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Regional inequality and rural dependency in South Africa

How can opposing trends in regional inequality be explained?

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Abstract: South Africa is among the most unequal countries in the world with an income Gini of 0.65 and a land Gini of 0.64. Inequality decreased in all provinces except for Limpopo and the Eastern Cape, which have experienced the slow pace of transition after apartheid. The study combines the South African National Income Dynamics Study panel (four waves from 2008 to 2015) with data on regional inequality. The study shows that high inequality is found to persist under weak institutions. We find that land inequality accelerates urbanization through rural exodus. The Limpopo case is puzzling because it exhibits paramount land inequality and relatively low but rising expenditure inequality. Given that the poor are equally poor, low levels of inequality fail to reveal anything about social mobility and equality of opportunity. A higher share of population active in subsistence agriculture significantly increases income dependency on grants and pensions. In addition, using panel data econometrics, education is found to be key in explaining economic dependency: a 1 percentage point increase in school attendance is associated with an average decrease of the dependency ratio by more than 6 percentage points.

Key words: inequality, rural exodus, subsistence agriculture, social mobility, education, apartheid, panel data econometrics

JEL classification: O1, R5, I3, Q1

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1 Introduction

> Children have never been very good at listening to their elders, but they have never failed to imitate them.—James A. Baldwin[1]

In development economics, there seems to be a great deal of excitement and academic discussion being generated about whether there could be systematic reasons for societies to evolve institutions more conducive to growth. The role of unequal distributions of endowments, wealth and income has been considered as such a systematic reason (Acemoglu and Robinson 2008). Inequality in income and land come along with a lot of caveats for economic growth and social and political development. Literature calls attention to the potential of political destabilization, negative effects on growth, less access to public goods, and increasing crime rates—some of the downsides of immense inequality. Income inequality is a persistent phenomenon in the case of South Africa and established through patterns of historic discrimination. South Africa is ranked as one of the most unequal countries with an income Gini of 0.65 in 2015 (Maluleke 2019), which coincides with a land Gini of 0.64 (Frankema 2010).

Although it remains above 0.5, the income Gini coefficient for the Republic of South Africa has slowly but steadily decreased since 2008, except for the two provinces of Limpopo and the Eastern Cape. Inequality measured by the Gini coefficient increased in these two provinces between 2006 and 2015 from 0.56 to 0.61 and from 0.63 to 0.65, respectively. How can this opposing trend be explained?

The hypothesis of this paper is that high dependency, defined as the share of household income derived from remittances and social grants, is explained by the lack of social mobility, which in turn explains the increase in inequality in the respective provinces.

South African inequality cannot be analysed without considering persistent unemployment and some characteristics of rural poverty, such as subsistence agriculture. The novelty and motivation of this paper lies within exploring the status quo of making a living as someone who is not integrated into the labour market and does not derive large shares of income through formal employment but through remittances and government grants—a phenomenon particularly pronounced among the rural poor. Given the gentrification strategies by the apartheid regime, land in these two provinces is extremely unequally distributed with Limpopo standing out with a land Gini coefficient of 0.93 (Eastwood et al. 2006), which is one of the highest in the entire world. Land inequality translates into income inequality as land is a factor of production and identity for many black farmers (Lahiff et al. 2012; Ladzani and Netswera 2009; James 2001).

Motivation lies in uncovering the following puzzle. All provinces except for Limpopo and Eastern Cape reported a decrease in their respective expenditure Gini coefficients. Surprisingly, while the Eastern Cape was the most unequal province, the expenditure Gini coefficient in Limpopo was among the lowest, despite having paramount land inequality. These observations suggest that inequality is driven by different factors in the country and that there are intra-provincial differentials in the determination of inequality.

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[1] J. Baldwin, 'Fifth Avenue, Uptown: A Letter from Harlem', *Nobody Knows My Name: More Notes of a Native Son*. Dial Press, New York, 1961.

2 Literature review

Easterly (2007) claims South Africa is an evident example for structural inequality and that agricultural endowments predict inequality and inequality in turn predicts development. The Eastern Cape, Limpopo, and Kwazulu-Natal reported the highest proportion of agricultural households within their provincial borders;[2] at the same time, Limpopo (32.6 per cent) and the Eastern Cape (32.2 per cent) had the highest proportions of agricultural household heads with no income (Statistics South Africa 2013). Being home to large rural populations and incorporating the largest areas of former homelands or *bantustans*[3] during apartheid, these two provinces are also outstanding in terms of lacking behind in infrastructure and high levels of poverty (Statistics South Africa 2013). These two provinces are both marked by weak capacity base, low educational and healthcare standards, low economic growth, and a concomitant high dependence on state pensions and remittances for migrants (Ladzani and Netswera 2009; Paumgarten et al. 2005). Even though inequality in terms of Gini might be lowest in certain regions in a national context, one has to bear in mind that it is still high and that inequality in poor regions is lower because the poor are equally poor. The persistence of poverty-related underdevelopment expresses the legacy of the apartheid system, since three of the ten former *bantustans* (low-productive land assigned to black South Africans) were located in Limpopo[4] and the largest Transkei homeland in the Eastern Cape (Philipps 2017).

Demombynes and Özler (2005) emphasize that inequality has to be analysed on finer geographic levels rather than the national level, as its effects are particularly evident in local coexistence. Accordingly, the authors assess the inequality–crime nexus among South African police station jurisdictions. Economic theory suggests a positive link between crime and inequality (Becker 1968; Bourguignon 2001), especially for property-related crimes (Ehrlich 1973). In South Africa, burglary rates are indeed 20–30 per cent higher because of local income inequalities (Demombynes and Özler 2002). South Africa being among the most unequal economies in the world, it is in turn no surprise that parts of the country are ranked among the most dangerous in the world (Willman et al. 2018), discouraging investment and hampering economic growth in the long run. South Africa's overall land Gini was 0.64 (Frankema 2010), with a bimodal farming sector (Wegerif and Guereña 2020), and income Gini was 0.65 in 2015 (Maluleke 2019). Scholars identify a nexus between inequality in land and conflict (Couttenier and Soubeyran 2014; Hidalgo et. al 2010). In South Africa, mistrust and anger on the stagnating progress of land reform as well as severe economic shocks have translated into hate crimes, opening up a populist political discourse fired by proponents of expropriation (BBC 2019; Willman et al. 2018). Farm attacks, including murder, surged by 340 per cent between 2010 and 2019 (AfriForum 2020) and increasingly cause international media sensation (*The New York Times* 2019). This does not only further undermine social cohesion but also comes with an economic cost of increased fencing expenses, security and supervision costs, not to mention the psychological losses and reluctance to take risk (AfriForum 2020; Demombynes and Özler 2005). Fear of crime is also found to foster brain drain (Dodson 2002). Theories suggest a higher incidence of criminal behaviour in more unequal areas if income

[2] Of total households, 35 per cent in the Eastern Cape, 33 per cent in Limpopo, and 28 per cent in Kwazulu-Natal identify as agricultural households (Easterly 2007).

[3] With the passage in 1951 of the Bantu Authorities Act, apartheid set in motion the development of ten *bantustans*, one of the most notorious racial ordering projects in South Africa. In an effort to legitimize the apartheid agenda and to strip black South Africans of their citizenship by establishing ten parallel 'countries', the *bantustans* were also known as 'homelands' in the official language (Philipps 2017).

[4] Namely Lebowa, Venda, and Gazankulu.

inequality is correlated with social mobility (Wilson and Daly 1997). In addition, large inequality in land is found to rapidly disrupt efficient land governance, including rising occurrence of conflicts, and it hampers attempts to tackle environmental degradation and climate change (Wegerif and Guereña 2020). Hence, if one also includes climate change in the influencing factors of political destabilization, the discussion about land inequality becomes even more drastic.[5]

Adato et al. (2006) record how historical social exclusion based on racial discrimination limits new paths to social mobility by restricting people's access to social networks beyond their own local community. Hence, even if some opportunities arise, they usually do not mobilize beyond a small geographic area. Louw et al. (2007) empirically link economic inequality and social mobility through educational data and explore the role parental education plays in the creation of children's human capital. The study finds that intergenerational social mobility within race groups improved over a 30-year-period. However, educational quality differentials among race remains substantial, and thus, given the persistence of structural gentrification, also consolidates divergence among regions. Hausman and Szekely (1999) reveal that the educational achievement of parents is a more significant determinant of educational achievement of children than household income. The quality differential reflects in the rates of matriculation, as the likelihood to discontinue school attendance is highest with least-educated parents (Louw et al. 2007; Van der Berg et al. 2016). Interestingly, especially in the rural areas it is not only parents' education that exerts a significant effect on children's well-being but also grandparents' education. More than a quarter of black South African children below the age of 5 years live with a pension recipient (Duflo 2003). Analysing the effect of this large cash transfer programme on grandchildren, disaggregated by gender, it is found that pension had a significantly positive causal effect on anthropometric outcomes of girls (Duflo 2003). Further, Duflo (2003) shows that observed effect was entirely driven by pensions received by women and unique for South Africa. Case and Deaton (1999) indicate that having a household head who has completed secondary education may increase the educational achievement of a child by more than a quarter of a grade per year compared with children living in households led by individuals who have only completed primary education.

Expanding on labour migration models (Lewis 1954; Harris and Todaro 1970), Oyvat (2016) causally links income and land inequality and empirically confirms that countries with egalitarian agricultural systems are predicted to experience a faster accumulation of human capital.[6] The study finds that high land inequality raises Gini coefficients for income in both the urban and rural markets, by generating scarcity in the urban subsistence market.[7] However, it is also these agrarian structures that can diminish the gap in service provision, such as education, posed by high levels of land and income Gini (OECD 2015). In addition, the question of convergence is raised: land inequality in the 1960s has a significant positive impact on both, current urban income inequality and overall income inequality. Overurbanization,[8] which is triggered by unequal land access, increases income inequality (Oyvat 2016), creating a vicious cycle of inequality fostering inequality. Finally, countries with higher land inequalities are prone to larger shares of population engaged in

[5] The Potsdam Institute for Climate Impact Research predicts that Sub-Saharan Africa will experience major declines in crop yields at a temperature increase scenario of 1.5–2°C (Biewald et al. 2015). Couttenier and Soubeyran (2014) exploit a large dataset of the Palmer Drought Severity Index, covering a period from 1946 to 2005. They show that drought has been a key factor in Sub-Saharan Africa's civil wars (after independence), and that the connection between drought and civil war in Sub-Saharan African countries is robust.

[6] The nexus between human capital improvements and equalizing agriculture is also established by Easterly (2007).

[7] Data for South Africa depicts the situation in 2007–08 and is taken from Leibbrandt et al. (2010).

[8] In the paper, 'overurbanization' is presented as a phenomenon of urban unemployment with negative spillovers and downward pressure on urban and rural wages (Oyvat 2016).

low-productivity urban subsistence activities (Oyvat 2016). This process materializes in an urban income Gini of 0.67 in 2008 in South Africa (Leibbrandt et al. 2010).

Gennaioli et al. (2014) empirically compare the speed of convergence of per capita income across and within 83 countries. Their study finds evidence of significant barriers to factor mobility within countries. The speed of regional convergence increases with national gross domestic product (GDP) and integrated capital markets, according to the authors. South Africa has been identified as a country, where migration lowers human capital in both low- and high-income regions (Gennaioli et al. 2014). On average, workers that choose to emigrate from one South African region to another have 1.2 more years of schooling than the natives from those regions. Consequently, the outflow of migrants tends to diminish the sending region's human capital. For the recipient region, effects are ambiguous depending on the unemployment rate and educational differentials among other factors (Louw et al. 2007; Oyvat 2016). *Ceteris paribus*, the influx of migrants from other regions tends to increase the receiving region's human capital. However, this effect only holds if both regions have similar levels of human capital—an assumption likely to be breached if migration flows from poor to rich regions. Given the identified slow convergence, the effect of migration on human capital is low but relatively larger in the poorest regions of South Africa: the education differential in the bottom quartile of regional GDP per capita yields 0.09 more years of education (Gennaioli et al. 2014). In contrast, residents of rich regions in South Africa (in the top quartile of regional GDP per capita) have 0.01 less years of schooling than the natives of such regions (Gennaioli et al. 2014).

In a nutshell, inequality delimitates opportunities to access all three factors of production. Human *capital* is affected through the lack of social mobility and brain drain is a higher risk in the poorest provinces. The differentials in educational quality translate into a lack of opportunities in the *labour* market and, given low opportunities in the former homelands, foster urbanization. However, with unemployment being structurally high, a phenomenon of urban unemployment with negative spillovers emerges, coined as 'overurbanization' (Oyvat 2016). The link between endowments and development of institutions is historically pronounced in South Africa and consolidates in *land* inequality with overlapping land rights in traditional authority areas (Cotula et al. 2009; Liversage 2011). The overlapping land claims have been found to create conflict and constrained the land transition underlying the problems with crime and violence in South Africa today (Beinart et al. 2017). Consequently, it is imperative to understand the factors that create inequality, particularly where persistent historical institutions impede social mobility.

3 Data

3.1 Data sources

The National Income Dynamics Study (NIDS) is the nationally representative panel study in South Africa (see DPME 2020). For consistency with other data sources, this analysis covers the first four waves of NIDS, conducted in (i) 2008, (ii) 2010/11, (iii) 2012, and (iv) 2014/15. In this survey, a multi-stage sample method was used based on a stratified approach, with probability proportional to the size range of primary sampling units in the first stage and the sampling of dwelling units with systematic sampling in the second (Brophy et al. 2018). The merged dataset compiles 42,562 observations at a household level and the individually derived NIDS covers 142,820 observations, which have been averaged to enable the analysis at a provincial level.

The survey was further stratified by geography after redistribution of the survey to the provinces (primary stratification). Geographical information is based on the 2011 District Council codes

(Brophy et al. 2018). Data on provincial inequality derives from Maluleke (2019), who uses primary data inputs from data that Statistics South Africa officially collected and published, more precisely the Income and Expenditure Survey (IES), Living Conditions Survey (LCS), General Household Survey (GHS), and the Quarterly Labour Force Survey (QLFS). Calculations on provincial inequality are based on Statistics South Africa IES and LCS and matched in the best possible manner based on the time proximity to the NIDS waves. The same applies to crime data, which was taken from the South African Police Service (2018). The report disentangles police reports granularly by the type of crime and covers observations at a provincial level.

3.2 Variable measurement

This paper aims to connect provincial inequality and its economic manifestation in terms of income dependency on remittances and social grants (pension, child support), resulting in two different dependent variables. The first variable to be explained is the income Gini coefficient based on expenditure per capita (Maluleke 2019). The Gini is chosen because of its intuitive interpretation and, given that vast amounts of observations are averaged to create provincial observations, because the Gini index is the most robust to data contamination or outliers (Klasen 2016). The dependency ratio is calculated as the sum of remittances and government grants over the total household income, based on NIDS data:

$$\overline{dependency_{it}} = \frac{remittances_{it} + childgrant_{it} + pension_{it}}{total\ household\ income_{it}}$$

In the baseline model, the following variables are used to explain the dependency ratio: *agri_pop* refers to the population active in agriculture in the past 12 months, without calling it professional employment (derived from 'h_ag', NIDS). *Homeland* measures the share of population that lives in geographic units, former homelands (*bantustans*), that are now defined as 'traditional authority area': 'communally-owned land under the jurisdiction of traditional leaders; settlement within these are villages' (Brophy et al. 2018: 68). *School_attend* refers to the share of learners aged 6–18 years, based on the GHS (Maluleke 2019).

The augmented model adds the share of *bank account holders* per province as well as the perceived *health* status, both based on NIDS data. The health status is ranked 1 for 'excellent', 2 for 'very good', 3 for 'good', 4 for 'fair', and 5 for 'poor'.

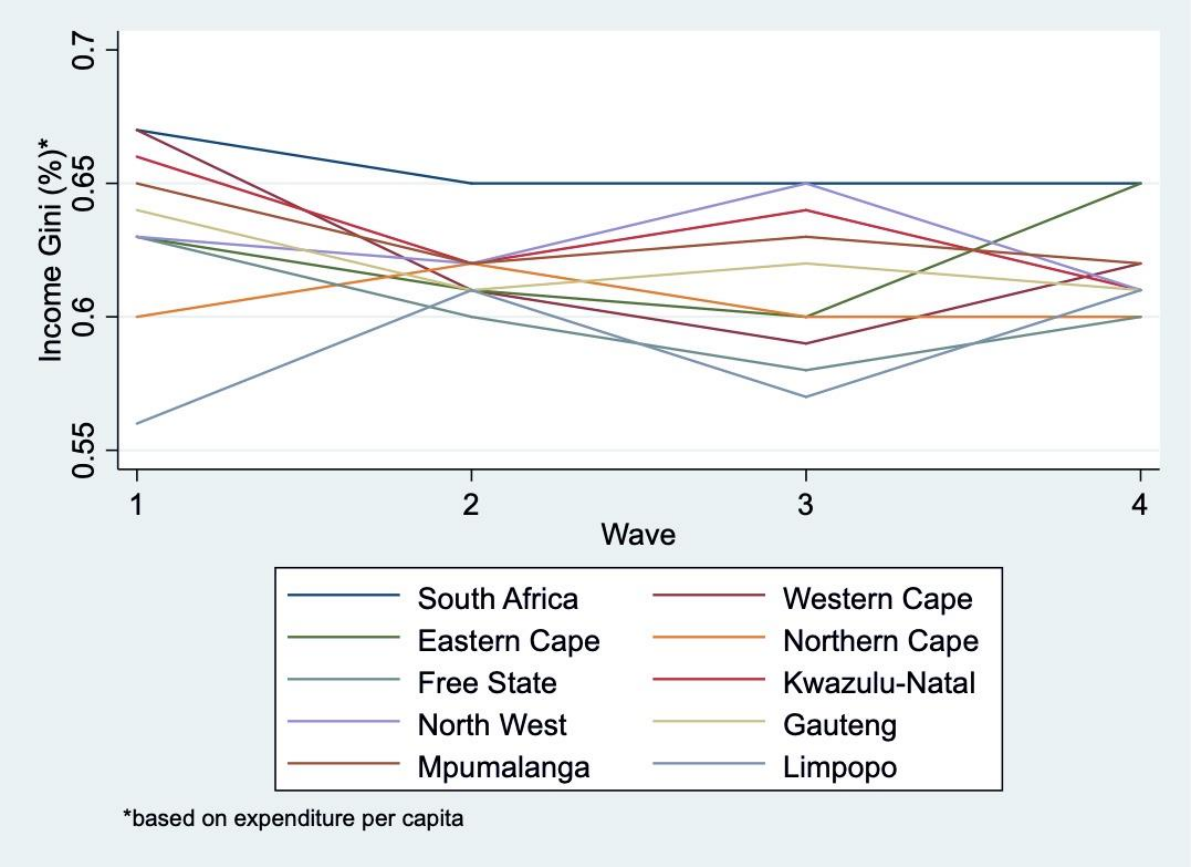
For descriptive statistics and robustness checks, further variables are used: crime ratio refers to the provincial ratios of 'serious crime' (South African Police Service 2018). *Prop_crime* captures all the property-related crime incidents (mainly break-ins and theft located at individuals' residences), adjusted for the population share of each province (Maluleke 2019). Other variables that capture the ownership of assets (e.g. cell phone ownership) are derived from NIDS.

3.3 Empirical strategy

A credible regression model to explain the variation in Gini is complicated by two challenges. First, there are four time periods and nine provinces, resulting in small *T* and small *N*. In addition, the Gini coefficient shows little variation, which makes it difficult to estimate it using fixed-effects estimation, because the within estimator is carried out through time-demeaning, further decreasing the necessary variation in the variance matrix (Wooldridge 2010). However, it is imperative to at least be able to assess unobserved heterogeneity in a panel data framework, which random-effects models assume to be orthogonal to the error term, a somewhat strong assumption. In other words, fixed effects will not work well with data for which within-cluster variation is minimal or for slow-changing variables over time, such as the Gini coefficient.

For the given reasons, this paper proceeds with a descriptive approach to explaining inequality and using regression analysis to model the dependency ratio, which has been identified as a potential driver of increases in inequality and as a particularity of the two provinces, where inequality increased (see Figure 1).

Figure 1: Trends in income inequality province comparison and national aggregate over time (2006–15)



Source: author's elaboration based on Makulele (2019).

The model specification is

$$dependency_{it} = \beta_0 + \beta_1 homeland_{it} + \beta_2 agricultural\_pop_{it} + \beta_3 school\_attend_{it} + \beta_i \boldsymbol{X}_{it} + c_i + u_{it},$$

where $\boldsymbol{X}_{it}$ is a vector that contains further control variables. For the random-effects models, we assume orthogonality between the time-invariant unobserved heterogeneity c_i and the regressors, which is why c_i can be specified within a composite error term $v_{it} = c_i + u_{it}$, assuming strict exogeneity in conditional means $E(u_{it} \mid c_i, \boldsymbol{x}_i) = 0$. Fixed-effects models model the unobserved heterogeneity c_i, allowing for arbitrary correlation with the regressors. Derived from the same sources described earlier, additional control variables that were included in the model were unemployment, cell phone access, property crime rates, assault ratio, share of households that experienced crop failure, median income of the population, household size, median education of the adult population, and perceived health status. The variable 'bank account' refers to the share of population owning a bank account and captures the fact that a formal account is needed to receive government grants. From the NIDS interview language variable, an ethnolinguistic diversity score was created counting all the different languages spoken in the provinces in order to cater the finding that economic development can be explained by ethnic diversity (Easterly and Levine 1997). However, except for the perceived health status and the bank account share, none

of the control variables entered significantly nor improved the fit of the model. The baseline model and the augmented model with the best fit are further explained in Section 4.

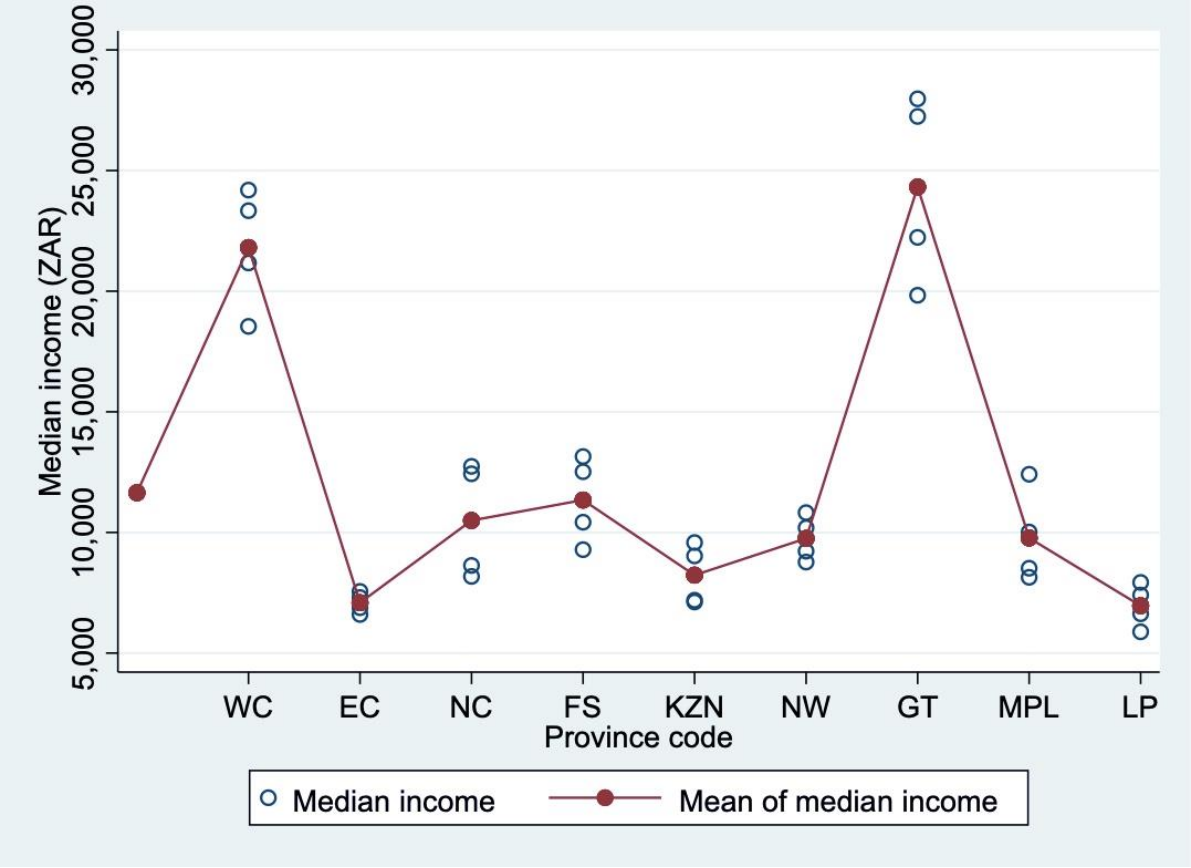
4 Results and discussion

4.1 Descriptive results

Remittances have been identified as a potential driver of positive changes in the Gini coefficient, establishing a link to the puzzling inequality increase between 2006 and 2015 in Limpopo and the Eastern Cape amid an overall decline (see Figure 1).

Economic realities are heterogeneous across South Africa (see Figure 2). The annual median income, which is already less susceptible for outliers, varies by more than 15,000 ZAR between rich and poor provinces and is lowest in the provinces where structural racial disadvantage was implemented in the form of *bantustans*. To put the monetary divergence into perspective, the annual median income in South Africa amounted to 13,546 ZAR in 2015 (Maluleke 2019).

Figure 2: Heterogeneity in median income across provinces



Note: WC, Western Cape; EC, Eastern Cape; NC, Northern Cape; FS, Free State; KZN, Kwazulu-Natal; NW, North West; GT, Gauteng; MPL, Mpumalanga; LP, Limpopo.

Source: author's elaboration based on Maluleke (2019).

Figure 1 confirms a similar heterogeneity among the trends in income inequality among provinces. To shed a first light on drivers of provincial Gini, correlation coefficients between inequality measures and socio-demographic variables are useful. Inequality, measured in terms of the income Gini, correlates to varying degrees and also in different directions with the variables at national

versus provincial level. There are consistently positive connections between the Gini and the dependency ratio, the distance to water sources from dwellings und the unemployment rate. Where households are larger and a large share of household income is derived from remittances, the income inequality tends to be consistently lower. None of the relationships described lay claim to causality. Some variables at the national level exhibit inconsistent directions (+/−) compared with variable correlations measured at a provincial level. For instance, provincial inequality yields a negative correlation with the share of agricultural population, whereas the national correlation coefficient is positive and five times larger. Property-related crime seems to be important to explain aggregate inequality and, surprisingly, correlates negatively with it.

For Limpopo province only, strong positive correlations[9] are scored between the provincial Gini coefficient and the share of black population (0.9902), household size (0.9635), school attendance rate (0.9177), the share of elderly (0.9059), and the average asset score (0.8660). Strong negative correlations exist between Limpopo's income inequality and the share of native Afrikaans speakers (−0.9889), households with access to a cell phone (−0.9856), the share of white population (−0.9665), the share of bank account holders (−0.9575), the ratio of assault crimes (−0.9382), and the ethnolinguistic diversity score (−0.8660).

In the Eastern Cape, strong positive correlations are scored between the provincial Gini coefficient and the share of English speakers[10] (0.9765), median income (0.9728), unemployment rate (0.9397), the share of agriculturally active population (0.9192), the urban population share (0.8835), cell phone access in a household (0.8814), the share of former homeland residents (0.8648), and the elderly population ratio (0.8458). Strong negative correlations exist between the Eastern Cape's income inequality and property crime ratio (−0.9803), the share of population living on farms (−0.9398), social grant recipients (−0.9232), assault ratio (−0.8348), household size (−0.822), and the share of black population (−0.8129). At first glance, the directions of the correlation are in line with the assumption of low inequality among the poor.

Figure 3 shows that the Eastern Cape and Limpopo exhibit an above average dependence on remittances and social grants and that even the low quintiles that generate some other income are relatively highly dependent.

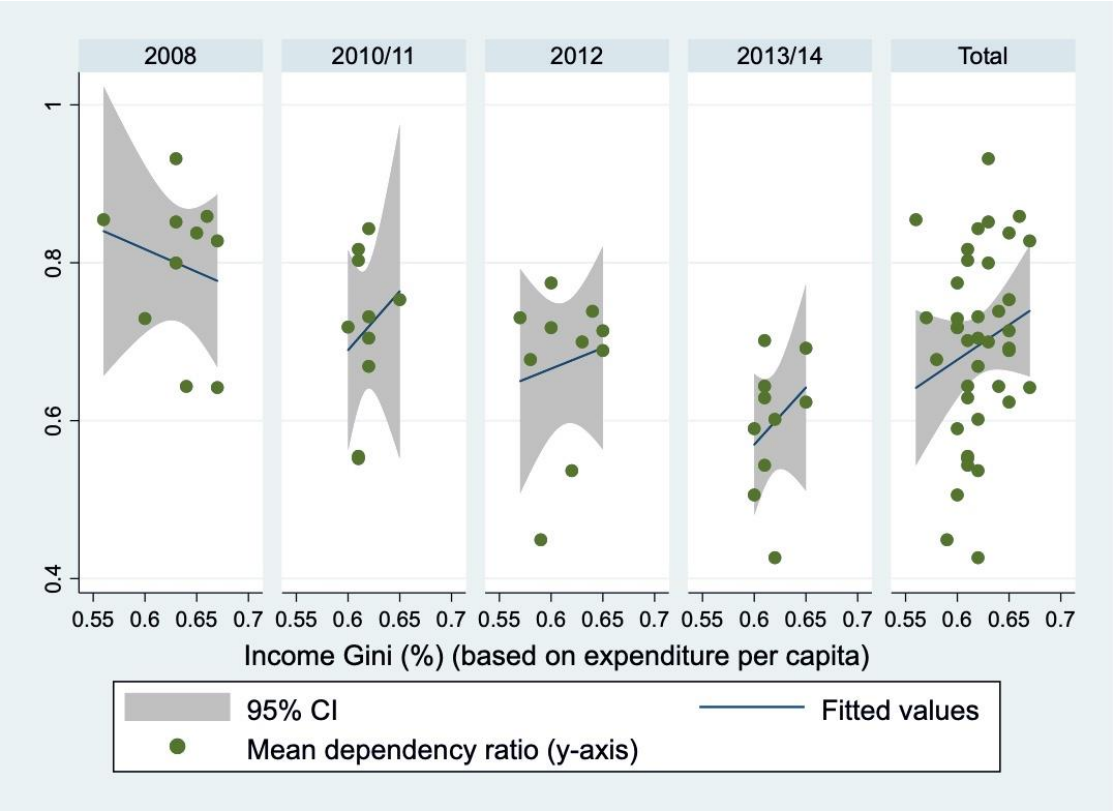
Given that poor households are disproportionally affected by increases in food prices, land inequality is especially harmful for subsistence farmers (Statistics South Africa 2013). The relationship between the dependency ratio and regional expenditure Gini has turned around after the food price spikes in 2008[11] (Figure 4). Despite the increase in the dependency ratio for all of South Africa over time, the linear fit between regional expenditure Gini coefficients and fitted values for the dependency ratio has become sharper. Ignoring any causal interpretations, Figure 4 confirms the findings from previous literature. There is an increasingly strong relationship between rural dependencies and regional inequality, which coincide with food price increases.

[9] Above a 0.8 correlation coefficient.

[10] Refers to English understood as preferred or first household language. See DPME, SALDRU, and UCT (2017a, b) for NIDS documentation of details on language classification.

[11] In 2007–08, the nominal prices of almost all food commodities increased by more than 50 per cent. For an analysis of potential drivers, see Tadasse et al. (2016); for a political impact analysis, see Feil et al. (2013).

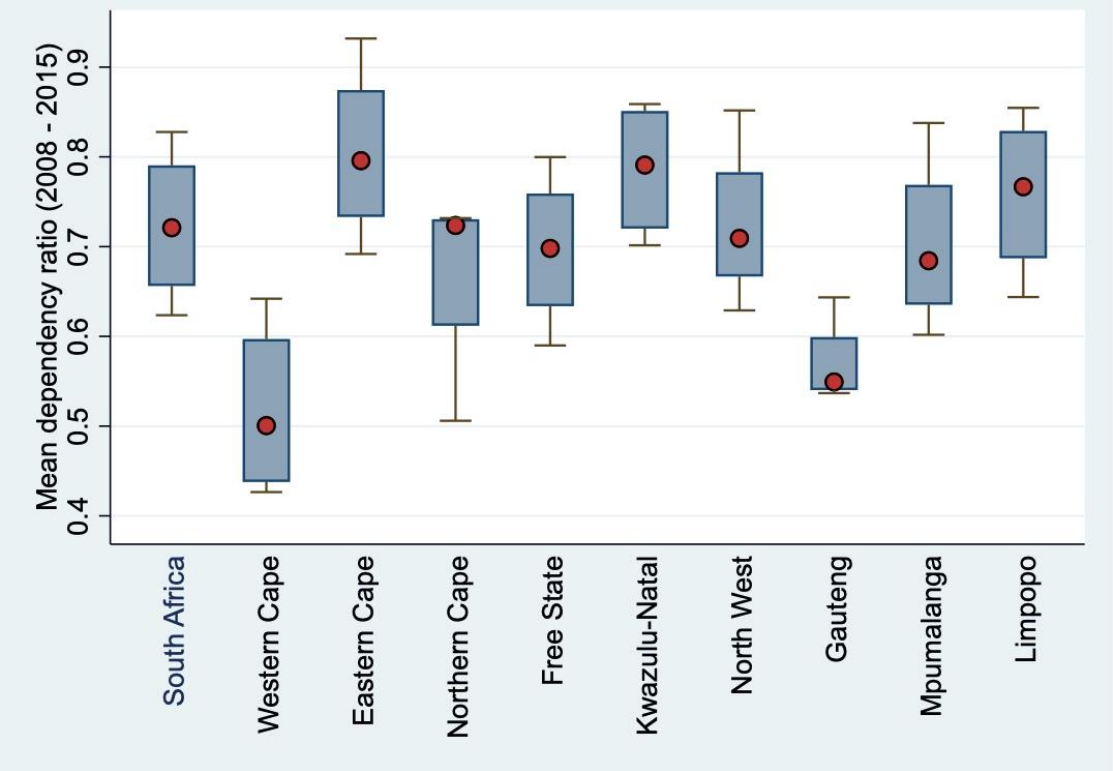
Figure 3: Dependency ratio as the share of total household income derived jointly from remittances and government grants (pensions, child support)



Note: CI, confidence interval.

Source: author's elaboration based on NIDS waves 1–5 (2008–15).

Figure 4: Boxplots dependency ratio (over provinces and years)



Source: author's elaboration based on NIDS waves 1–5 (2008–15).

4.2 Econometric results

Starting off with a basic random-effects model with robust standard errors, including only *remittances* and *property crime ratios* to explain the change in the Gini coefficient, the latter two variables alone significantly explain 27 per cent of the variation in provincial and aggregate income inequality. On average, a 1 per cent increase in remittances is associated with a decline in income inequality by 15.12 per cent. The nexus may not be causal, but according to the χ^2 statistics, the model is correctly specified at a 1 per cent level and unbiased under the assumption that there are no perfect linear relationships among the explanatory variables and ruling out correlation between the unobserved effect and the explanatory variables by assumption (assumptions *RE.1* and *RE.2* in Wooldridge 2010).[12] Based on the link between inequality and external non-wage sources, linear random- and fixed-effects models are used to dig deeper into what constitutes dependency.

First, the regression equation

$$dependency_{it} = \beta_0 + \beta_1 homeland_{it} + \beta_2 agricultural\_pop_{it} + \beta_3 school\_attend_{it} + c_i + u_{it}$$

is estimated by pooled ordinary least squares (POLS), which ignores the existence of unobserved heterogeneity ($c_i = 0$). All coefficients are statistically significant at a 5 per cent level or higher, except for the share of agricultural population. The three explanatory variables alone already explain 43 per cent of the variation in the dependency ratio, with only a 4.9 per cent divergence between the R^2 and its adjusted version. A 1 percentage point increase in the share of population living in traditional authority areas (former homelands) is associated with a 0.352 percentage point increase in the dependency ratio. If the share of learners aged 6–18 years increases in a province by 1 percentage point the dependency ratio on average decreases by 2.17 percentage points.

If c_i is correlated with any element of the regressors, then POLS is biased and inconsistent (Wooldridge 2010). The Breusch–Pagan test uses the Lagrange multiplier principle to test for heteroskedasticity (Breusch and Pagan 1980) and thus enables to opt for either POLS or random effects. Their test assesses the hypothesis Var(c_i)=0, meaning that the unobserved heterogeneity is the same across all individuals (Park 2009). Here, we reject the H_0 at a 5 per cent level of significance; thus, there is a significant unobserved heterogeneity across individuals that need to be taken into account. Since the POLS does not make any specifications about the structure of the error term, we would be better off with a random-effects model. The Breusch–Pagan test is not only understood as a test for heteroskedasticity but also known as a 'test for random effects' (Park 2009). Indeed, rejecting the null hypothesis hints at the random-effects structure of the variance matrix. However, this test statistic detects many forms of serial correlation in the composite error term (Hill et al. 2018; Wooldridge 2010). Thus, only because we reject H_0, the variance matrix might not necessarily exhibit the random-effects structure, which claims to use robust standard errors.

Second, the model is estimated using random effects. In this more efficient estimation, all variables turn out to be statistically significant at a 1 per cent level of significance and marginal effects increase. A 1 percentage point increase in the population that has been active in subsistence agriculture lowers the dependency ratio on average by a 0.3 percentage point. A larger share of

[12] However, a Breusch–Pagan test for heteroskedasticity (Wooldridge 2010) reveals that the model might be inconsistent due to either serial correlation or the lacking random-effects structure in the variance matrix of the composite error term v_{it}.

dwellers in former homelands within the borders of a province significantly increases the economic dependency on external sources of people living in the respective province. School attendance yields an opposite effect: all else being equal, where school attendance increases by 1 percentage point, dependency decreases by approximately 5 percentage points on average.

To overcome the restrictions of the Breusch–Pagan test, Wooldridge (2010) suggests using tests that precisely assess for random effects of the variance–covariance matrix of the composite error term (see Baltagi and Li 1995). The Baltagi–Li (1991) joint test for serial correlation and random effects suggests that the possible misspecification is more likely due to the presence of serial correlation than random effects. Serial correlation can of course be created through the time-invariant part of the error term, thus the unobserved heterogeneity.

Third, to allow for arbitrary correlation between the unobserved heterogeneity and the regressors, fixed-effects estimation is applied to the model, yielding marginally larger and statistically significant coefficients among all three regressors. The directions of the effects are consistent among all models and, according to χ^2 and *F*-test regressors, are jointly significant and models significantly well-specified. Especially the coefficients for homeland and school attendance gain importance in the fixed-effects model, and the within-estimation increases the fit to 75.1 per cent of the variance in the dependency ratio explained by the three regressors. Hausman (1978) proposed a test based on the difference between the two sets of coefficients estimated by random and fixed effects. Here, the null is rejected at a 5 per cent level of significance, random effects is not consistent and we use fixed effects.[13] Thus, the Hausman test confirms the results of the adjusted tests for random effects, and the fixed-effects model is unbiased and consistent under the necessary assumptions including strict exogeneity (Wooldridge 2010).

Appendix Table A1 shows the panel data estimations of the baseline model comparing pooled OLS, random effects, and fixed effects. Appendix Table A2 contains the regression results of the augmented model

$$dependency_{it} = \beta_0 + \beta_1 homeland_{it} + \beta_2 agricultural\_pop_{it} + \beta_3 school\_attend_{it} + bank\ account_{it} + health\ perception_{it} + c_i + u_{it}.$$

Linear multiplier tests for heteroskedasticity and random effects are repeated, as well as the Hausman test, leading again to a confirmation of substantial unobserved heterogeneity, making the fixed-effects model the preferred option. Substantively, fixed-effects models are designed to study the causes of changes within a province.

The θ[14] of the random-effects model is 0.51, thus in-between zero and one, which can be interpreted as a medium importance of time-invariant factors.

Comparing the three augmented models, the share of population, not professionally but for other purposes involved in agriculture, gains significance and magnitude. In the pivotal fixed-effects

[13] Since fixed effects is consistent when *c_i* and *x_it* are correlated, but random effects is inconsistent, a statistically significant difference is interpreted as evidence against the random effects assumption *RE.1*(*b*). Formally, *b*–*B*=0 (i.e. difference between the two sets of coefficients). The first set of coefficients (*b*) is consistent under the null and under the alternative hypothesis (fixed effects, in our case). The second set of coefficients (*B*) is only consistent under the null but more efficient than the other set.

14 Adding the θ option in Stata tells us how much of the variation is due to the individual, time-invariant effect, as it is calculated based on ρ. If θ is close to zero, the estimated coefficients of random effects are similar to those of the POLS; if it is unity, we actually estimate a fixed-effects model (see Wooldridge 2010).

model, a 1 percentage point increase in the agricultural population share is associated with an average decrease of 0.38 percentage points in dependency. Subsistence agriculture is key in explaining economic dependency and seems to balance out the foregone income from external sources; for example, family members sending money from cities facing a cash crunch.

Despite being statistically significant in both, the POLS and random-effects model, the own health perception is not significant any more in the fixed-effects model. School attendance share is highly significant and a 1 percentage point increase in the latter relates to an average decrease in dependency ratio of 6.14 percentage points, holding all else constant. Education turns out to be crucial in explaining economic dependency. Provinces with higher shares of learners aged 6–18 years attending school appear to be able to create economic opportunities rather than deriving larger income from external, non-productive sources. This interpretation goes along with Case and Deaton (1999), as well as Louw et al. (2007): Dropping out of school is more likely for students from poor families—such as highly dependent households—facing constrained time out of economic necessities.

Of course, part of the dependency ratio is also generated through pensions and child support. The findings can also be interpreted in a way confirming the effect of pensions for child welfare as identified by Duflo (2003). Before they attend school, a quarter of black South African children live with a pension recipient. The empirical results suggest that once they grow older, children (together with their parents) and adolescents migrate to other areas. If the migration route coincides largely with homeland-out migration, we could explain the increase in significance for school attendance taking up the decrease in significance for the homeland population share. At the end of the day, the root cause of both effects is the same: lack of opportunities in former homelands, resulting in skewed age structures in the rural communities with elderly, mostly female subsistence farmers and small children left behind (Lahiff et al. 2012; Duflo 2003).

The results suggest evidence for long-term patterns of land inequality as drivers of change in provincial economic opportunities, which indirectly relate to income inequality. The share of people living in former homelands is statistically significant in all models; however, the significance decreases to the 10 per cent level in the fixed-effects model with the highest explanatory power. Fixed-effects models are designed to study the causes of changes within an entity. The share of homeland dwellers is quite time-invariant over time with an average change of less than 1 per cent for Limpopo and the Eastern Cape. In contrast, especially between 2012 and 2015, the share of agriculturally active households increased.

5 Conclusions

South Africa is afflicted with structural unemployment, high crime rates, and persistent inequality. It is imperative to understand that these factors are deeply intertwined. For policy makers, this opens up a variety of adjusting levers within the toolbox in order to tackle the lack of social mobility. Economic welfare is shaped by a large part at the local level. The study shows that inequality measures at national levels accordingly leave out a lot of the picture, drawn to understand drivers of inequality. A more granularly understanding of local contexts is key to realize, first, what drives inequality in regions differently and, second, to what extent these drivers are structural patterns. Even achieving low levels of inequality has to be taken with a pinch of salt, because given that the poor are equally poor, low levels of inequality fail to reveal anything about social mobility and equality of opportunity or the prevalence of poverty. An increase in income inequality among the poorest provinces, however, is even more alarming, as it points to increasing inequality among the poor. It is precisely this fact that gives rise to concern in the face of rising trends for the Eastern

Cape and Limpopo. South Africa has been identified as a country where migration between provinces lowers human capital in both low- and high-income regions. Rural exodus of certain age groups spurs regional inequality through rural dependency and brain drain.

Few economic opportunities other than subsistence agriculture have been created in the former homelands. There is even ground for concern that social grants maintain the structural underdevelopment, since they are almost entirely responsible for sustaining the livelihoods in these regions. Without claiming causality, the strong relationship between rural dependencies and regional inequality has been found to be increasing.

Education and infrastructural development are found to be key for the current disadvantaged generation to overcome historical disadvantage. Correspondingly, dependency on remittances and social support is found to be significantly lower, where the share of learners increases. The empirical analysis confirms that social mobility is particularly dependent on parental education. Living with a household head with only a primary school degree lowers children's achievements by more than a quarter of a grade per year compared with parents with secondary schooling. Historical trends of racism engender discrimination. An ensuing scenario in the former homelands is that of children growing up with their grandparents, which usually leaves these children deprived of their opportunities.

References

Acemoglu, D., and J.A. Robinson. (2008). 'Persistence of Power, Elites, and Institutions'. *American Economic Review*, 98(1): 267–93. https://doi.org/10.1257/aer.98.1.267

Adato, M., M.R. Carter, and J. May (2006). 'Exploring Poverty Traps and Social Exclusion in South Africa Using Qualitative and Quantitative Data'. *The Journal of Development Studies*, 42(2): 226–47. https://doi.org/10.1080/00220380500405345

AfriForum (2020). 'Farm Attacks and Farm Murders in South Africa. Analysis of Recorded Incidents: 2019.' AfriForum Research Institute South Africa. https://www.afriforum.co.za/wp-content/uploads/2020/07/Farm-attacks-and-farm-murders-in-South-Africa-Analysis-of-recorded-incidents-2019.pdf (accessed February 2021).

Baltagi, B.H., and Q. Li (1991). 'A Joint Test for Serial Correlation and Random Individual Effects'. *Statistics and Probability Letters*, 11: 277–80. https://doi.org/10.1016/0167-7152(91)90156-L

Baltagi, B.H., and Q. Li (1995). 'Testing AR(1) Against MA(1) Disturbances in an Error Component Model'. *Journal of Econometrics*, 68: 133–51. https://doi.org/10.1016/0304-4076(94)01646-H

BBC (2019). *Julius Malema—South Africa's Radical Agenda Setter*, 30 April. Available at: https://www.bbc.com/news/world-asia-pacific-14718226 (accessed February 2021).

Becker, G. (1968). 'Crime and Punishment: An Economic Approach'. *Journal of Political Economy*, 76(2): 169–217. https://doi.org/10.1086/259394

Beinart, W., P. Delius, and M. Hay (2017). *Land Rights: A Guide to Restitution and Tenure Reform in South Africa*. Johannesburg: Jacana.

Biewald, A., H. Lotze-Campen, I. Otto, N. Brinckmann, B. Bodirsky, I. Weindl, A. Popp, and H.J. Schellnhuber (2015). *The Impact of Climate Change on Costs of Food and People Exposed to Hunger at Subnational Scale*. PIK Report 128, pp. 1–80. Potsdam: Potsdam-Institut Für Klimafolgenforschung. Available at: https://publications.pik-potsdam.de/pubman/faces/ViewItemOverviewPage.jsp?itemId=item_20465_4 (accessed February 2021).

Bourguignon, F. (2001). 'Crime as a Social Cost of Poverty and Inequality: A Review Focusing on Developing Countries'. Mimeo. Washington, DC: World Bank.

Breusch, T.S., and A.R. Pagan (1980). 'The Lagrange Multiplier Test and Its Applications to Model Specification in Econometrics'. *Review of Economic Studies*, 47(1): 239–53. https://doi.org/10.2307/2297111

Brophy, T., N. Branson, R.C. Daniels, and M. Leibbrandt (2018). *National Income Dynamics Study Panel User Manual.* Available at: https://www.datafirst.uct.ac.za/dataportal/index.php/catalog/712/download/9561 (accessed February 2021).

Case, A., and A. Deaton (1999). 'School Inputs and Educational Outcomes in South Africa'. *The Quarterly Journal of Economics*, 114(3): 1047–84. https://doi.org/10.1162/003355399556124

Cotula, L., S. Vermeulen, R. Leonard, and J. Keeley (2009). *Land Grab or Development Opportunity? Agricultural Investment and International Land Deals in Africa.* London/Rome: IIED/FAO/IFAD. Available at: https://pubs.iied.org/12561IIED (accessed February 2021).

Couttenier, M., and R. Soubeyran (2014). 'Drought and Civil War in Sub-Saharan Africa'. *The Economic Journal*, 124(575): 201–44. https://doi.org/10.1111/ecoj.12042

Demombynes, G., and B. Özler (2005). 'Crime and Local Inequality in South Africa'. *Journal of Development Economics*, 76(2): 265–92. https://doi.org/10.1016/j.jdeveco.2003.12.015

Dodson, B. (2002). 'Gender and the Brain Drain from South Africa'. SAMP Migration Policy Series 23. Waterloo, ON: Southern African Migration Programme (SAMP). Available at: https://scholars.wlu.ca/cgi/viewcontent.cgi?referer=https://scholar.google.com/&httpsredir=1&article=1119&context=samp (accessed February 2021).

DPME (2020). *The National Income Dynamics Study (NIDS)*. Republic of South Africa: Department for Planning, Monitoring and Evaluation (DPME), South Africa Labour and Development Research Unit, and University of Cape Town. Available at: http://www.nids.uct.ac.za/ (accessed February 2021).

DPME, SALDRU, and UCT (2017a). *National Income Dynamics Study Wave 5 2017: Household Questionnaire*. Republic of South Africa: Department for Planning, Monitoring and Evaluation (DPME), South Africa Labour and Development Research Unit (SALDRU, and University of Cape Town (UCT). Available at: http://www.nids.uct.ac.za/images/documents/wave5/W5_Household_Questionnaire_28Aug2018.pdf (accessed February 2021).

DPME, SALDRU, and UCT (2017b). 'NIDS User Manual'. *South Africa—National Income Dynamics Study 2017, Wave 5*. Republic of South Africa: Department for Planning, Monitoring and Evaluation (DPME), South Africa Labour and Development Research Unit (SALDRU), and University of Cape Town (UCT). Available at: https://www.datafirst.uct.ac.za/dataportal/index.php/catalog/712 (accessed February 2021).

Duflo, E. (2003). 'Grandmothers and Granddaughters: Old-Age Pensions and Intrahousehold Allocation in South Africa'. *The World Bank Economic Review*, 17(1): 1–25. https://doi.org/10.1093/wber/lhg013

Easterly, W. (2007). 'Inequality Does Cause Underdevelopment: Insights from a New Instrument'. *Journal of Development Economics*, 84(2): 755–76. https://doi.org/10.1016/j.jdeveco.2006.11.002

Easterly, W., and R. Levine (1997). 'Africa's Growth Tragedy: Policies and Ethnic Divisions'. *The Quarterly Journal of Economics*, 112(4): 1203–50. https://doi.org/10.1162/003355300555466

Eastwood, R., J. Kirsten, and M. Lipton (2006). 'Premature Deagriculturalisation? Land Inequality and Rural Dependency in Limpopo Province, South Africa'. *Journal of Development Studies*, 42(8): 1325–49. https://doi.org/10.1080/00220380600930614

Ehrlich, I. (1973). 'Participation in Illegitimate Activities: A Theoretical and Empirical Investigation'. *Journal of Political Economy*, 81(3): 521–65. https://doi.org/10.1086/260058

Feil, J.H., O. Musshoff, and A. Balmann (2013). 'Policy Impact Analysis in Competitive Agricultural Markets: A Real Options Approach'. *European Review of Agricultural Economics*, 40(4): 633–58. https://doi.org/10.1093/erae/jbs033

Frankema, E. (2010). 'The Colonial Roots of Land Inequality: Geography, Factor Endowments, or Institutions?'. *Economic History Review*, 63(2): 418–51. https://doi.org/10.1111/j.1468-0289.2009.00479.x

Gennaioli, N., R. La Porta, F. Lopez De Silanes, and A. Shleifer (2014). 'Growth in Regions'. *Journal of Economic Growth*, 19(3): 259–309. https://doi.org/10.1007/s10887-014-9105-9

Harris, J.R., and M.P. Todaro (1970). 'Migration, Unemployment and Development: A Two-Sector Analysis'. *The American Economic Review*, 60(1): 126–42. http://www.jstor.org/stable/1807860

Hausman, J.A. (1978), 'Specification Tests in Econometrics'. *Econometrica*, 46: 1251–71. https://doi.org/10.2307/1913827

Hausman, R., and M. Szekeley (1999). 'Inequality and the Family in Latin America'. IADB Working Paper 393. Washington, DC: Inter-American Development Bank (IADB). Available at: https://publications.iadb.org/en/publication/inequality-and-family-latin-america (accessed February 2021).

Hidalgo, F.D., S. Naidu, S. Nichter, and N. Richardson (2010). 'Economic Determinants of Land Invasions'. *The Review of Economics and Statistics*, 92(3): 505–23. https://doi.org/10.1162/REST_a_00007

Hill, R.C., W.E. Griffiths, and G.C. Lim (2018). *Principles of Econometrics*, 5th edn. Hoboken, NJ: John Wiley & Sons.

James, D. (2001). 'Land for the Landless: Conflicting Images of Rural and Urban in South Africa's Land Reform Programme'. *Journal of Contemporary African Studies*, 19(1): 93–109. https://doi.org/10.1080/02589000125070

Klasen, S. (2016). 'What To Do about Rising Inequality in Developing Countries?' PEGNet Policy Brief 5/2016. Kiel: Kiel Institute for the World Economy (IfW), Poverty Reduction, Equity and Growth Network (PEGNet). Available at: https://www.econstor.eu/bitstream/10419/146398/1/866806989.pdf (accessed February 2021).

Ladzani, W., and G. Netswera (2009). 'Support for Rural Small Businesses in Limpopo Province, South Africa'. *Development Southern Africa*, 26(2): 225–39. https://doi.org/10.1080/03768350902899512

Lahiff, E., N. Davis, and T. Manenzhe (2012). *Joint Ventures in Agriculture: Lessons from Land Reform Projects in South Africa*. London: International Institute for Environment and Development. Available at: https://pubs.iied.org/12569IIED (accessed February 2021).

Leibbrandt, M., I. Woolard, A. Finn, and J. Argent (2010). 'Trends in South African Income Distribution and Poverty Since the Fall of Apartheid'. OECD Social, Employment and Migration Working Papers 101. OECD and Institute of Development Studies. https://doi.org/10.35648/20.500.12413/11781/ii079

Lewis, W.A. (1954). 'Economic Development with Unlimited Supplies of Labour'. *The Manchester School*, 22(2): 139–91. https://doi.org/10.1111/j.1467-9957.1954.tb00021.x

Liversage, H. (2011). 'Responding to "Land Grabbing" and Promoting Responsible Investment in Agriculture'. *IFAD Occasional Paper*, 2(June): 1–16. Available at: https://www.land-links.org/wp-content/uploads/2016/09/USAID_Land_Tenure_2012_Liberia_Course_Module_2_Responding_to_the_Land_Grab_Liversage.pdf (accessed February 2021).

Louw, M., S. van der Berg, and D. Yu (2007). 'Convergence of a Kind: Educational Attainment and Intergenerational Social Mobility in South Africa'. *South African Journal of Economics*, 75(3): 548–71. https://doi.org/10.1111/j.1813-6982.2007.00137.x

Maluleke, R. (2019). 'Inequality Trends in South Africa'. *Statistics South Africa* (Issue October). https://nicspaull.files.wordpress.com/2020/01/saldru-2019-stats-sa-inequality-report.pdf

New York Times, The (2019). 'South African Wine Farmer in Land Dispute Is Shot Dead'. Available at: https://www.nytimes.com/2019/06/03/world/africa/south-africa-wine-farmer-killed.html (accessed February 2021).

OECD (2015). *South Africa Policy Brief: Regional, Urban and Rural Development*. Paris: OECD Publishing. Available at: https://www.oecd.org/policy-briefs/south-africa-territorial-development-for-more-inclusive-growth.pdf (accessed February 2021).

Oyvat, C. (2016). 'Agrarian Structures, Urbanization, and Inequality'. *World Development*, 83: 207–30. https://doi.org/10.1016/j.worlddev.2016.01.019

Park, H.M. (2009). 'Linear Regression Models for Panel Data Using SAS, Stata, LIMDEP, and SPSS'. Technical Report (not peer-reviewed). Mathematical Computing Department, Indiana University..

Paumgarten, F., C. Shackleton, and M. Cocks (2005). 'Growing of Trees in Home-Gardens by Rural Households in the Eastern Cape and Limpopo Provinces, South Africa'. *International Journal of Sustainable Development and World Ecology*, 12(4): 365–83. https://doi.org/10.1080/13504500509469647

Philipps, L. (2017). 'History of South Africa's Bantustans'. In *Oxford Research Encyclopaedias: African History*. Oxford: Oxford University Press. https://doi.org/10.1093/acrefore/9780190277734.013.80

South African Police Service (2018). *Crime Statistics 2017/2018*. Available at: https://www.saps.gov.za/services/april_to_march2018_19_presentation.pdf (accessed February 2021).

Statistics South Africa (2013). *Census 2011: Agricultural households*. Report 03-11-01 (2011). Pretoria: Statistics South Africa. Available at: http://www.statssa.gov.za/publications/Report-03-11-01/Report-03-11-012011.pdf (accessed February 2021).

Tadasse, G., B. Algieri, M. Kalkuhl, and J. Von Braun (2016). 'Drivers and Triggers of International Food Price Spikes and Volatility'. In M. Kalkuhl, J. Von Braun, and M. Torero (eds), *Food Price Volatility and Its Implications for Food Security and Policy* (pp. 59–82). Cham: Springer. https://doi.org/10.1007/978-3-319-28201-5_3

Van der Berg, S., N. Spaull, G. Wills, M. Gustafsson, and J. Kotzé (2016). *Identifying Binding Constraints in Education*. Synthesis Report for the Programme to Support Pro-poor Policy Development (PSPPD). South Africa: Department of Planning, Monitoring and Evaluation, PSPPD, and Research on Socio-Economic Policy, Department of Economics, University of Stellenbosch. Available at: http://resep.sun.ac.za/wp-content/uploads/2016/05/PSPPD_BICiE-email.pdf (accessed February 2021).

Wegerif, M.C.A., and A. Guereña (2020). 'Land Inequality Trends and Drivers'. *Land*, 9(4): 1–23. https://doi.org/10.3390/land9040101

Willman, A., C. Gould, G. Newham, M. Puerto Gomez (2018). *Republic of South Africa Systematic Country Diagnostic. Background Note: Crime, Violence, & Exclusion in South Africa Society. Overcoming the Legacy of Exclusion in South Africa*. Available at: http://documents1.worldbank.org/curated/pt/438921549055415403/134272-REVISED-DIGITAL-Republic-of-South-Africa-Systematic-Country-Diagnostic.pdf (accessed February 2021).

Wilson, M., and M. Daly (1997). 'Life Expectancy, Economic Inequality, Homicide, and Reproductive Timing in Chicago Neighbourhoods'. *BMJ*, 314(7089): 1271. https://doi.org/10.1136/bmj.314.7089.1271

Wooldridge, J.M. (2010). *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT Press.

Appendix

Table A1: Dependency regressions—pooled ordinary least square, random effects, and fixed effects

	(1)	(2)	(3)
Variables	Dependency_ratio	Dependency_ratio	Dependency_ratio
Agri_pop	–0.142	–0.299***	–0.393***
	(0.128)	(0.101)	(0.0394)
Homeland	0.352***	0.466***	1.543***
	(0.066)	(0.121)	(0.370)
School_attend	–2.170**	–4.980***	–6.178***
	(0.957)	(0.748)	(0.915)
Constant	2.638***	5.270***	6.049***
	(0.896)	(0.713)	(0.906)
Observations	36	36	36
R-squared	0.480		0.751
Number of province code		9	9
Overall *R*-squared		0.420	0.464
Within *R*-squared		0.723	0.751
Between *R*-squared		0.334	0.610

Note: standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1.

Source: author's computation.

Table A2: Extended dependency regressions— pooled ordinary least square, random effects, and fixed effects

	(1)	(2)	(3)
Variables	Dependency_ratio	Dependency_ratio	Dependency_ratio
Agri_pop	–0.228*	–0.326***	–0.382***
	(0.122)	(0.0606)	(0.0222)
Homeland	0.356***	0.426***	0.897*
	(0.0618)	(0.110)	(0.417)
School_attend	–1.675*	–3.788***	–6.135***
	(0.962)	(0.804)	(1.100)
Health	0.192**	0.139**	0.109
	(0.0912)	(0.0571)	(0.0659)
Bank_acc	0.585	0.226	–0.338
	(0.452)	(0.277)	(0.353)
Constant	1.427	3.724***	6.161***
	(0.964)	(0.791)	(1.135)
Observations	36	36	36
R-squared	0.585		0.776
Number of province code		9	9
Overall *R*-squared		0.513	0.490
Within *R*-squared		0.719	0.776
Between *R*-squared		0.445	0.520

Note: standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1.

Source: author's computation.