

GY460 Summative:
Measuring the Legacy Impacts of Bantustans on Income in South Africa

Word Count: 4195

Introduction & Literature Review

Apartheid was a political system of racial segregation that favored 'White' persons over 'Asian', 'Coloured' and 'Black' persons in South Africa from 1948 to 1994 (Dubow, 2014). This involved near total political power being held in the hands of White South Africans and a disenfranchisement of initially Asian, Coloured, and Black persons, but towards the end of Apartheid, disenfranchisement of predominantly Black South Africans alone (SAHO, 2004). Nevertheless, some attempts at territorial concessions and self-rule were given in mostly nominal terms to Black South Africans in the form of 'Bantustans' (Khuno, 2009). These Bantustans were ceremonially independent nations within South Africa, but all foreign and most domestic affairs were run exclusively by the white minority government. Today, South Africa no longer has Bantustans, as explicit racial boundaries are banned by the 1994 constitution (Constitutional Assembly 1996), but South Africa's official languages give insight into for whom the Bantustans were for. As mentioned, South Africa is divided into 4 main ethnic groups: Whites, Asians, Blacks, and Coloureds (A mixed race ethnic group dating back to the Dutch settlement of South Africa in 1600s). However, South Africa has 12 official languages, these are the official languages of Apartheid South Africa: Afrikaans (spoken natively by a majority White and Coloured South Africans) and English (spoken natively by a majority of Asian South Africans and a significant minority of all races) (UCT, 1980-2011). However, with the exception of South African Sign Language, the other 9 official languages of South Africa (Ndebele, Northern Sotho, Southern Sotho, Swazi, Tsonga, Tswana, Venda, Xhosa and Zulu) cover the languages spoken by the 9 main black ethnic groups in South Africa. These 9 main languages formed the basis for the formation of the 10 Bantustan nations of Apartheid South Africa (Khuno, 2009). They are as follows:

- Bophuthatswana for the Tswana people
- Both Ciskei and Transkei for the Xhosa people
- Gazankulu for the Tsonga people
- KaNgwane for the Swati people (Swazi speakers)
- KwaNdebele for the Ndebele people
- KwaZulu for the Zulu people
- Lebowa for the Pedi people (Northern Sotho speakers)
- QwaQwa for the Basotho people (Southern Sotho speakers)
- Venda for the Venda people

The population of these Bantustans ranged from a few hundred thousand to a few million by the end of Apartheid. Furthermore, while the Bantustans were granted nominal independence they were deprived of economic opportunities and resources afforded to White South Africans (Khuno, 2009). Therefore, using South African census data collected from 1980 to 2011, this paper seeks to measure the legacy of the Bantustans in post-Apartheid South Africa via the discrepancies in income and employment that expands on the research of Dinkleman (2011, 2017), who wrote about the legacy disparities of Apartheid on employment and health outcomes in Bantustans respectively. Moreover, research has been conducted in how dual economies are set up within highly unequal societies that can lead to a bifurcation of socio-economic variables between the elite and informal economies (Assouad et al., 2018) and the economic lag of incorporating those who were excluded in Apartheid (Coulibaly, Logan, 2009), which this paper also seeks to forward and highlight in South Africa.

Data & Methodology

All the shapefile data was sourced for the 52 districts of South Africa (There were minor rural district boundary changes in 2005 that affected less than 1% of the population) from the Stanford Library (Hijmans, 2015). The Census data for the regressions were sourced from the University of Cape Town's Data Catalog of the South African Census (UCT, 1980-2011), and this involved sourcing data from the formation of all the Bantustans (1980 Census) to the most recently published South African Census (2011). This includes the censuses conducted in 1991, 1996, and 2001. The 1985 Census was excluded due to income questions not being asked on the initial surveys. Moreover, the 1980 and 1991 censuses contain provincial information that allows each

census entry to be mapped to a specific Bantustan or province depending on which Bantustan/province the individual lived in.

Using questions that are mostly asked in all 5 censuses, the following variables were selected from the cleaned data: age, marital status, place of birth, amount of education, annual income, race, native language, dwelling type, sex, and district. Marital status, sex, and place of birth are cleaned down to the dummy variables: 0 - Unmarried & 1 - Married; 0 - Male & 1 - Female; and for place of birth: 0 - Abroad & 1 - South Africa, respectively. Meanwhile, age, education, and income are all treated as quantitative variables on a continuous scale. While age is kept as reported, annual income is binned based on the average range of values, e.g. if income is reported as 1-400 ZAR, then it is manipulated to 200.5, as exact values are not often defined, and to define the maximum distance from the outliers (maximum and minimum income). Annual income is further manipulated into the variable $\text{Income}_{\text{real}, 2022}$ which normalizes all incomes across all censuses to 2022 current ZAR inflation levels, allowing for the minimizing of error attributed to inflation in the OLS and IV spatial regressions. This is then further transformed into $\ln(\text{Income}_{\text{real}, 2022})$ to account for the exponential nature of income.

Furthermore, education is cleaned into only the highest level of education completed, with values of 1-12 provided for grades 1-12 respectively, 13 for all post secondary school diplomas, 14 for a bachelor's degree, 15 for a master's degree and 16 for a doctor's degree. Therefore, for example, the binning would treat someone who has a master's and a doctor's degree at the same level as someone who has a doctor's degree only (16). These are all summarized in the summary statistics of Table 1 below:

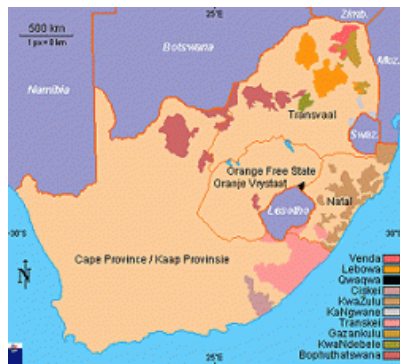
Table 1:

<u>Variable</u>	<u>Min.</u>	<u>1st Qu.</u>	<u>Median</u>	<u>Mean</u>	<u>3rd Qu.</u>	<u>Max.</u>
Bantu District	0.00	0000	0.00	0.42	1.00	1.00
Age	0.00	11.00	23.00	26.52	39.00	120.00
Marital Status	0.00	0.00	0.00	0.30	1.00	1.00
Place of Birth	0.00	1.00	1.00	0.97	1.00	1.00
Education	0.00	1.00	7.00	6.06	10.00	16.00
Employment	0.00	0.00	0.00	0.30	1.00	1.00
Sex	0.00	0.00	1.00	0.52	1.00	1.00
Income	0	0	0	9385	1750	2457601
$\text{Income}_{\text{real}, 2022}$	0	0	0	30768	12529	6259994

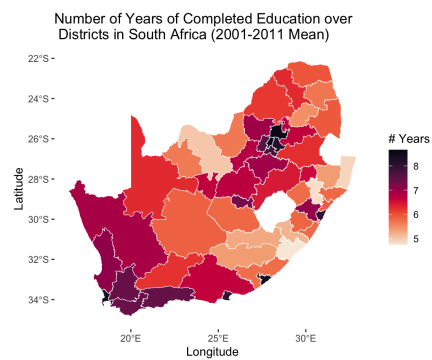
Finally, there is the categorical variables of native language, dwelling type, race and district. These are subdivided into: *language* - South Africa's 12 official languages and all other languages binned as *Other*. *Race* is subdivided down into Black, White, Asian, and Coloured, and dwelling type being subdivided into *hut/shack*, *house*, *institution* (school, prison, asylum), *flat/hotel*, and *homeless/refugee*. Lastly, *district* is excluded from all but the 2001 & 2011 census as geospatial data does not appear to exist for pre-2001 census data at the district level in South Africa. From the data above the following dummy variables were also created: $\gamma_{ib, it}$ and $\gamma_{cb, it}$. As for the variable $\gamma_{ib, it}$, this adds 1 to all people living in Bantustans from 1980 to 1991 censuses and 0 for everyone else through all censuses. Meanwhile, $\gamma_{cb, it}$ bins everyone who lives in a bantustan and a district that occupies part of a former Bantustan as 1 and everyone else as 0 throughout all censuses, allowing for different estimations on the legacy effects of Bantustans on income in South Africa. For the purposes of the regressions, the variable *Bantu District* is created from: $\gamma_{it} = \gamma_{cb, it} - \gamma_{ib, it}$ from this it allows the segregation of the treatment (districts in the 2001 & 2011 census who saw the removal of their bantustans) from our control (districts in 2001 & 2011 census who never had a bantustan in their borders).

Due to the nature of the combined multiple censuses data having around 160 million observations a random sampling of 1% was applied to the data to conduct all regression analyses. Moreover, regressions were conducted on all of the sample data as well as a filtered sampled dataset in which data that was contained in Metropolitan Districts (Cities of Bloemfontein, Cape Town, Durban, East London, Gqeberha, Johannesburg, and Pretoria) was removed for the introduction of bias towards income.

For understanding both the explanatory and dependent variables, it is important to develop a visual context. Looking at a political map of Apartheid South Africa, the Bantustans tended to congregate in Black majority areas of South Africa in the North and East, this can be seen in *Map 1*. In comparison, using the data taken from 2001 and 2011 South African Censuses, a cursory mapping was conducted on both the independent and dependent variables, by spatially linking them to the and the Stanford Libraries' shapefile. *Map 2* demonstrates the first discrepancy independent variable:

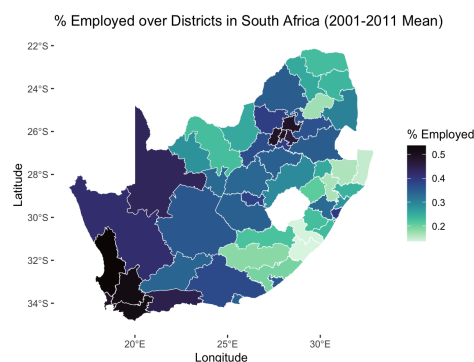
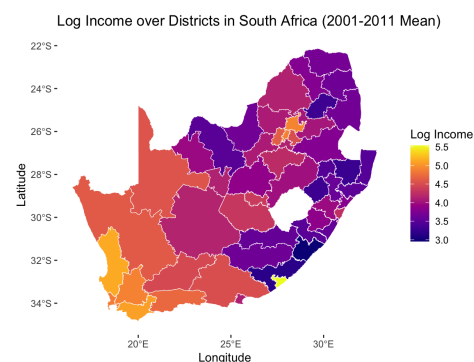
Map 1:

Source: SAHO

Map 2:

Map 2 was created for the purposes of this paper using R Studio

Here it can clearly be seen that the lower levels of education are in areas that correlate with the historic areas of the Bantustans (*Map 1*) in the North and East of the country (save for Gauteng, where Metropolitan Johannesburg and Pretoria are), while the number of years of schooling is higher in the South and West parts of the Cape where Coloureds are the majority or the plurality over Black South Africans. This highlights the first hypothesis that the dismantling of Bantustans has a lag effect on education. Moreover, mapping the explanatory variable of Employment shows clear partial insight into the potential expected lower incomes, as *Map 3* shows that areas of the historic Bantustans that have significantly higher unemployment rates as a majority of respondents don't work in the formal sector in those areas. Confirming this relationship, *Map 4* shows the discrepancies in the average of the log annual income for districts in South Africa adjusted for 2022 current ZAR.

Map 3:**Map 4:**

Map 3 & 4 were created for the purposes of this paper using R Studio

Here, it is safe to assume there may be a casual relationship between education, employment, and the legacy effects of Bantustans towards real income that make up the rationale for exploring this relationship and main results in the following sections.

Based on the plotting of the census data in the last section, the methodology approach taken to explore the relationship between the effects of the Bantustans and other explanatory variables on income is that of a baseline Ordinary Least Squares (OLS) Regression and an Instrumental Variable (IV) Regression to better estimate the effect of Bantustans on Income. First, a baseline OLS regression of Bantustans on Income is conducted on the 1% census sample from 1980 to 2011 using all censuses. This is represented by the following equation:

$$I_{it} = \beta\gamma_{it} + \varepsilon_i \quad (1)$$

Where I_{it} is quantitative variable of the log of real income (2022) of a given person: i in a given year: t , and γ_{it} is the spatial binary variable of whether a person in that district received a treatment of the removal of a Bantustan in a given year, and is ε_i the error term. However, given that much of the error term may be explanatory in nature, a generalized equation of all variables is added to the existing equation and is conducted in a generalized OLS Regression, represented by the following equation:

$$I_{it} = \beta\gamma_{it} + a_{it} + s_{it} + e_{it} + p_i + m_{it} + c_{it} + r_i + d_{it} + l_i + \varepsilon_i \quad (2)$$

Where a_{it} is quantitative variable of the respondent's age in a given year, s_{it} is the binary variable of their sex, e_{it} is the binary variable of their employment, p_i is the binary variable of if the person was born in South Africa, m_{it} is the binary variable of their marital status, c_{it} is the quantitative variable of number of years of education they have completed, r_i is the categorical variable of their race, d_{it} is the categorical variable of their dwelling type, and l_i is the categorical variable of their native language. This offers of generalized regression model that seeks to increase the R^2 and explanatory nature of the removal of Bantustans, but due to the potential endogeneity concerns of Bantustans, an explicit racial policy, being correlated with race, an IV approach is selected to reduce potential concerns of correlation between the independent variable

of the Bantustans and the error term. Therefore, the spatial variable of the removal of the Bantustans is chosen as the instrument and the following 2 stage regression is chosen.

$$I_{it} = \beta\gamma^*_{it} + a_{it} + s_{it} + e_{it} + m_{it} + c_{it} + \varepsilon_i \quad (3)$$

$$\beta\gamma^*_{it} = p_i + r_i + d_{it} + l_i + \omega_i \quad (3')$$

Where ω_i is the first stage error term. As a robustness check, to make sure higher incomes due to urbanization and availability of services (a non-directly measured variable) are not affecting the difference between the control and treatment incomes, a series of filtered OLS and IV regression were conducted that excluded the urban areas of the Metropolitan Districts of Bloemfontein, Cape Town, Durban, East London, Gqeberha, Johannesburg (2 Districts), and Pretoria were excluded from the 1996, 2001, and 2011 census sample so that only Bantu and non-Bantu rural areas are compared minimizing the error attributed to urbanization on real incomes. Although, urban areas are not excluded in the 1980 and 1991 census as it isn't possible to map to urban districts based on the data. However, this is of minimal concern as Black South Africans who were living in urban areas were excluded from the economic benefits of urbanization, such as increased access to education and job services, due to Apartheid, when compared to the non-Bantustan rural areas in South Africa. The results of which will be discussed in the next section.

Lastly, because the treatment is defined as the removal of Bantustans that coincided with the end of Apartheid, a robustness check is conducted on a treatment applied to Bantustans ($\gamma_{ib, it}$) only and a treatment variable that also includes a Bantustan and the corresponding corresponding district(s) that followed their dismantling ($\gamma_{cb, it}$). This is conducted in both the generalized OLS regression, as well as the IV regression analysis. The results of this finding is also discussed in the next section.

Main Results:

First, the relationship between race and income is examined via measuring the impact of the removal of Bantustans on income directly. Table 2 below shows the results of I_{it} regressed on $\beta\gamma_{it}$:

Table 2:

Variable	(1)	(2)	(3)	(3), urban area excluded
Removed Bantustan District	-0.774*** (0.008)	0.041*** (0.010)	-0.844*** (0.020)	-0.539*** (0.020)
Age		0.067*** (0.001)	0.068*** (0.001)	0.072*** (0.001)
Marital Status		-0.146*** (0.012)	-0.099*** (0.012)	-0.122*** (0.016)
Place of Birth		-0.456 (0.709)	-0.002 (0.015)	-0.014 (0.022)
Education		0.037*** (0.001)	0.045*** (0.001)	0.041*** (0.001)
Employment		6.666*** (0.011)	6.654*** (0.012)	6.423*** (0.015)
Sex		-0.155*** (0.009)	-0.136*** (0.009)	-0.120*** (0.011)
Race (Asian)				
x Black		-0.097. (0.053)	-0.372*** (0.009)	-0.209*** (0.013)
x Coloured		0.024 (0.038)	-0.610*** (0.006)	-0.436*** (0.011)
x White		0.806*** (0.037)	-0.456*** (0.006)	-0.197*** (0.010)
Native Language (Afrikaans)				
x English		0.250*** (0.025)	0.053*** (0.004)	0.314*** (0.009)
x Ndebele		-0.311*** (0.054)	0.409*** (0.009)	0.587*** (0.010)
x North Sotho		-0.226*** (0.046)	0.430*** (0.008)	0.602*** (0.009)
x Other		0.034 (0.113)	0.234*** (0.015)	0.419*** (0.019)
x South Sotho		-0.403*** (0.046)	0.088*** (0.008)	0.073*** (0.010)
x Swazi		-0.179*** (0.051)	0.552*** (0.008)	0.604*** (0.009)
x Tsonga		-0.135** (0.048)	0.392*** (0.008)	0.587*** (0.009)
x Tswana		-0.347*** (0.046)	0.297*** (0.008)	0.403*** (0.009)
x Venda		0.064 (0.054)	0.347*** (0.008)	0.403*** (0.010)
x Xhosa		-0.247*** (0.045)	0.322*** (0.008)	0.476*** (0.009)
x Zulu		-0.337*** (0.045)	0.473*** (0.007)	0.582*** (0.009)
Dwelling (Flat/Hotel)				
x Homeless/Refugee		-0.730*** (0.214)	-0.072. (0.038)	0.070 (0.066)
x House		-0.278*** (0.065)	0.084*** (0.010)	0.089*** (0.010)
x Hut/Shack		-0.309*** (0.083)	-0.184*** (0.010)	-0.198*** (0.010)
x Institution		-0.266***	0.035***	0.011

		(0.070)	(0.011)	(0.011)
x Other		-0.953*	-0.134***	-0.138***
		(0.280)	(0.013)	(0.015)
<hr/>				
Observations	1580199	232862	232862	146423
R-Squared	0.006	0.737	0.722	0.692
<hr/>				

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, . $p < 0.1$ Parentheses contain heteroskedasticity robust standard error.

The results show that the removal of a Bantustan in South Africa results in a -0.54 in income for each new ZAR earned. In other words, the removal of Bantustans results in a 54% drop in incomes. Likewise, these results are statistically significant at a 99% confidence interval, but the R^2 remains quite low and therefore the removal of Bantustans in South Africa most likely does not explain most of the variation in income here.

To better understand the variation in income attributed to race, the variables: Age, Marital Status, Place of Birth, Education, Employment, Sex, and Language are added into the generalized equation (2) in Table 2. The results show that the removal of Bantustans results in 0.042 or 4.2% increase in incomes at the 99% confidence interval. This means there is a relatively minor correlation between the end of Apartheid's Bantustans and higher incomes, suggesting the legacy impacts of Apartheid still affect Bantustans' lower quality of life indicators represented visually in Map 2, 3 & 4. Likewise, the positive coefficients on Age, Education, and Employment correspond to the predictions that an increase in age, levels of education, and having a job increases one's income. Hereafter, the negative coefficients on Sex, Marital Status, and Place of Birth correspond to the prediction that being female, married (and therefore perhaps more unemployed people in a household) and born in South Africa seem plausible given societal norms and gendered expectations and discrimination. Thereafter, with baselines of speaking Afrikaans, being Asian, and living in a flat/hotel, the main results of the categorical variables appear as predicted. Mainly, English is a preferable native language over Afrikaans, while all Bantu languages (with the exception of Venda not being significant) are detrimental towards higher incomes. Additionally, living in a flat/hotel is correlated with higher real incomes over being homeless or in a house/hut/shack, most likely because flat/hotels are correlated with urbanization. Lastly, Whites and Coloureds appear to correlate with having higher than Asian incomes and Blacks would appear to have correlation with lower incomes relative to Asians, but the OLS doesn't produce a statistically significant result. This highlights one of the main flaws

with the OLS regression, giving credence to the fact that being in a Bantustan is correlated with being Black and suggests a two-stage IV regression may be more appropriate. Concurrently, the negative coefficient on year is alarming and may suggest that the OLS regression is biased as it would suggest that real incomes across the board have not risen between 1980 and 2011.

Therefore, it is important to examine the results from the IV regression in Table 2 next.

Here the adjusted R² remains roughly the same but the coefficient on γ_{it} has changed, while the signs and values of the other explanatory variables remain consistent from the OLS regression. The estimate γ_{it} shifted from 0.042 or 4.2% increase to -0.570 or 57.0% decrease effect on income. While this is a significant reversal from the generalized OLS regression, it is quite similar to the initial individual OLS regression of equation 1. This gives credence to the idea that the IV regression does not dramatically alter the initial individual effect of the removal of Bantustans on income, but does explain more of the variation and adds robustness by incorporating other explanatory variables and accounting for concerns of endogeneity. As for the number itself, it is shocking but not surprising. Much of the legacy of segregation persists post-Apartheid via informal and self-segregating selection (Khuno, 2009). However, this may be heightened as the results suggest, by the driving factor of internal migration as a serious brain-drain may have occurred in the rural land of the Bantustans as people seek new opportunities of work in the big cities, leaving real incomes lower in the Bantustans even if nominal incomes have grown. To test this next the results from the robustness check will be assessed.

Secondary Results & Robustness Check

Using all the districts in the main results, one of the concerns was that internal migration may overstate the relative disparity between cities and the Bantustans as while Bantustans may have had a lag result on income only in relative terms to urban areas like Johannesburg, which saw an explosion in the size of the Black middle class and their relative incomes since the dismantling of Apartheid. Therefore, as part of the robustness check, the 8 Metropolitan Districts of Bloemfontein, Cape Town, Durban, East London, Gqeberha, Johannesburg (2 Districts), and Pretoria were excluded in an attempt to minimize the error due to urbanization as mentioned before. The results found, the coefficient on γ^*_{it} in the IV regression decreased to -0.417 or

-41.7% as compared to -0.570 or -57.0% in the main results, while the OLS results became less significant and minimally above zero (0.054 or 5.4%).

Likewise, further robustness checks were conducted $\gamma_{ib, it}$ and $\gamma_{cb, it}$ on both the whole dataset and the urban exclusion subset of the data, which expectedly flipped sign to positive for both cases of $\gamma_{ib, it}^*$ and produced a small negative coefficient for $\gamma_{cb, it}^*$ respectively. This highlights that $\gamma_{ib, it}^*$ most likely is a pre-brain drain treatment explanation for income divergence of post-Apartheid South Africa, and the fact that this relationship is maintained when excluding urban areas in the subset data, highlights that this hypothesis holds true when excluding urban integration and only comparing Bantustans to rural integrated areas. Furthermore, the relatively minor results on the coefficient of $\gamma_{cb, it}^*$ suggests that the differences between the main treatment of γ_{it} and the robustness check of $\gamma_{ib, it}$ is expectedly canceled out in the regression of the full dataset and the urban-exclusionary subset of the data. This gives further validity to the effects measured in the IV regression of the main results. One of the main concerns of the data however is the fact that because the Bantustans were abolished, not all of the area of the newly formed districts that contain former Bantustans was previously a Bantustan. There are areas of the treatment districts that have a spatial spillover of the control into the treatment (although not the reverse), and therefore the coefficients on treatment are most likely biased upwards (due to the inclusion of higher income rural areas). Moreover, the potential presence of the lack of data in pre-Apartheid South Africa for low skilled black labor may mean the average income falls post-Apartheid due to better reporting of employment figures of this group like others have found (Dinkleman, 2011). This is a limitation of the data however, and could only be remedied with extensive spatial mapping and exact geolocations of census respondents which were not given in the dataset.

Limitations & Conclusion

In conclusion, this paper seeks to measure the spatial impact of Bantustans on post-Apartheid income on the inhabitants who live in their former geographic boundaries. Accounting for a series of binary, quantitative, and categorical variables of each individual census respondent. A 1% sample of the 1980-2011 censuses showed that the removal of Bantustans that followed the end of Apartheid lead to real terms income decrease in the former Bantustans as robustness checks suggest that removing urban areas minimized this decrease,

further suggesting that following Apartheid internal migration may have causally caused a brain drain in former Bantustans resulting in higher income earners moving towards urban areas, and further studies that accounted for former non-Bantustan rural areas and smaller cities could better estimate the coefficient, as due to the spatial spillovers the coefficient on the removal of Bantustans may be slightly biased upwards or downwards depending on the spatial spillover or lack of accounting for medium size cities respectively.

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