foreign immigration ratio is seen to contribute positively only to property crime.

The coefficient of time is significant in the robbery, property-related crime and drug estimations, indicating a clear increase in crime rates over the period 2011–2016. The dangerous cocktail when it comes to property-related crime is poverty, income inequality and migration. Although the descriptive statistics indicated a marginal reduction in serious crimes, this is not seen to be statistically significant in the multivariate analysis.

The deterrence variable, police response time, is insignificant for serious crime, robbery and drug-related crime; and negative and significant for property-related crime and sex crime estimations. Other proxies tried out including the number of police stations in each municipality, police stations per square kilometre of the municipality geographical area, etc., also yielded positive and significant coefficients, indicative of endogeneity. This is rather unexpected, but in line with the findings of Verrinder (2013), and can be explained as a response of the South African Police Service to the higher crime rate in those areas. The results, however, indicate that increased intervention by SAPS has not been successful in bringing down sex-related crime and property-related crime. This highlights the need for further study on the role of deterrence in South Africa, taking endogeneity into account.

6.3.1 | Robustness checks

Robustness checks were undertaken by estimating MLMs at the district municipality level (Table A3). The results indicating positive impact of internal migrants on all categories of crime except sexual offences are consistent at both district level and local municipality level estimations. The insignificant impact of foreign immigrants is also consistent across both estimations. Further, estimations without internal migration variable were undertaken at the local municipality level to ascertain the role of foreign immigrant ratio on crime rate (Table A4). The variable continued to be insignificant in estimations without the internal migrant variable for all categories of crime except robbery and property-related crime. Various measures of police efficiency, economic desperation also yielded consisted

TABLE 7 LR Test Results

Crime	Log likelihood			LR test chi df (13)=22.36			
	Random Slope (RS)	Random Intercept (RI)	Fixed Effects (F)	RI vs F	RI vs RS	RS vs Fixed	Chosen Model
Serious crime	1313.7	1312.1	1277.7	68.83***	−3.2	71.98***	RI
Robbery	2445	2445	2434.7	20.9*	0	20.15*	F
Drug	2064	2064	1945	238.47***	0	238.47***	RI
Sexual	2882	2881.6	2845.4	72.38***	−0.7	73.13***	RI
Property-related crime	1815	1815	1809	12.61	−0.1	12.7	F

Notes: *** p<0.01, ** p<0.05, * p<0.1

Source: Author estimated

results. These results verify the robustness of our findings that, while internal migration increases most crimes, foreign immigration has no such impact.

6.3.2 | Study limitations

The study limitations emanate from not taking into account the characteristics of internal migrants and foreign immigrants in the regression analysis. Future research on the impact of migrants on crime should take into account migrant characteristics like age, sex, education and employment. Country of origin of the immigrants also can offer an interesting perspective for future studies. Despite these weaknesses it may be argued that the relationships hold and findings may be considered robust. Another limitation of the study is that it has not been able to include a judicial competence due to the lack of province/municipality level data.

7 | CONCLUSION

The study estimated the impact of migration on local municipality-level crime rates in South Africa. The high levels of crime in South Africa aside, additional motivation behind the study has been the increasing rhetoric in media and by politicians insinuating the significant role of foreign immigrants in the high crime levels of the country. The analysis, however, included internal migrants along with foreign immigrants. While this is the first attempt to study this relationship in the South African context, it also stands apart from other existing studies undertaken in developed countries by accounting for both internal migrants and foreign immigrants. This aspect has been ignored in most studies on the subject. Furthermore, the study claims the use of multi-level regression estimations as a further improvement from the existing studies on the issue by accounting for variance clustering across different spatial levels.

The analysis did not find evidence of endogeneity except for drug-related crime, and the relationship between migration/immigration and crime is found to be unidirectional with the former causing the latter. In all the estimated models, internal migrant ratio came out as positively and significantly related to crime rates across the board, with the sole exception of sex-related crime rate. There was no evidence of a positive relationship between foreign immigrant ratio and crime rate in any of the

crimes analysed, except property crime. The findings regarding the foreign immigrants and crime are consistent with the results obtained in the US context by Butcher and Piehl (1998b) who found that among 18–40-year-old men in US, immigrants were less likely to be incarcerated compared to native-born men with similar demographic characteristics. Similar findings are reported by Butcher and Piehl (1998a) in their analysis that new immigrants do not significantly impact on the city crime rate. The results of Nontenja and Kollamparambil (2018), who found positive self-selection among foreign immigrants compared to internal migrants in South Africa, further indicate why they do not have to resort to crime to survive in South Africa. Internal migrants in South Africa have been found to have the worst labour market conditions (Kollamparambil, 2017; Nontenja & Kollamparambil, 2018). Therefore, the contribution of internal migrants to the crime rate in South Africa can be explained by the argument by Butcher and Piel (1998a) that those with more limited legal opportunities will be more likely to engage in crime. Hence it is not surprising that our analysis found a higher internal migrant rate rather than foreign immigrant rate as leading to an increase in the crime rate.

The conclusion of the study is that internal migrants contribute positively to the problem of crime in South Africa. It is clearly not a coincidence that the survey of the victims of crime undertaken in South Africa also revealed that only a small minority (under 6%) believed foreigners to be responsible for the crime in their area, while 32% believed that South Africans from outside their area were responsible (Stats SA, 2017). These perceptions are found to be grounded on reality, unlike the media and political rhetoric which are exploited by antisocial elements to fuel xenophobic attack against foreign immigrants.

The findings of the study indicate that foreign immigrants do not significantly contribute to the high crime rate in the country. On the other hand, this study finds crime (other than sex-related crime) to be higher in municipalities with higher levels of inequality, and higher internal migrant ratio. Unlike Demombynes and Özler (2005) and Bhorat et al. (2017) the study finds economic inequality to be a positive determinant of all forms of crime analysed except sex-related crime. The insignificant police efficiency variable for serious crime, robbery and drug-related crime indicates that police are not able to deter crime effectively. The negative and significant police efficiency variable in the case of sex-related crime and property crime is in keeping with Verrinder (2013) and underlines the need for research focusing on the role of policing in determining crime rate in South Africa. Although an ideal variable to capture the deterrence could not be included in the analysis due to lack of data, recent statistics on conviction rate for robbery in South Africa gives strong signal on the lack of deterrence as a possible driving factor of crime in the country. According to Stats SA (2017) arrests were made only in about 19% of the incidents of housebreakings/burglaries and home robberies reported to the police. Furthermore, the conviction rate among suspects of housebreaking/burglary was 14.3% and 22% among those accused of home robbery. This boils down to an extremely small probability of being apprehended and caught following a crime. The costs therefore associated with crime perpetration is very low and points to a major problem that needs to be tackled. Further studies need to consider this aspect more deeply in analysis of crime in South Africa.

The significance of sex ratio for all types of crime analysed as well as the positive and significant impact of youth proportion on drug-related crime indicate the indirect role of migration. This is because, according to Budlender (2014) in-migration increases the proportion of males and youth in the total population. Furthermore, Kollamparambil (2017a) finds internal in-migration to increase the income inequality of migrant-receiving areas in the South African context, which again is found to be a positive determinant of crime. Therefore, the true impact of migration, taking into account the direct and indirect impacts can be said to be higher than estimated in the study.

To conclude, our study finds further evidence to validate the statement: “the link between immigration and crime is misleading, to the extent of constituting a mythology” (Hagan & Palloni, 1999,

TABLE 8 Preferred Multi-level & Fixed Coefficients Model

	Random Intercept	Fixed	Random Intercept	Random Intercept	Fixed
Variables	**Serious crime**	**Robbery**	**Drug crime**	**Sex crime**	**Property crime**
Internal migrant	0.00716***	0.000622***	0.00157***	−0.000136*	0.00142***
	(0.00253)	(0.000125)	(0.000587)	(7.84e-05)	(0.000492)
Foreign immigrant	0.000181	0.000103*	0.000253	−2.95e-05	0.00103***
	(0.000974)	(6.10e-05)	(0.000197)	(3.07e-05)	(0.000241)
Poverty	−0.000138	8.87e-05***	7.75e-05	−3.41e-05	7.40e-05
	(0.000698)	(3.00e-05)	(0.000171)	(2.14e-05)	(0.000118)
Income inequality	0.147***	0.00746***	0.0190**	0.00186	0.0423***
	(0.0388)	(0.00231)	(0.00763)	(0.00122)	(0.00911)
Average income	−1.14e-08	1.45e-09	−6.68e-09	−1.73e-09**	−2.23e-09
	(2.37e-08)	(2.01e-09)	(4.48e-09)	(7.55e-10)	(7.93e-09)
Average income squared	0	−0	0	0**	−0
	(0)	(0)	(0)	(0)	(0)
Population density	−1.88e-08	1.98e-09	−5.09e-09	6.24e-10	−7.55e-09
	(3.83e-08)	(3.29e-09)	(7.24e-09)	(1.22e-09)	(1.30e-08)
Sex ratio	0.0684***	0.00308***	0.00868***	0.00149***	0.0185***
	(0.0100)	(0.000830)	(0.00191)	(0.000320)	(0.00328)
Youth proportion	−0.0969	−0.0845***	0.144***	0.00200	−0.0785*
	(0.130)	(0.0104)	(0.0247)	(0.00413)	(0.0411)
Population	−4.96e-10	5.58e-10***	2.59e-10	−1.29e-10***	−5.07e-10
	(1.44e-09)	(1.20e-10)	(2.74e-10)	(0)	(4.75e-10)
Police response	−0.00729	0.000186	−0.000744	−0.000491**	−0.00410**
	(0.00682)	(0.000463)	(0.00143)	(0.000215)	(0.00183)
Time	0.000349	9.79e-05***	0.000419***	−5.97e-05***	0.000281***
	(0.000350)	(2.68e-05)	(7.19e-05)	(1.11e-05)	(0.000106)
Constant	−0.797	−0.204***	−0.859***	0.121***	−0.590***
	(0.724)	(0.0550)	(0.149)	(0.0229)	(0.217)
Observations	456	456	456	456	456
No. of groups	9		9	9	
Wald chi2	104.15***	129.34***	153.41***	252.06***	219.04***
Log likelihood	1312.08	2434.21	2064.437	2881.62	1808.8622
chi2(2) =	5.96*	12.98***	33.08***	90.8***	40.64***
AIC	−2596.16	−4844.42	−4102.87	−5739.23	−3591.72

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

p. 630). However, enough evidence has been found by this study to link internal migration to crime. Thus, looking to the root causes of crime in South Africa needs to include internal factors like internal migration in addition to economic aspects like income inequality and poverty.

REFERENCES

Akers, R. (1999). *Criminological theories: Introduction and evaluation* (4th ed.). Los Angeles, CA: Roxbury.

Bankston, C. L. (1998). Youth gangs and the new second generation: A review essay. *Aggression and Violent Behavior*, *3*, 35–45. https://doi.org/10.1016/s1359-1789(97)00010-4

Beck, R. H. (1996). *The case against immigration: The moral, economic, social, and environmental reasons for reducing US immigration back to traditional levels*. New York, NY: W. W. Norton.

Becker, G. S. (1968). Crime and punishment: An economic approach. In N. G. Fielding, A. Clarke, & R. Witt (Eds.), *The economic dimensions of crime* (pp. 13–68). London: Palgrave Macmillan.

Bhorat, H., Lilenstein, A., Monnakgotla, J., Thornton, A., & van der, Zee, K. (2017). *The socio-economic determinants of crime in South Africa: An empirical assessment* (DPRU Working Paper No. 201704). Retrieved from the Development Policy Research Unit website: http://www.dpru.uct.ac.za/wp-201704-socio-economic-determinants-crime-south-africa-empirical-assessment

Bianchi, M., Buonanno, P., & Pinotti, P. (2012). Do immigrants cause crime? *Journal of the European Economic Association*, *10*, 1318–1347. https://doi.org/10.1111/j.1542-4774.2012.01085.x

Blackmore, F. L. E. (2003). A panel data analysis of crime in South Africa. *South African Journal of Economic and Management Sciences*, *6*, 439–458. https://www.ingentaconnect.com/content/sabinet/ecoman/2003/00000006/00000003/art00001

Boers, K., Walburg, C., & Kanz, K. (2017). Crime, crime control and criminology in Germany. *European Journal of Criminology*, *14*, 654. https://doi.org/10.1177/1477370817734432

Borjas, G. J. (1987). *Self-selection and the earnings of immigrants* (NBER Working Paper No. 2248). Retrieved from the National Bureau of Economic Research website: https://www.nber.org/papers/w2248

Borjas, G. J. (1995). The economic benefits from immigration. *The Journal of Economic Perspectives*, *9*(2), 3–22. https://doi.org/10.1257/jep.9.2.3

Brown, K. V. (2001). The determinants of crime in South Africa. *The South African Journal of Economics*, *69*, 104–112. https://doi.org/10.1111/j.1813-6982.2001.tb00013.x

Budlender, D. (2014). *Migration and employment in South Africa: Statistical analysis of the migration module in the Quarterly Labour Force Survey, third quarter 2012* (MiWORC Report No. 5). Retrieved from the African Centre for Migration & Society website: http://www.oit.org/wcmsp5/groups/public/—ed_protect/—protrav/—migrant/documents/publication/wcms_379450.pdf

Butcher, K. F., & Piehl, A. M. (1998a). Cross-city evidence on the relationship between immigration and crime. *Journal of Policy Analysis and Management*, *17*, 457–493. https://doi.org/10.1002/(sici)1520-6688(199822)17:3<457:aid-pam4>3.0.co;2-f

Butcher, K. F., & Piehl, A. M. (1998b). Recent immigrants: Unexpected implications for crime and incarceration. *ILR Review*, *51*, 654–679. https://doi.org/10.1177/001979399805100406

Card, D. (2005). *Is the new immigration really so bad?* (CDP Series 02/04). Retrieved from the Centre for Research and Analysis of Migration website: http://www.cream-migration.org/publ_uploads/CDP_02_04.pdf

Danso, R., & McDonald, D. A. (2001). Writing xenophobia: Immigration and the print media in post-apartheid South Africa. *Africa Today*, *48*(3), 115–137. https://doi.org/10.2979/aft.2001.48.3.114

Demombynes, G., & Özler, B. (2005). Crime and local inequality in South Africa. *Journal of Development Economics*, *76*, 265–292. https://doi.org/10.1016/j.jdeveco.2003.12.015

Drzewoszewska, N. (2014). Multilevel modelling of bilateral trade flows between European Union countries. *Przegląd Statystyczny*, *61*, 283–305. http://keii.ue.wroc.pl/przeglad/Rok%202014/Zeszyt%203/2014_61_3_283-306.pdf

Empey, L., Stafford, M., & Hay, C. (1999). *American delinquency: Its meaning and construction*. Belmont, CA: Wadsworth.

Facchini, G., Mayda, A. M., & Mendola, M. (2011). *South-South migration and the labor market: Evidence from South Africa*. Retrieved from World Bank website: http://documents.worldbank.org/curated/en/879331468302453175/South-South-migration-and-the-labor-market-evidence-from-South-Africa

Friedberg, R. M., & Hunt, J. (1995). The impact of immigrants on host country wages, employment and growth. *The Journal of Economic Perspectives*, *9*(2), 23–44. https://doi.org/10.1257/jep.9.2.23

Garson, G. D. (2013). Fundamentals of hierarchical linear and multilevel modeling. In G. D. Garson (Ed.), *Hierarchical linear modeling: Guide and applications* (pp. 3–25). Retrieved from http://www.sagepub.in/upm-data/47528_ch_1.pdf

Goodey, J. (2003). Migration, crime and victimhood: Responses to sex trafficking in the EU. *Punishment and Society*, *5*, 415–431. https://doi.org/10.1177/14624745030054003

Hagan, J., & Palloni, A. (1999). Sociological criminology and the mythology of Hispanic immigration and crime. *Social Problems*, *46*, 617–632. https://doi.org/10.2307/3097078

Hirschi, T., & Gottfredson, M. (1983). Age and the explanation of crime. *American Journal of Sociology*, *89*, 552–584. https://doi.org/10.1086/227905

Kingdon, G. G., & Knight, J. (2004). Unemployment in South Africa: The nature of the beast. *World Development*, *32*, 391–408. https://doi.org/10.1016/j.worlddev.2003.10.005

Kollamparambil, U. (2017a). Impact of internal in-migration on income inequality of receiving areas: A district level study of South Africa. *Journal of Development Studies*, *53*, 2145–2163. https://doi.org/10.1080/00220388.2016.1277019

Kollamparambil, U. (2017b). *Labour market impact of internal in-migration: A district level analysis of South Africa* (ERSA Working Paper No. 667). Retrieved from the Economic Research Southern Africa website: https://econrsa.org/system/files/publications/working_papers/working_paper_667.pdf

Kwok, O. M., Underhill, A. T., Berry, J. W., Luo, W., Elliott, T. R., & Yoon, M. (2008). Analyzing longitudinal data with multilevel models: An example with individuals living with lower extremity intra-articular fractures. *Rehabilitation Psychology*, *55*, 370. https://doi.org/10.1037/a0012765

Lee, M. T., & Martinez Jr, R. (2002). Social disorganization revisited: Mapping the recent immigration and black homicide relationship in northern Miami. *Sociological Focus*, *35*, 363–380. https://doi.org/10.1080/00380237.2002.10570709

Lee, M. T., Martinez, R., & Rosenfeld, R. (2001). Does immigration increase homicide? Negative evidence from three border cities. *Sociological Quarterly*, *42*, 559–580. https://doi.org/10.1111/j.1533-8525.2001.tb01780.x

Leibbrandt, M., Finn, A., & Woolard, I. (2012). Describing and decomposing post-apartheid income inequality in South Africa. *Development Southern Africa*, *29*, 19–34. https://doi.org/10.1080/0376835X.2012.645639

Luiz, J. M. (2001). Temporal association, the dynamics of crime, and their economic determinants: A time series econometric model of South Africa. *Social Indicators Research*, *53*, 33–61. https://doi.org/10.1023/A:1007192511126

MacDonald, J. M., Hipp, J. R., & Gill, C. (2013). The effects of immigrant concentration on changes in neighborhood crime rates. *Journal of Quantitative Criminology*, *29*, 191–215. https://doi.org/10.1007/s10940-012-9176-8

Martinez, R., & Valenzuela Jr, A. (2006). *Immigration and crime: Race, ethnicity, and violence*. New York, NY: NYU Press.

Mbatha, C. N., & Roodt, J. (2014). Recent internal migration and labour market outcomes: Exploring the 2008 and 2010 national income dynamics study (NIDS) panel data in South Africa. *South African Journal of Economic and Management Sciences*, *17*, 653–672. http://www.scielo.org.za/scielo.php?pxml:id=S2222-34362014000500010&script=sci_arttext&tlng=pt

McDonald, W. F. (1997). Crime and illegal immigration: Emerging local, state, and federal partnerships. *National Institute of Justice Journal*, *232*, 2–10. http://www.ncjrs.gov/App/publications/abstract.aspx?ID=184605

Mears, D. P. (2001). The immigration-crime nexus: Toward an analytic framework for assessing and guiding theory, research, and policy. *Sociological Perspectives*, *44*, 1–19. https://doi.org/10.2307/1389806

Mears, D. P. (2002). Immigration and crime: What's the connection? *Federal Sentencing Reporter*, *14*, 284–288. https://doi.org/10.1525/fsr.2002.14.5.284

Nontenja, N., & Kollamparambil, U. (2018). Self-selection in migration between developing countries: The role of unobservable skills of Gauteng's migrant population. *International Migration*, *56*(5), 167–189. https://doi.org/10.1111/imig.12454

Ousey, G. C., & Kubrin, C. E. (2009). Exploring the connection between immigration and violent crime rates in US cities, 1980–2000. *Social problems*, *56*, 447–473. https://doi.org/10.1525/sp.2009.56.3.447

Piopiunik, M., & Ruhose, J. (2017). Immigration, regional conditions, and crime: Evidence from an allocation policy in Germany. *European Economic Review*, *92*, 258. https://doi.org/10.1016/j.euroecorev.2016.12.004

Reid, L. W., Weiss, H. E., Adelman, R. M., & Jaret, C. (2005). The immigration–crime relationship: Evidence across US metropolitan areas. *Social Science Research*, *34*, 757–780. https://doi.org/10.1016/j.ssresearch.2005.01.001

Rumbaut, R. G. (2008, August 21–22). *Undocumented immigration and rates of crime and imprisonment: Popular myths and empirical realities*. Paper presented to the Police Foundation National Conference on The Role of Local Police: Striking a Balance between Immigration Enforcement and Civil Liberties, Washington, DC. Retrieved from https://www.policefoundation.org/wp-content/uploads/2015/06/Appendix-D_0.pdf

SAPS. (2016). *Annual report 2015/16: South African Police Service*. Retrieved from https://www.saps.gov.za/about/stratframework/annual_report/2015_2016/saps_annual_report_2015_2016.pdf

SAPS. (2018). *South African Police Service crime statistics: Financial years 2008–2009 to 2017–2018* [Spread sheet]. Retrieved from https://www.saps.gov.za/services/crimestats.php

Shaw, C. R., & McKay, H. D. (1969). *Juvenile delinquency and urban areas*. Chicago, IL: University of Chicago Press.

Stats SA. (2016a). *Mid-year population estimates: Statistical release, P0302*. Retrieved from the Statistics South Africa website: https://africacheck.org/wp-content/uploads/2017/02/2016-midyear-population-estimates.pdf

Stats SA. (2016b). *Community survey 2016, statistical release, P0301*. Retrieved from the Statistics South Africa website: http://cs2016.statssa.gov.za/wp-content/uploads/2016/07/NT-30-06-2016-RELEASE-for-CS-2016-_Statistical-releas_1-July-2016.pdf

Stats SA. (2016c). *Provinces at a glance: Community Survey 2016, Report 03-01-03*. Retrieved from the Statistics South Africa website: http://cs2016.statssa.gov.za/wp-content/uploads/2016/06/CS-2016-Provinces-at-a-glance.pdf

Stats SA. (2017). *Victims of Crime Survey 2016/17, Report 03-01-03*. Retrieved from the Statistics South Africa website: https://www.statssa.gov.za/publications/P0341/P03412016.pdf

Steele, F. (2008). *Module 5: Introduction to multilevel modelling concepts*. LEMMA VLE Module 5 (pp. 1–45). Retrieved from http://www.bristol.ac.uk/media-library/sites/cmm/migrated/documents/5-concepts-sample.pdf

Sutherland, E. H. (1934). *Principles of criminology*. Chicago, IL: Lippincott.

Tonry, M. (1997). Ethnicity, crime, and immigration. *Crime and justice*, *21*, 1–29. https://doi.org/10.1086/449248

UNODC. (n.d.). *Intentional homicide victims*. Retrieved from United Nations Office on Drugs and Crime website: https://dataunodc.un.org/crime/intentional-homicide-victims

Verrinder, N. (2013). *Untangling the determinants of crime in South Africa (Master's dissertation)*. Retrieved from https://open.uct.ac.za/bitstream/handle/11427/11547/thesis_com_2013_verringer_n.pdf?sequence=1&isAllowed=y

Waldinger, R. (1997). Black/immigrant competition re-assessed: New evidence from Los Angeles. *Sociological Perspectives*, *40*, 365–386. https://doi.org/10.2307/1389448

Zimmermann, K., & Bauer, T. K. (Eds.). (2002). *The economics of migration*. Volume *4*. Cheltenham: Edward Elgar Publishing.

Zuma, N. (2013). *Rural-urban migration in South Africa. Growth, transformation, reform: Emerging economies in the next decade*. Haikou, China: Economic Policy Forum.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

How to cite this article: Kollamparambil U. Immigration, internal migration and crime in South Africa: A multi-level model analysis. *Dev Policy Rev*. 2019;37:672–691. https://doi.org/10.1111/dpr.12382