# Father's employment and sons' stature: the long run effects of a positive regional employment shock in South Africa's mining industry

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# Father's employment and sons' stature: the long run effects of a positive regional employment shock in South Africa's mining industry[1]

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ABSTRACT

I exploit the sudden increase in employment in 1975, 1976 and 1977 in four former South African homelands to compare the long term adult outcomes of children benefitting from the employment increase to those not subject to it. Using a standard difference in difference approach I find that there was severe malnutrition in the homelands resulting in stunting in African men born during the shock providing support to the foetal origins hypothesis. The employment shock did not affect other long term outcomes such as education and general health, although there is some evidence of an improvement in long term health. This study provides previously unmeasured individual level information on the quality of life in the homelands during apartheid, an era when African living standards were neglected but unmeasured because of a lack of data collection.

Keywords: apartheid; living standards; stunting; difference-in-difference; foetal origins hypothesis
JEL codes: I31 N37

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## Introduction

There is a large literature on the long term impacts of in utero and early childhood environmental conditions on adult outcomes such as health, cognitive ability and longevity (Komlos 1987, Barker 1992, Costa 1993, Steckel 1995, Almond 2006, Frijters et al. 2010, Hatton et al. 2010, and Almond and Currie 2011). Food intake, public health provision and the disease environment all play a role (Almond et al. 2007, and Gørgens et al. 2012). It is also now well known that exposure to increased family incomes in early childhood years can lead to increased nutritional intake (Jensen 2000, Duflo 2003, and Banerjee et al. 2010). The implication is that family income increases can improve early childhood environmental conditions which can result in positive adult outcomes such as increased stature, longevity and improved health. However, many studies that characterise improvements in living standards rely on time variation between cohorts during periods of economic growth and slumps. As Banerjee et al. (2010) note, these studies cannot necessarily distinguish between the role that improvements in nutritional intake play versus the role played by the increase in the provision of public services such as health care that might occur during boom periods when incomes increase. This paper fills the gap by exploiting the considerable and sudden rise in incomes in regions in South Africa that had previously suffered from long term malnutrition because of poverty, regions where changes in the provision of public services did not occur.

The paper uses the 2008 wave of the National Income Dynamics Study (NIDS) to determine the impact of an unexpected shock to the labour supply of the South African mining industry between 1975 and 1978 on living standards in the South African homelands.[2] In 1974 the South African mining sector experienced an unanticipated decline of its massive foreign labour supply and responded by increasing recruitment activities in only four of the

[2] There were 10 homeland areas, one homeland for each ethnic group. Four homelands had been granted political independence by the South African government by the end of apartheid, although this was never formally recognised by the international community.

10 former homelands resulting in an unexpected and sudden increase in the incomes of African men living in those homelands. In April 1974 President Hastings Banda of Malawi suspended all recruiting operations of the South African Chamber of Mines in that country pending the outcome of an enquiry into the causes of a plane crash that killed 77 Malawian miners. The decision to halt Malawian labour supply affected 70, 000 gold miners that the South African Chamber of Mines had to replace. Then in 1976, the new government in Mozambique, the Liberation Front of Mozambique (FRELIMO), discouraged the migration of workers from Southern Mozambique to apartheid South Africa. The number of foreign workers in the mining industry fell from 297, 000 in December 1973 to 189,000 at the end of 1977 as shown in table 1 (South African Institute of Race Relations 1974, 1977, and 1978). To fill the short fall of workers, employment of domestic recruits increased from 95,000 to 193,000 over the same period. For approximately 24 % of households in the affected areas this signified an increase in family incomes of at least R14.22 per month when the average yearly income was between R40 and R120 in 1953, the latest date for which there is data for all homelands (Tomlinson Commission 1955).[3] [4]

South Africa's former homeland regions were home to approximately 20 million African South Africans until they were reincorporated into South Africa in 1994. Their physical land mass constituted slightly more than 13 percent of the total South African land mass and yet they housed approximately 50 percent of the African population. Homelands were situated in rural areas of South Africa with either low rainfall, poor soil quality or both. Homelands were overcrowded and unable to support the agricultural activities on which most inhabitants depended. They were subsequently poverty stricken with few economic opportunities within the homelands and were characterised by high levels of unemployment.

[3] One Rand was worth around one US dollar at this time.
[4] Butler, Rotberg and Adams (1978 p 125) note that incomes for Bophuthatswana and Kwa-Zulu in 1973 were between R40 and R165.

While we know that the level of poverty in the homelands was high (Hirsch 1986), details of the living standards and the long term physical consequences of poverty in the homelands are not well known due to the lack of data collected during apartheid. The 1970 census, the last census to enumerate almost the entire country prior to the end of apartheid in 1994, excluded people living in Venda, one of the independent homelands. [5] Furthermore, the census had one questionnaire for Coloureds, Asians and Whites and a different one for Africans.[6] The African questionnaire contained only a limited subset of the questions in the Coloured, Asian and White survey. There are other discrepancies, for instance almost four million Whites were enumerated but only 751, 892 Africans were enumerated despite their numerical dominance. Subsequent censuses excluded the independent homelands and also ultimately the non-independent homelands. Since 1994, censuses and household surveys represent the entire population but do not explicitly record whether an individual was born in a former homeland or not. Due to the high levels of mobility in South Africa from rural to urban areas in the post apartheid period, a large number of people who would have grown up in the homelands no longer live there and their origins could not be traced until now.

The NIDS data improve on other post-apartheid survey data by documenting where a person was born as well as when. In addition, the data contain a number of well being measures such as height, education and health. We now have information on individual characteristics in the homelands which could be used to determine the standard of living in these areas (Nicholas and Steckel 1991, Komlos 1993, Steckel 1995, and Steckel 2008).

Both the nature of the shock and the South African political environment at the time make it easier to interpret the results. Firstly, the shock itself was completely unexpected and not the result of any changes in South African racial policy. In 1975, Leys discussed the nature of recruitment of foreign workers noting that there was only minimal discussion by the

[5] The other three: Bophuthatswana, Ciskei and Transkei were not yet independent at this time.
[6] The racial terminology in this paper is consistent with that used by the current South African government. African make up 80 % of the population, Whites 10 %, Coloureds 6 % and Indians 4 % (Feinstein 2005).

Chamber of Mines of what independence in Mozambique might bring. The paper was published before the full extent of the Malawian withdrawal was known. Secondly, the selection of the homelands that would contribute to mining was for the most part independent of conditions in the homelands. The Chamber of Mines recruited predominantly from specific homelands meaning that only some homelands experienced the large increase in employment. There is therefore a convenient comparison group to determine the quality of the living standards in areas affected and unaffected by the shock. Since, mining industry recruitment was higher in more densely populated regions (Wilson, 1972), one concern is that living standards may have been lower in the homelands that experienced the labour demand shock than in other homelands. Any changes in outcomes, in that case, would be for the worst off individuals who may not necessarily represent the general homeland population. However, given the high levels of poverty in all homeland regions, I believe that the poorest homelands still provide some information on living standards in the homelands in general. Furthermore, Leys (1975) notes that South African government policy was that each homeland would send the majority of its workers to one specific industry. The choice of industry each homeland contributed to was independent of the stature or strength of the inhabitants. The selection of the most crowded homelands to fill the labour shortfall most likely had more to do with access to larger amounts of workers than any attempt to benefit those who might be worst off. Thirdly, there was unlikely to have been much, if any, migration into areas subject to the shock from other areas by people looking to take advantage of the increase in labour demand in those areas. The policy regarding the mobility of the African population was extremely restrictive. Pass Laws made it very difficult for people to move from one region to another. Related to that, because of the immobility of the population it is very unlikely that financial gains in one homeland would spread to another given their geographical distance. Therefore, the positive impacts in each homeland would have stayed within that homeland.

Using a standard difference in difference analysis, I find a strong impact of a positive change in childhood welfare in 1976 and 1977 on adult heights in 2008. Men who were born in the affected regions in 1976 and 1977 are on average 6 centimetres taller than other African men. While this number may seem extremely large, table 1 shows that on average African men living both within and outside of a homeland were approximately 8 centimetres shorter than Whites. The implication is that living standards for Africans during apartheid were indeed very poor compared to those of Whites. There is no genetic reason to believe that Whites should be taller than any other race group. I find that men born at the time of the shock in the selected homelands have better long term health, however I do not find any impact on education or other health measures. Neither do I find any impact on men born slightly before the shock nor slightly after, lending support to the hypothesis that foetal conditions are most important for long run physical development (Barker 1992, Almond 2006). The evidence is also consistent with the findings in Duflo (2003) where increases in male incomes are not necessarily passed on to children in the household. There is no discernible impact of the shock on African women born during the shock which is somewhat troubling given that the gender of the individual would have been unknown until birth. This is only a beginning toward our deeper understanding of living conditions in the former homelands, however the study does provide evidence that the levels of poverty in the homelands had negative physical consequences for the male inhabitants.

The following section discusses the employment of foreign labour and well as conditions in the homelands and migrant labour. Section 3 presents the data and summary statistics. Section 4 discusses the analytical approach and results and Section 5 concludes.

**Mining industry employment and the shock to domestic labour demand**

By 1973, foreign workers made up 75 % of the gold mining workforce in South Africa. The majority of these workers came from Malawi and Mozambique with Lesotho

sending the third largest contingent of workers. While Tanzania and Zambia restricted their citizens from working in the mines already in the 1960s, two events occurred in the mid-1970s that drastically reduced the supply of foreign workers to the gold mining industry. In April 1974 Malawi's president, Hastings Banda, reduced the flow of workers to South Africa pending the outcome of an enquiry into the causes of a plane crash that killed 77 workers. The number of Malawian workers decreased by 14 000 between 1973 and 1974 and another 72 000 by the end of 1975 (see table 2). Following that, in 1976, after Mozambican independence, the supply of workers from that country to South Africa declined substantially, by 24 000 between 1975 and 1976 and another 33 000 by April of 1977. As a consequence, the size of the mining labour force declined by 53 000 workers between 1973 and 1974 and another 28 000 by 1975.

The domestic labour recruitment arm of the South African Chamber of Mines, the Native Recruitment Corporation (renamed The Employment Bureau of Africa, or TEBA, in 1977), responded to the decrease in the supply of foreign workers by setting up recruitment branches close to several former homelands. The majority of the workers came initially from Transkei in 1975 with increases also in Bophuthatswana, Ciskei and Kwa-Zulu in 1976 (Crush 1986, Crush et al. 1991). The number of South Africans employed in the industry increased from 76 523 in 1974 to 228 109 by 1978, an increase of almost 200 %.[7]

This is a substantial increase in the number of workers recruited domestically and leads to two questions. Firstly, why were the mines not in the habit of hiring predominantly domestic workers from the outset and secondly, why was there such a large amount of available domestic workers at the time of the shock to foreign supply? The policy of employing foreign workers in the mining industry was a long standing one (Wilson, 1972). Some commentators maintain that the industry only prospered because it was able to utilise a

[7] Figures from the South African Institute of Race Relations Annual Reports (1969 – 1979).

source of cheap unskilled labour (Wilson 1972, Leys, 1975, Crush et al. 1991, Feinstein 2005). When the industry was unable to satisfy labour demand locally it expanded its catchment area to other countries/colonies in southern Africa where the British and Portuguese colonial authorities were accommodating (Prothero, 1974). The proportion of foreign workers in the South African mining industry rarely fell below 50 percent between 1886 and 1973.

Difficulties in hiring domestic workers were associated with the attitude of South Africans to the mining industry. The domestic African labour force increasingly rejected mining as an employment option in the first two thirds of the twentieth century. Labour demand in manufacturing was increasing in the post war period and paid higher wages compared to the extremely low wages paid in the mining industry. Moreover, labour demand in the post-war manufacturing sector was large enough to offer many workers a job. Simultaneously the mining industry's reputation suffered from its poor safety record (Leys 1975). The industry defended its low wage policy by claiming that domestic labourers had families based in the homelands that were supporting themselves through subsistence farming. There was therefore no need to pay a man a wage large enough to maintain his family, unlike that required for white workers. Foreign workers were preferred because they accepted lower wages since population densities in southern African countries were low enough that the remaining community could survive by subsistence agriculture without the migrant's wages.

The result was that by the early 1970s, domestic Africans had been excluded from the mining industry and the NRC did not actively recruit other than in Transkei. Yet, economic circumstances in the homelands had deteriorated during the apartheid years so that by the time the employment crisis came to the mining industry in 1974, the homelands were

characterised by high rates of unemployment, poverty, and overcrowding and workers were willing to relocate to the mining industry.

The South African government originally created the homelands in the 1913 Land Act. The Act allocated 7.6 percent of South Africa's land mass in the form of reserves to the African population which at the time accounted for 67 percent of the population of almost six million people (Feinstein, 2005).[8] The government allocated each African ethnic group in South Africa to a reserve so that the 10 homelands ultimately served 10 ethnic groups (most homelands consisted of a majority ethnic group and minorities from other groups (Horrell 1973 p38)). Figure 1 presents a map of South Africa during apartheid with the homelands shaded in. Under apartheid, the reserves became homelands and during the 1970s four of them were granted independence by the South African government (Bophuthatswana, Ciskei, Transkei and Venda); although this was never recognised by any other nation. The government hoped that eventually all homelands would become independent. As part of its separate development program, the government claimed that every African person belonged to a homeland and had citizenship and rights in that homeland thereby justifying the lack of racial equality within South Africa.[9]

The homeland governments initially resisted independence, arguing for the need for greater land mass if these were to become economically viable nations. Homeland leaders argued that even without the forced resettlement of Africans from South African rural areas into the homelands, these regions suffered from overcrowding. In 1968 the Paramount Chief of Transkei asked the South African government to increase the land allocation, the government refused and refused again several times throughout the 1970s (Horrell 1973 p10-14). By 1972 the population density of Transkei was 122 people per square mile, with forced population resettlement this was expected to increase to 212 people per square mile (Horrell

[8] The 1936 Land Act increased the reserved area to 13 percent.
[9] This was also the justification used for the lack of data collection by the South African government in these regions during apartheid.

1973 p 39).[10] Wilson (1972) notes that on a visit in 1963 he found 360 families living on land suitable for only 102 families (p 134). The Tomlinson commission (1955) noted already for the 1951 population, that the land could only sustain 36 - 43 % of the current population and that amount only if the remaining 57 - 64 % moved off the land, the number depending on the type of agriculture (p 116). Only Bophuthatswana had a lower density of approximately 61 people per square mile but much of the land was in arid zones (Horrell 1973 p39). Indeed, the land quality of many homelands was poor, and several of them were geographically fragmented with poor infrastructure between them, see figure 1 (see also Horrell 1973 p 6). While rainfall was higher in Transkei than in more arid homelands such as Bophuthatswana in the north west, and the three homelands of Lebowa, Gazankulu and Venda in the north east, Horrell (1973 p 5) notes that topographically much of Transkei was mountainous land not suited to agriculture. The 1955 Tomlinson Commission reported that only 26 % of the land was free of erosion. Problems with the terrain and the quality of the soil were similar across the homelands (Horrell 1973 p 9). The population densities are therefore really lower bounds on the number of people trying to scratch a living off the land.

The quality of the land is crucial both because few alternative opportunities for employment were being created by the 1960s and because forced resettlement increased crowding within homelands when millions of Africans were forced off of white owned farms and out of towns into the homelands (Feinstein 2005 p 194). Relatively few industries were situated close to the majority of the homelands. There were some employment opportunities in the white towns close to the homelands but not enough to absorb the massive supply. Agricultural employment peaked in 1962 (Feinstein 2005 p 195) and began to decline thereafter in response to mechanisation and the decline in labour tenancy (Crush 1986, Feinstein 2005). Although employment in the manufacturing sector was growing, the sector

[10] In comparison in the non-reserve areas the population density was 35 people per square mile (Horrell 1973 p 39)

was unable to absorb the massive supplies that had begun to accumulate in the homelands and unemployment rates in the homelands grew.

Agriculture in the homelands consisted of mixed farming, a combination of livestock rearing and maize cultivation. The Tomlinson Commission (1955) found that around 1953, 13 % of the farmers owned more than 20 head of cattle, 63 % had 10 or less. Of these, 32 % had 4 or less and 15 % owned no livestock at all.[11] The Commission found that 12 % of the farmers made more than R120 a year and 44 % made less than R40.[12] Numbers are equally distressing for Bophuthatswana, the Commission found that 19 % of the farmers there made more than R120 a year and 37 % made less than R40.[13] These numbers are far below the poverty datum line. An article in Abasebenzi (a workers' newsletter) notes in 1973 that the Poverty Datum Line was R20 a week for a family just to survive. Wilson (1972 p 135) claims that in order to sustain a family in an urban area the wage would have needed to be R180 per year more than it was. He claims that even with this small income, most families would have been better off than they were in the homelands at that time. Much of the agricultural activity in most of the homelands was done on communal, tribally owned land, the farmers did not own the land themselves. Therefore, not even the sale of assets was an option for people trying to feed their families. Although data collection in the homelands was unreliable and inadequate, these descriptions are sufficient to show that the homelands must have suffered from high levels of poverty. In his 1970 speech to the Transkeian Legislative Assembly, Paramount Chief Matanzima noted that agricultural productivity had hardly increased in the last 30 years. Horrell (1973) believes this to be true for most homelands. In his 1972 speech to the Transkeian Legislative Assembly, Paramount Chief Matanzima expressed the need to

[11] 1953 is before the increase in homeland populations following the decline in agricultural employment in the Republic and forced resettlement. No later data is available.
[12] The Tomlinson Commission considered the recommendation that a farming family should earn at least R120 per year from agriculture. The report notes that even earning that amount was extremely difficult given the levels of population density, the overcrowding of livestock and the poor soil quality in most homelands (p113).
[13] Butler et al. provide more recent figures for Bophuthatswana and Kwa-Zulu for 1973, incomes were between R40 and R165.

make agriculture the most important industry in a quest to counter malnutrition in that region.[14]

By the time the increase in the demand for workers from the homelands came, starting in the second half of 1974, income earning opportunities for working age males were limited. While mining wages were low relative to the amount of money needed to feed and house a family, a job on a mine still signified an increase in income. In 1972 the monthly wage in the mining industry was R21. The monthly wage increased to R29 in 1973. Following labour disputes throughout 1973, the wage increased to R46 in 1974, R79 in 1975, R92 in 1976, R102 in 1977, R123 in 1978 and R141 in 1979 (SAIRR Annual Surveys). Although the inflation rate was increasing rapidly at this point, these nominal wage increases did translate into real wage increases (Crush et al. 1991). Wage increases were ultimately experienced throughout the country in a number of sectors including manufacturing and the construction industries, a fact that needs to be taken into account when evaluating the impact of the mining labour demand shock as living standards would have improved following these wage increases for a broad section of the African population.

Estimating the size of the income shock and the possible effects on living standards in the former homelands is complicated by the lack of data on earnings and subsistence earnings. The best estimates depend on assumptions about a family's income that cannot be verified but must seem reasonable. As table 2 shows, the number of workers from Transkei increased from 47 139 in 1973 to 104 181 in 1978 in a region of 2.3 million people as estimated in 1982.[15] That is an increase of almost 60 000 people. A conservative estimate is that half the population were children at the time and half were women, then that is 60 000 men out of approximately 500 000 men (if we assume that the population in 1975 was around

[14] Wilson (1972 p 136) also notes the poverty of the homelands and suggests that migrant workers were actually healthier at their place of work than they would have been in the homelands.
[15] As mentioned earlier, data collection in the former homelands was poor and this figure is an estimate from Mauder (1982).

2 million). If we further estimate that only half of the men might have been young enough and fit enough to work in mining, that reduces the pool of potential workers to 250 000. These are likely to have been young men, more likely to have had small children or to be older siblings of small children. If each worker came from a household with a small child, this *ad hoc* calculation suggests that about 24 % of people born at the time of the shock in the region of the shock were likely to have been affected by a change in a family member's employment status in Transkei. If the recruited family member had been unemployed prior to the shock then the increase in income is from 0 to R46 per month in 1974. As noted, this is not a large wage but it does signify a large increase in family income if that individual was a net consumer in the household. The mining industry paid for transport to the mine, accommodation and food for the workers once at the mine. Because of raical policy restricting the mobility of African, opportunities to leave the mining compound were few and hence it can be assumed that a large portion of the mine worker's wage would be retained for his family's consumption in the homeland of his origin. The assumption that the new mine worker was previously unemployed is not an entirely unreasonable one. Horrell (1973) notes that farm work in the homelands was often done by women and herding may well be done by teenage boys. The implication is that approximately a quarter of the households in Transkei experienced what would have amounted to a large increase in income. If we further assume knock on effects in the local economy, the proportion of the population affected may be even larger. For a population suffering from malnutrition, these income increases may well have had substantial effects.

Even if the mine workers remitted only a portion of their wages to the homeland household, the increase in household income would have been substantial relative to what the household was earning before. Wilson (1972 p57) notes that migrant workers from the homelands remitted around 18 % of their wage through official channels to their dependents

in the homelands. For a household that sent an unemployed member to the mines in 1975 the increase in monthly income for the household would have been R14.22 (if we assume that a worker used only official channels) and one less household member to feed. [16] Horrell (1969 p140) says that often up to half of a worker's wage was given to the homeland household, driving the increase in income up to R40 in 1975. Relative to the farming incomes noted above, this represents a substantial increase in household income especially if we assume that the absence of the migrant household member did not negatively affect farming income.

The expectation is that increases in household incomes should lead to improvements in the well-being of small children and those that are in utero at the time of the shock. However, the manner of household resource allocation for these households is not known and it remains to be seen what the effects of increased household income are on younger household members.

**Data and Summary Statistics**

The first wave of the National Income Dynamics Study (NIDS), run by the Southern Africa Labour and Development Research Unit (SALDRU) at the University of Cape Town, is the first comprehensive South African survey to ask respondents retrospective questions on month and year of birth, birth location as well as to record measures of health, and height. Wave 1 of the study (done in 2008) became available in July of 2009. The adult sample consists of 16,885 adults over the age of 15 and includes information such as race and age, fertility outcomes, parents' characteristics, employment data, income and expenditure data, education, health, and height measurements. Height measurements were taken by the enumerators of the survey. Enumerators were instructed to take two height measurements and a third if the first two differed by more than two centimetres.

[16] Francis Wilson notes in personal conversation (October 2011) that while 18 % of the wage may have been sent through formal channels, most certainly the worker also brought a portion of his wage home with him when on leave from the mines which occurred approximately every six to nine months.

The treatment group consists of people who were born at the time of the shock in the homelands that experienced the shock as these are the individuals most likely to show a response to changes in living standards, primarily through stature according to the foetal origins hypothesis (Barker 1992). In order to create the treatment variable I need to know where an individual was born. The original NIDS adult data contains information on the province and district council where a person was born only if she has moved away from her region of birth at some stage. However 9, 543 individuals have never moved from their area of birth and there is no record of where they were living at the time of the survey. I supplement the adult data with the derived household data file which records the province and the district council where the household in the survey was situated at the time of the survey. After taking account of missing data or cases where the respondent did not know the answer there are 10, 433 Africans, 4, 098 males and 6, 335 females. The homelands that were most affected by the employment shock are Transkei, Ciskei, Bophuthatswana and Kwa-Zulu. These regions now fall within the provinces of the Eastern Cape (Transkei and Ciskei), the Northern Cape and North-Western Province (Bophuthatswana), and Kwa-Zulu Natal (figure 2 shows the post 1994 provinces). There is no clear continuation between former homeland boundaries and current district councils; however, the overlap can be matched up from maps. Figure 3 maps the district councils in South Africa. I assign a person to the treatment group depending on the district council in which they were born. If the district council overlaps with parts of one of the affected former homelands the value of the variable is one, it is zero if the district council does not include parts of the affected former homelands. There are 53 district councils in total, 28 of which overlap with former homeland areas, 19 of those were subject to the large increase in employment.

The outcome variables I consider are height, educational attainment, and an assortment of health conditions. The literature on heights and nutrition suggests that nutrition

matters at early ages, particularly at the foetal stage of development (Almond 2006, Faber and Wenhold 2007, Case and Paxson 2008, Banerjee et al. 2010, Almond and Currie 2011, Gørgens et al. 2012). I have therefore focused on men and women who were born at the time of the employment shock. Note that not all individuals in the treatment group would have been treated; however, it is not possible to determine whether an individual lived with a person employed in mining or not.

I restrict the sample to people born in districts that contained the homelands and exclude all Africans born outside of these districts as it is not clear that they would constitute a valid control group. Africans living in urban areas were subject to fewer restrictions on movement and employment than those from the homelands.71.69 percent of the men in the sample were born in the treatment area and 4.55 percent of them were born during the years where employment increased the most, 1976 and 1977. 3.45 percent of them were born in both the treatment area and treatment years. 72.35 percent of the women were born in the treatment area and 4.94 percent of them were born in the treatment years, with 3.54 percent of them born in both the treatment area and treatment years.

Tables 3a and b contain summary information on the outcomes. The average height of the control group, that is all men born in all regions from 1941 to 1990 excluding those born in 1976 and 1977 (born before 1990 to include only individuals who have completed their growth phase by the time of the survey) is 168.64 centimetres (table 3a). The average height of men in the treatment group is 171.17 centimetres, taller than the entire birth cohort as well as taller than other men born in the treated region. With respect to education, on average the highest level achieved in the control group is eight and a quarter grades, while men in the treatment group have attained eight and half grades.

The four health measures in the table are based on the respondent's answers to several health questions. For general health, answers range between one for poor health and five for

excellent health.[17] The specific health variable is constructed from 23 questions regarding the respondent's current health complaints, an answer of 1 indicates they suffered from that complaint in the last 30 days while 2 indicates no symptoms. The measure in this paper is the sum of the responses to the 23 questions so that a higher number indicates fewer complaints than a lower number. Similarly, the long term health variable was constructed from 7 questions on long term illness including tuberculosis, high blood pressure, diabetes, stroke, asthma, heart problems and cancer. Higher values indicate fewer illnesses. The measure of emotional health is again a composite from 10 questions regarding the respondent's state of mind in the last week, responses range from one for symptoms that were experienced throughout the previous week to four when the respondent rarely experienced the symptoms. The mean values for general health, specific ailments, long term illnesses and emotional health are not very different from those for the control group and sometimes appear to be lower than the control group.

Table 3b shows that the average height for African women in the control group is 158.22 centimetres. The average height of women in the treatment group is 158.83. African women in the treatment group have more education than the control group, nine and a half grades compared to eight grades; however, this result appears to be driven by the increase in educational attainment by younger women as the mean attainment of all those born in 1976 or 1977 is highest.

As with the men, there is no clear difference in health status between women in the treatment group and women in the control group and in general it appears that younger women are healthier. The control group includes older women as well as younger women and the older women pull the mean value down.

[17] In the questionnaire, responses range from one for excellent health to five for poor health. I have turned these around to be compatible with the measures of specific illness and long term illness.

As tables 3a and b show, the number of men and women in the treatment group is small and this affects the power of the results. Furthermore, because of the small sample I have chosen to ignore the stratification specification of the weighting, I do follow the rest of the suggested weighting specification as noted in the survey documentation (SALDRU 2009). While the coefficient estimates of the regressions that follow are unchanged as a result of this specification relative to the full weighting specification, the standard errors are likely to be more conservative resulting in lower rates of statistical significance.

Figure 4 plots the height distributions of males and females in the control and treatment groups. The kernel density plot suggests that treated females are not taller than untreated females while there is some evidence that treated males may be taller than untreated males. The following section presents a more detailed analysis of the effect of treatment on heights.

**Analysis**

The hypothesis is that in the regions that experienced the positive employment shock, outcomes such as height should be larger for people born during the shock than before the shock and also that the outcomes in the affected homeland should be higher than those in unaffected homelands. I will adopt a standard difference in difference approach:

$$Y_i = \alpha + \beta birthdistrict_i + \gamma yearofbirth_i + \delta birthdistrict_i * yearofbirth_i + \Gamma X_i + \varepsilon_i \quad (1)$$

where $Y_i$ is the outcome of interest such as height, education, and health. $birthdistrict_i$ is a dummy variable equal to one if a person was born in the homelands affected by the employment change, and zero otherwise, $yearofbirth_i$ is a dummy variable equal to one if a person was born during the shock, and equal to zero otherwise. $birthdistrict_i * yearofbirth_i$ is an interaction term equal to one if a person was born in the treatment area and born during the shock. $X_i$ is a vector of control variables including age, age cohorts and birth years which take

account of any cohort specific changes, a person's province of birth and language group to take account of any physical differences by ethnic group, and father's occupation since any changes in height should be related to whether or not the father worked in the mining sector. $\varepsilon_i$ is a random error term. If the shock has an impact on outcome variable $Y_i$ then we expect $\delta$ to be significant, denoting that individuals born during the shock in the treated regions were affected by the shock.

Ideally, the specification would include a record of siblings' heights and parents' heights as well as parental education levels. However, since the individuals in the data are adults at the time of the survey, there is no way to know who their siblings are unless they reside in the same household. To the extent that individuals live with their parents, such height information may be available. However, not all parents are still living with their children and including parental heights may result in some amount of selection bias, not to mention the reduction of an already small sample.

Parental income and education are known to be important determinants of height. In this data there is no record of parental income unless the respondent still lives with a parent and that parent still works. However, there is no record of parental income while the respondent was a child, which would be the variable of interest. Respondents are asked the level of education their parents attained. Unfortunately, many respondents do not know the level of their parents' education. Furthermore, it is unclear under the apartheid system of education exactly what role a person's education should play in the height outcomes of their children especially if they grew up in a homeland. Information on father's occupation is available. however, the job categories in the data are at an extremely aggregated level so that it is not possible to determine the actual occupation an individual's father held and certainly not whether an individual's father worked in the mining sector. Nevertheless, I do include the broad categories in the regressions since father's occupation should be directly related to

child's height if the father worked in the mining sector. This inclusion would reduce the sample somewhat since many respondents do not know their father's occupation, I include a categorical variable for whether an individual knows his or her father's occupation. No other socio-economic determinants of the outcome variables are included in the regressions.

The decision of where the workers who would fill the gap created by the lack of foreign workers would come from was based on the South African government's industrial policy and was not determined by any of the potential outcome variables and in that sense the choice of treatment group is independent of the outcome variable. I run standard ordinary least squares regressions and ordered probit regressions of the outcome variable of interest on the treatment group as in equation 1. Separate regressions are run for males and females.

Crush et al. (1991) show that the first wave of employment increases occurred in 1975 in Transkei. Subsequent and larger increases occurred in 1976 and 1977 in Transkei, Ciskei, Bophuthatswana and Kwa-Zulu and by 1978 employment had stabilised with very few increases from then onwards and a series of layoffs starting in the mid 1980s.[18] Although small employment increases began already in 1974 following the withdrawal of Malawian workers, the biggest increases in the four homelands of interest were in 1976 and 1977.

In table 4 I consider three groups of birth years, the first contains males born between 1974 and 1978, the second, males born between 1975 and 1977 and the third, males born in 1976 or 1977. For each set of birth years I consider four specifications of the treatment group. Specification 1 allows for individual birth years interacted with separate birth regions and includes year of birth and region of birth dummies. This means that there are three distinct $\beta$'s, five distinct $\gamma$'s and 15 distinct $\delta$'s as defined in equation 1. Specification 2 combines the treatment regions into one treatment region dummy but keeps the years of birth separate. This specification provides one $\beta$, five $\gamma$'s and five $\delta$'s. Specification 3 combines the treatment

[18] Employment in the other homelands also increased but only slightly and the proportions affected are much lower than in the four homelands listed above (Crush et al. 1991).

regions into one dummy, the years of birth into another and one treatment variable equal to one if the person was born in the treated years in a treated region providing one $\beta$, one $\gamma$, and one $\delta$. The final specification, specification 4, combines the regions and birth years into one treatment dummy but keeps the regions separate so that there are three distinct $\beta$'s, one for each of the three treated regions, five $\gamma$'s and one $\delta$.

Table 4 reports the results of OLS regressions of height on the treatment group for males, treatment variable coefficients are in bold. Looking only at the treatment variables for those born between 1974 and 1978, in columns 1 and 2 I find no significant effects of being born in 1974, 1975 or 1978, regardless of whether I separate the regions in order to capture the employment increase in Transkei in 1975. This finding is consistent with our expectations since the shock really began to matter in 1976 and the data do not allow me to distinguish people born in Transkei from those born in Ciskei as both are in the Eastern Cape.[19] The effect of being born in the treatment group is an increase in height of between 6.9 and 10 centimetres, depending on the region of birth. There is no significant impact on height for those born in the treated regions in the selected years in specifications 3 and 4.

The next set of four specifications excludes 1974 and 1978. I again find no significant effect for those born in 1975 for specifications 1 and 2, however I do find a positive effect for the combined treatment group in specification 3 and 4. This result is most likely driven by those born in 1976 and 1977 and in subsequent analysis I exclude 1975. The increase in height is between 7 and 10 centimetres.

The final set of four specifications examines only the effect of treatment for those born in 1976 and 1977. I find a positive effect on height in 1976 for those born in Bophuthatswana, Kwa-Zulu and the Eastern Cape (Transkei and Ciskei combined). I also find a positive effect for those born in Kwa-Zulu in 1977. When I combine regions but keep

[19] The Amathole district council that contains most of Ciskei also contains a portion of Transkei making it impossible to distinguish between the two.

birth years separate I find a positive effect only for those born in 1976, in specification 2 with an increase in height again between 7 and 10 centimetres. When I combine treated years and the treated regions in specifications 3 and 4 I find a positive effect on height in both specifications. The results suggest that male heights of those born during the years of the shock increased by between 5.9 and 6.3 centimetres. The effects found are very large suggesting that the income increase in these homelands had substantial effects on male heights. This is not surprising given the differences in heights between African and white males noted in table 1. The effect should be tempered for the Eastern Cape by the fact that males born in Ciskei and Transkei are around two and half centimetres shorter than males born in other homelands. Because of the ease of interpretation, specification 4 is the preferred specification, it also allows for separate regional and birth year differences. Subsequent analysis will focus on variations to specification 4.[20] [21]

Table 5 repeats table 4 for women born in the treated regions at the time of the shock. As shown in figure 4, women in the treated group actually appear to be shorter than women in the control group and table 5 confirms this result. All specifications yield height decreases of between 1.8 and 3.7 centimetres for women born in the treated regions at the time of the shock.[22] This result is disconcerting since these women were in utero at the time of the income increase and their gender would not have been known at the time. It is also unlikely that at the time of birth when their gender became known that they would have been nurtured any less than prior to the shock.

In table 6 I take specification 4 from table 4 for birth years 1976 and 1977 and test for the robustness of the specification. The first specification includes only the treatment variable

[20] Subsequent results are robust to the specification choice and are not included in this paper, they are available from the author on request.
[21] The results are robust to adjusting the control group to those born between 1965 and 1990 to try to eliminate shrinkage in older men.
[22] The very large decreases in heights in specification 1 across all three groups of birth years need to be tempered with the coefficients for region since African women born in the treated regions seem to be taller than African women born in other homelands.

as an explanatory variable and replicates the findings in the summary statistics on height in table 3a. Men born in the treatment regions in 1976 and 1977 are 2.53 centimetres taller than men in the control group. This specification does not take account of the region of birth and years of birth separately. Columns 2 – 4 test for the robustness of the height result by including age and language of the respondent as well as region and year of birth. The inclusion of age should not affect the results because year of birth has already been included. Language allows me to control for possible ethnic differences in heights. Column 2 includes age, column 3 includes age and language and column 4 includes only language. In all three specifications the effect on the treatment group is significant and the increase in heights is between 5.9 centimetres and 6 centimetres. With the inclusion of language in columns 3 and 4, being born in the Eastern Cape is no longer negative and significant. However, speaking Xhosa, the dominant language of Africans from Ciskei and Transkei, is negative and significant with a value of -3.45 centimetres (results not shown).

The final column in table 6 replaces the indicator variable for the treatment group with an estimate of the proportion of the homeland population employed in the mining industry. The sample is limited to 460 as there is no data on the numbers employed in mining from each region prior to 1970. Estimates of the numbers employed are taken from Crush et al. (1991). Estimates of population in the homelands come from Butler, Rotberg and Adams (1978), these estimates are based on population estimations for 1973 and do not take account of population growth over that time. The results suggest that an increase of one percentage point in the proportion of workers in the mining sector leads to an increase in height of 0.68 centimetres for people born in the treated regions in 1976 and 1977. The result is not significant, however.

The literature on the value of nutrition for stature notes that increased nutrition can have an effect on stature in early childhood as well as for teenagers (Steckel 1995, Faber and

Wenhold 2007, Case and Paxson 2008, Hatton and Martin 2010, Gørgens et al. 2012). In table 7 I test whether there is an effect of being in the treated region on males who were toddlers, young children or teenagers at the time of the shock. I also look for the impact of the shock on those born just after the shock. Control variables include year of birth, province of birth, father's occupation and age. In column 1 I find that males born one to five years after the shock in the treated regions are 3.12 centimetres shorter than males born before the shock. Column 2 shows that males who were toddlers at the time of the shock, that is born 1 to 2 years before the shock (1973 and 1974), were not affected by the shock. This result is robust to including 1975 as a before shock year (results not shown). Column 3 tests whether males aged between two and five years at the time of the shock were affected by the shock and again I find no effect. Column 4 provides a robustness check and includes both toddlers and young children and again I find positive coefficients but no significance. Finally, column 5 tests for the effect of the shock on teenagers and I find no significant effect although the coefficient is positive. These results are consistent with the findings in Banerjee et al. (2010) who find an in utero effect of a negative income shock but no effect on small children or teenagers. The results might also suggest that increases in male incomes in the household are not passed on to existing children, a result consistent with Duflo (2003). Although I find no effect on heights, I include toddlers and small children in subsequent analysis to allow for the effect on education and health.

Environmental conditions at birth and early childhood are known to affect cognitive ability as well as health outcomes. In table 8 I run an ordered probit on the level of educational attainment to determine whether there is an effect of the treatment on educational attainment for males. Control variables include birth years, province of birth and mother's education (with an indicator term for those who do not know their mother's educational attainment). I find no effect of the treatment on educational outcomes, the coefficient is

negative suggesting males born in the affected regions at the time of the shock have lower educational attainment than the control group, although this effect is not significant. One possibility is that educational attainment is influenced by other childhood environmental conditions that usually improve during boom periods that did not occur in these regions because of apartheid. The extent of education provision for Africans in the homelands is not well known but given the financial constraints homeland governments faced it is also possible that education provision plays a more crucial role in final educational attainment than early childhood nutritional intake.

Table 9 provides estimation results of regressions of four health measures on the treatment group. The measures are general health at present; whether a person has suffered from a series of 23 ailments on the last 30 days; whether a person has ever suffered from problems such as tuberculosis, high blood pressure, diabetes, a stroke, asthma, heart problems or cancer; and an emotional health measure capturing whether a person has suffered from any emotional distress in the past week. I have reclassified all measures such that the higher the measure the healthier the person is likely to be. Control variables include age, province of birth, and father's work. Column one reports results of a probit regression of general health on the treatment group. I find that males from the treatment group are not likely to feel healthier than males from the control group, the coefficient is negative but not significant. Column 2 reports the results of an OLS regression of specific illnesses in the last 30 days on the treatment group. Although the coefficient is positive indicating fewer health complaints, it is not significant and males from the treatment group are not less likely to have suffered from specific health complaints in the last 30 days. Column 3 reports the results from an ordered probit regression of long run health outcomes on the treatment group. I do find a positive and significant effect of treatment on long run health outcomes, males from the treatment group are less likely to be suffering from any long term health complaints. This result is consistent

with the literature on the long run effects of early childhood nutrition on long run health (Almond 2006, Hatton and Martin 2010, Almond and Currie 2011). Finally, from an OLS regression of emotional health on the treatment group, I find no effect of the treatment on emotional health; although the coefficient is positive, indicating better emotional health, it is insignificant. All specifications also include toddlers and small children and I find no effects of treatment on their health outcomes. Tables 10 – 12 repeat tables 7 – 9 for women. Table 10 examines whether there was an effect on the heights of women born after the shock (column 1), 1 – 2 years before the shock (column 2), 2 – 5 years before the shock (column 3), 1 – 5 years before the shock (column 4) and on women who were teenagers at the time of the shock (column 5). I find no effect on any of those groups. The coefficients on toddlers and small children are positive but insignificant and the coefficients on the treatment group for those born after the shock and on teenagers is negative and insignificant.

As with the men, I find no effect of the treatment on educational attainment, shown in table 11. If anything, treated women appear to have less education although this is not statistically significant. Finally, in table 12 I show that women from the treatment group are not healthier than women from the control group. The coefficients on the treatment group for the general health, specific health and long term health specifications are all negative and insignificant. That for emotional health is positive, however also insignificant.

**Conclusion**

This study utilises recent cross sectional data to provide valuable evidence on living conditions in the former homelands of South Africa during apartheid. Although these regions were characterised by extreme poverty, it has not been possible to study the impact of poverty on individual outcomes until now with the National Income Dynamics Study. The sudden and large increase in employment in four of South Africa's 10 former homelands provides an

opportunity to test the importance of early childhood nutrition for long term adult outcomes such as height, education and health. A standard difference in difference analysis shows that African men born when employment increased in their region of birth are between 6 and 8 centimetres taller than men not affected by the shock. While this is a substantial increase in height, the paper shows that conditions prior to the shock were dire in the homelands and that while mining wages were low, a job in the mining industry still signified a substantial increase in household income. The result suggests that males in South Africa's former homeland regions suffered from undernourishment resulting in stunting and long run health concerns as is seen from the strong response to the slight increase in income in the affected regions. This finding is despite the small sample and the conservative standard errors that result from the weighting of the sample.

The increase in family income did not affect heights of men born before or after the shock. Nor is there any impact of the shock on educational attainment and health attainment other than long term health conditions for men. It may be that other childhood environmental conditions such as the disease environment or public health provision play a more important role for educational attainment and health status. However, the restrictive nature of the apartheid era education policy most likely impacted educational attainment and subsequently health status substantially. The increase in local employment appears not to have had any impact on women born at the time of the shock.

This study confirms the findings on the importance of in utero nutritional intake for long run adult outcomes such as stature. The paper contributes to the literature by isolating the effects of household income increases from regional income increases that might lead to improvements in adult outcomes because of increased public health provision in childhood.

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## Tables and Figures

### Table 1

### Comparison of heights and education of Africans in South Africa, in homelands and Whites

| | Men | | | Women | | |
|---|---|---|---|---|---|---|
| | African not born in homeland | African born in homeland | White | African not born in homeland | African born in homeland | White |
| Height | 168.12 | 168.62 | 176.20 | 157.32 | 158.07 | 163.91 |
| s.d | 0.362 | 0.288 | 1.075 | 0.343 | 0.210 | 0.541 |
| Observations | 925 | 2568 | 254 | 1390 | 4322 | 308 |
| Education | 8.94 | 7.96 | 11.20 | 8.89 | 7.66 | 11.04 |
| s.d | 0.199 | 0.161 | 0.122 | 0.159 | 0.149 | 0.147 |
| Observations | 1040 | 2773 | 333 | 1529 | 4645 | 421 |

Height measured in centimetres, education in grade levels from Grade 1 to Grade 12 as the highest level of secondary education
Source: National Income Dynamics Survey

**Table 2**
**Foreign Africans employed on gold mines (including Transkei)**

| | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 (April) | 1978 |
|---|---|---|---|---|---|---|---|---|---|---|
| Malawi | 52,901 | 77,329 | 92937 | 106,379 | 108,723 | 94,728 | 22,875 | 494 | 163 | 21,893 |
| Mozambique | 88,352 | 92,651 | 95900 | 80,242 | 83,387 | 80,737 | 91,359 | 67,436 | 34,817 | 32,237 |
| Other foreign | 90,854 | 92,802 | 95,643 | 95,947 | 104,021 | 96,913 | 105,554 | 130,211 | 152,061 | 142,091 |
| **Total foreign** | **232,107** | **262,782** | **284,480** | **282,568** | **296,131** | **272,378** | **219,788** | **198,141** | **187,041** | **196,221** |
| Transkei | 55,738 | 47,907 | 39,430 | 42,555 | 47,139 | * | * | * | 88,733 | 104,181 |
| **Total SA** | **-** | **-** | **-** | **91,899** | **96,310** | **76,523** | **100,748** | **142,958** | **194,718** | **228,109** |
| **Total** | **-** | **-** | **-** | **374,467** | **392,441** | **348,901** | **320,536** | **341,099** | **381,759** | **424,330** |

* No separation of workers in the Transkei from other South African workers in these years. – no data.
Source: South African Institute of Race Relations (1969-1978).

**Table 3a Summary Statistics**
**Men**

| | Control group | | | Born in 1976 or 1977 | | | Born in treated homeland | | | Treated group | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | sd | N | Mean | sd | N | Mean | sd | N | Mean | sd | N |
| Height | 168.64 | 0.30 | 2292 | 169.59 | 1.06 | 108 | 167.99 | 0.41 | 1702 | 171.17 | 1.35 | 82 |
| Education level | 8.23 | 0.16 | 2469 | 8.95 | 0.50 | 117 | 7.78 | 0.21 | 1817 | 8.49 | 0.58 | 86 |
| **Health** | | | | | | | | | | | | |
| General health | 3.82 | 0.04 | 2471 | 3.73 | 0.14 | 116 | 3.76 | 0.05 | 1817 | 3.61 | 0.17 | 85 |
| Specific health | 44.44 | 0.09 | 2464 | 44.51 | 0.27 | 116 | 44.27 | 0.13 | 1812 | 44.38 | 0.40 | 85 |
| Long run health | 13.82 | 0.01 | 2473 | 13.80 | 0.05 | 117 | 13.80 | 0.02 | 1819 | 13.82 | 0.07 | 86 |
| Emotional health | 32.00 | 0.17 | 2445 | 31.55 | 0.50 | 113 | 31.69 | 0.21 | 1798 | 31.51 | 0.71 | 83 |

Notes: Height is in centimetres, education is the highest grade achieved, excluding tertiary education. General health is characterised from 1 – poor health to 5 – excellent health. Specific health is constructed from 23 health questions where the respondent answered 1 if he had the disorder and 2 if not. The responses were then added up so that the higher the number of the new variable, the fewer conditions an individual had. The same is true for long run health which is constructed from 7 long term conditions. Emotional health is constructed from 10 questions where the answers are from 1 – the condition affects me all of the time to 4 – the condition rarely bothers me. The responses for each individual were added up so that the higher the total, the less a person suffers from emotional challenges.

**Table 3b Summary Statistics**
**Women**

| | Control group | | | Born in 1976 or 1977 | | | Born in treated homeland | | | Treated group | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | sd | N | Mean | sd | N | Mean | sd | N | Mean | sd | N |
| Height | 158.22 | 0.23 | 3728 | 160.33 | 0.93 | 191 | 157.98 | 0.30 | 2797 | 158.83 | 1.32 | 137 |
| Education level | 8.07 | 0.14 | 3973 | 9.76 | 0.24 | 200 | 7.80 | 0.18 | 2961 | 9.31 | 0.30 | 145 |
| **Health** | | | | | | | | | | | | |
| General health | 3.53 | 0.05 | 3966 | 3.68 | 0.11 | 202 | 3.44 | 0.06 | 2948 | 3.49 | 0.11 | 145 |
| Specific health | 43.81 | 0.12 | 3951 | 43.77 | 0.33 | 201 | 43.48 | 0.19 | 2939 | 43.34 | 0.55 | 144 |
| Long run health | 13.72 | 0.02 | 3958 | 13.88 | 0.03 | 201 | 13.68 | 0.02 | 2945 | 13.81 | 0.05 | 144 |
| Emotional health | 31.06 | 0.16 | 3942 | 31.95 | 0.59 | 199 | 30.67 | 0.17 | 2932 | 31.52 | 0.49 | 142 |

Notes: Height is in centimetres, education is the highest grade achieved, excluding tertiary education. General health is characterised from 1 – poor health to 5 – excellent health. Specific health is constructed from 23 health questions where the respondent answered 1 if he had the disorder and 2 if not. The responses were then added up so that the higher the number of the new variable, the fewer conditions an individual had. The same is true for long run health which is constructed from 7 long term conditions. Emotional health is constructed from 10 questions where the answers are from 1 – the condition affects me all of the time to 4 – the condition rarely bothers me. The responses for each individual were added up so that the higher the total, the less a person suffers from emotional challenges.

**Table 4**
**OLS regression of heights on treatment group, African men born 1974 - 1978**

| Treatment specifications | Birth cohorts: 1974 - 1978 | | | | 1975 - 1977 | | | | 1976 - 1977 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Separate treatment regions, separate treatment years | One treatment region dummy, separate treatment years | One treatment dummy, one region dummy, one year of birth dummy | One treatment dummy, separate region dummies | Separate treatment regions, separate treatment years | One treatment region dummy, separate treatment years | One treatment dummy, one region dummy, one year of birth dummy | One treatment dummy, separate region dummies | Separate treatment regions, separate treatment years | One treatment region dummy, separate treatment years | One treatment dummy, one region dummy, one year of birth dummy | One treatment dummy, separate region dummies |
| Born in Northwest | **-2.484** | | | | | | | | | | | |
| *1974 | **(3.886)** | | | | | | | | | | | |
| Born in Northwest | **-1.597** | | | | **-1.448** | | | | | | | |
| *1975 | **(2.642)** | | | | **(2.647)** | | | | | | | |
| Born in Northwest | **8.916**** | | | | **9.065**** | | | | **9.102**** | | | |
| *1976 | **(2.855)** | | | | **(2.851)** | | | | **(2.841)** | | | |
| Born in Northwest | **-3.146** | | | | **-2.993** | | | | **-2.956** | | | |
| *1977 | **(2.657)** | | | | **(2.638)** | | | | **(2.612)** | | | |
| Born in Northwest | **-2.140** | | | | | | | | | | | |
| *1978 | **(2.622)** | | | | | | | | | | | |
| Born in Natal | **-1.578** | | | | | | | | | | | |
| *1974 | **(3.377)** | | | | | | | | | | | |
| Born in Natal | **1.176** | | | | **1.318** | | | | | | | |
| *1975 | **(2.296)** | | | | **(2.275)** | | | | | | | |
| Born in Natal | **6.907**** | | | | **7.037**** | | | | **6.998**** | | | |

| | | | | | |
|---|---|---|---|---|---|
| *1976 | **(2.821)** | | **(2.815)** | | **(2.819)** |
| Born in Natal | **6.958**** | | **7.095**** | | **7.056**** |
| *1977 | **(2.543)** | | **(2.531)** | | **(2.522)** |
| Born in Natal | **-2.581** | | | | |
| *1978 | **(3.569)** | | | | |
| Born in Eastern Cape | **-2.110** | | | | |
| *1974 | **(3.588)** | | | | |
| Born in Eastern Cape | **-0.942** | | **-0.841** | | |
| *1975 | **(2.772)** | | **(2.779)** | | |
| Born in Eastern Cape | **12.38**** | | **12.46**** | | **12.50**** |
| *1976 | **(3.124)** | | **(3.136)** | | **(3.155)** |
| Born in Eastern Cape | **1.147** | | **1.249** | | **1.285** |
| *1977 | **(3.122)** | | **(3.106)** | | **(3.094)** |
| Born in Eastern Cape | **-0.561** | | | | |
| *1978 | **(3.831)** | | | | |
| Born in treated | | **-2.552** | | | |
| Region*1974 | | **(3.243)** | | | |
| Born in treated | | **-0.670** | | **-0.536** | |
| Region*1975 | | **(2.188)** | | **(2.203)** | |
| Born in treated | | **9.462**** | | **9.582**** | **9.609**** |
| Region*1976 | | **(2.146)** | | **(2.148)** | **(2.155)** |
| Born in treated | | **3.661** | | **3.795** | **3.819** |
| Region*1977 | | **(2.544)** | | **(2.538)** | **(2.521)** |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Born in treated Region*1978 | | **-1.521** **(2.268)** | | | | | | | | | | |
| Born in treated region in treated year | | | **1.165** **(1.236)** | **1.187** **(1.177)** | | | **3.195*** **(1.636)** | **3.142**** **(1.536)** | | | **6.266**** **(1.855)** | **5.919**** **(1.752)** |
| Born in Northwest | 0.768 (1.285) | | | 0.339 (1.220) | 0.487 (1.283) | | | 0.317 (1.257) | 0.452 (1.239) | | | 0.321 (1.220) |
| Born in Natal | 0.0303 (1.056) | | | -0.163 (1.016) | -0.234 (1.024) | | | -0.216 (1.040) | -0.193 (0.987) | | | -0.217 (0.989) |
| Born in Eastern Cape | -2.396** (1.147) | | | -2.740** (1.073) | -2.618** (1.081) | | | -2.768** (1.082) | -2.654** (1.040) | | | -2.714** (1.038) |
| Born in Treated Region | | -0.917 (1.026) | -1.256 (0.973) | | | -1.198 (0.984) | -1.300 (0.993) | | | -1.225 (0.950) | -1.286 (0.947) | |
| Born in treated year | | | 0.301 (4.041) | | | | -0.599 (15.56) | | | | -3.690 (3.369) | |
| Constant | 171.1** (28.72) | 172.3** (29.66) | 170.8** (11.35) | 167.1** (29.33) | 169.9** (28.65) | 171.1** (29.63) | 170.3** (29.91) | 167.2** (29.09) | 170.2** (28.66) | 170.9** (29.60) | 171.1** (11.26) | 167.9** (28.96) |
| N | 2,374 | 2,374 | 2,374 | 2,374 | 2,374 | 2,374 | 2,374 | 2,374 | 2,374 | 2,374 | 2,374 | 2,374 |
| R-squared | 0.071 | 0.053 | 0.045 | 0.060 | 0.070 | 0.052 | 0.047 | 0.062 | 0.070 | 0.052 | 0.050 | 0.065 |

All specifications include year of birth dummies, province of birth dummies and age. Treatment variable coefficients are in bold. Standard errors in parentheses.

** p<0.05, * p<0.1

**Table 5**
**OLS regression of heights on treatment group, African women born 1974 - 1978**

| Treatment specifications | Birth cohorts 1974 - 1978 | | | | 1975 - 1977 | | | | 1976 - 1977 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Separate treatment regions, separate treatment years | One treatment region dummy, separate treatment years | One treatment dummy, one region dummy, one year of birth dummy | One treatment dummy, separate region dummies | Separate treatment regions, separate treatment years | One treatment region dummy, separate treatment years | One treatment dummy, one region dummy, one year of birth dummy | One treatment dummy, separate region dummies | Separate treatment regions, separate treatment years | One treatment region dummy, separate treatment years | One treatment dummy, one region dummy, one year of birth dummy | One treatment dummy, separate region dummies |
| Born in Northwest *1974 | **-4.549** | | | | | | | | | | | |
| | **(2.990)** | | | | | | | | | | | |
| Born in Northwest *1975 | **4.823** | | | | **4.812** | | | | | | | |
| | **(2.995)** | | | | **(3.064)** | | | | | | | |
| Born in Northwest *1976 | **0.0610** | | | | **-0.0492** | | | | **-0.175** | | | |
| | **(2.761)** | | | | **(2.761)** | | | | **(2.765)** | | | |
| Born in Northwest *1977 | **-7.664**** | | | | **-7.837**** | | | | **-7.963**** | | | |
| | **(3.457)** | | | | **(3.437)** | | | | **(3.444)** | | | |
| Born in Northwest *1978 | **3.504** | | | | | | | | | | | |
| | **(2.721)** | | | | | | | | | | | |
| Born in Natal *1974 | **-0.998** | | | | | | | | | | | |
| | **(2.024)** | | | | | | | | | | | |
| Born in Natal *1975 | **-1.389** | | | | **-1.192** | | | | | | | |
| | **(2.257)** | | | | **(2.222)** | | | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Born in Natal | **-3.170*** | | **-3.336**** | | **-3.293**** |
| *1976 | **(1.654)** | | **(1.607)** | | **(1.621)** |
| Born in Natal | **-5.303** | | **-5.156** | | **-5.111** |
| *1977 | **(3.227)** | | **(3.226)** | | **(3.230)** |
| Born in Natal | **-2.448** | | | | |
| *1978 | **(2.336)** | | | | |
| Born in Eastern Cape | **0.441** | | | | |
| *1974 | **(2.942)** | | | | |
| Born in Eastern Cape | **-0.323** | | **-0.119** | | |
| *1975 | **(2.771)** | | **(2.728)** | | |
| Eastern | **-5.885**** | | **-6.148**** | | **-6.146**** |
| *1976 | **(2.371)** | | **(2.336)** | | **(2.340)** |
| Born in Eastern Cape | **0.606** | | **0.566** | | **0.569** |
| *1977 | **(5.528)** | | **(5.499)** | | **(5.490)** |
| Born in Eastern Cape | **-0.155** | | | | |
| *1978 | **(2.291)** | | | | |
| Born in treated | | **-0.431** | | | |
| Region*1974 | | **(2.234)** | | | |
| Born in treated | | **-0.0626** | | **-0.0273** | |
| Region*1975 | | **(2.034)** | | **(2.022)** | |
| Born in treated | | **-4.034**** | | **-3.999**** | **-3.998**** |
| Region*1976 | | **(1.713)** | | **(1.729)** | **(1.735)** |
| Born in treated | | **-3.308** | | **-3.273** | **-3.272** |
| Region*1977 | | **(3.691)** | | **(3.695)** | **(3.694)** |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Born in treated Region*1978 | | **-0.700** **(1.981)** | | | | | | | | | | |
| Born in treated region in treated year | | | **-1.799*** **(1.028)** | **-1.794*** **(1.026)** | | | **-2.465*** **(1.427)** | **-2.459*** **(1.422)** | | | **-3.675*** **(1.908)** | **-3.670*** **(1.906)** |
| Born in Northwest | 1.709 (1.046) | | | 1.752* (0.997) | 1.656 (1.046) | | | 1.734* (1.015) | 1.783* (1.039) | | | 1.758* (1.018) |
| Born in Natal | 1.893** (0.814) | | | 1.646** (0.825) | 1.747** (0.834) | | | 1.633* (0.832) | 1.703** (0.842) | | | 1.650* (0.843) |
| Born in Eastern Cape | 1.785* (0.933) | | | 1.737* (0.892) | 1.711* (0.946) | | | 1.719* (0.906) | 1.708* (0.934) | | | 1.744* (0.908) |
| Born in Treated Region | | 1.758** (0.827) | 1.702** (0.805) | | | 1.718** (0.831) | 1.686** (0.818) | | | 1.717** (0.828) | 1.708** (0.825) | |
| Born in treated year | | | -8.103 (5.395) | | | | -2.843 (3.918) | | | | -2.319 (4.038) | |
| Constant | 153.0*** (1.522) | 139.8*** (7.984) | 140.5*** (7.900) | 140.6*** (7.874) | 139.8*** (7.838) | 139.9*** (7.953) | 140.4*** (7.886) | 140.5*** (7.858) | 139.8*** (7.817) | 139.9*** (7.939) | 140.0*** (7.877) | 140.0*** (7.847) |
| N | 3,865 | 3,865 | 3,865 | 3,865 | 3,865 | 3,865 | 3,865 | 3,865 | 3,865 | 3,865 | 3,865 | 3,865 |
| R-squared | 0.048 | 0.044 | 0.042 | 0.042 | 0.049 | 0.044 | 0.043 | 0.043 | 0.048 | 0.044 | 0.044 | 0.044 |

All specifications include year of birth dummies, province of birth dummies and age. Treatment variable coefficients are in bold. Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

**Table 6**
**OLS regression of height on treatment group, African men born 1976 and 1977, robustness check**

| Treatment variable | Indicator whether born in treatment region in treatment year | | | | Proportion of homeland population employed in gold mining, 1970 - 1978 |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| Born in treated region in | 2.534*** | 6.046*** | 5.886*** | 5.889*** | 0.675 |
| treated years | (1.307) | (1.746) | (1.704) | (1.701) | (0.879) |
| Born in | | 0.496 | 0.158 | 0.145 | 0.502 |
| Northwest | | (1.228) | (1.869) | (1.849) | (3.324) |
| Born in Natal | | -0.271 | 3.113* | 3.093* | 7.994** |
| | | (1.031) | (1.820) | (1.824) | (3.518) |
| Born in | | -2.634** | 2.054 | 2.031 | 7.894* |
| Eastern Cape | | (1.048) | (1.984) | (1.977) | (4.676) |
| Age | | -0.0133 | -0.0605 | | |
| | | (0.445) | (0.437) | | |
| Language | | No | Yes | Yes | Yes |
| Constant | 168.64 | 164.4*** | 168.6*** | 164.7*** | 172.3*** |
| | (0.297) | (14.01) | (28.43) | (3.856) | (5.023) |
| Observations | 2,374 | 2,374 | 2,374 | 2,374 | 460 |
| R-squared | 0.003 | 0.072 | 0.081 | 0.081 | 0.105 |

Specification 1 replicates the summary statistics from Table 3a and includes only treatment as an explanatory variable. Specifications 2 - 5 include year of birth dummies, province of birth dummies and father's job dummies. Standard errors in parentheses.
Source for column 4: Crush et al 1991, Butler et al. 1978
*** p<0.01, ** p<0.05, * p<0.1

**Table 7**
**Testing the effects of treatment on men born after the shock, toddlers, small children, and teenagers**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Born in treated region in treated years | 5.461*** | 6.129*** | 6.247*** | 6.272*** | 6.060*** |
| | (1.752) | (1.753) | (1.772) | (1.773) | (1.758) |
| Born in the treated region 1 to 5 years after the shock | -3.122*** | | | | |
| | (1.139) | | | | |
| Born 1 to 2 years before the shock | | 1.619 | | 0.815 | |
| | | (2.182) | | (2.251) | |
| Born 2 to 5 years before the shock | | | 2.066 | 1.886 | |
| | | | (1.733) | (1.810) | |
| Teenager during the shock | | | | | 0.132 |
| | | | | | (1.207) |
| Born in Northwest | 1.070 | 0.327 | 0.213 | 0.153 | 0.482 |
| | (1.274) | (1.137) | (1.229) | (1.167) | (1.246) |
| Born in Natal | 0.250 | -0.412 | -0.508 | -0.559 | -0.282 |
| | (1.078) | (0.972) | (1.040) | (0.997) | (1.041) |
| Born in Eastern Cape | -2.187** | -2.787*** | -2.888*** | -2.942*** | -2.648** |
| | (1.073) | (1.013) | (1.072) | (1.043) | (1.070) |
| Age | -0.117 | -0.00802 | -0.00331 | -0.00152 | -0.0126 |
| | (0.446) | (0.446) | (0.446) | (0.446) | (0.445) |
| Constant | 173.5*** | 164.4*** | 164.2*** | 166.5*** | 167.0*** |
| | (28.71) | (14.02) | (14.02) | (28.72) | (28.69) |
| Observations | 2,374 | 2,374 | 2,374 | 2,374 | 2,374 |
| R-squared | 0.076 | 0.072 | 0.073 | 0.073 | 0.072 |

All specifications include year of birth dummies, province of birth dummies, father's job dummies and age.
Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

**Table 8**
**Ordered probit regression of educational attainment on treatment group, African men born 1976 – 1977, toddlers and small children**

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Born in treated region in | -0.118 | -0.0733 | -0.134 | -0.0926 |
| treated years | (0.312) | (0.314) | (0.310) | (0.311) |
| Born 1 to 2 years before | | | -0.103 | -0.259 |
| the shock | | | (0.429) | (0.420) |
| Born 2 to 5 years before | | | -0.0941 | -0.0566 |
| the shock | | | (0.235) | (0.244) |
| Born in | -0.612** | -0.592** | -0.590** | -0.559** |
| Northwest | (0.248) | (0.246) | (0.235) | (0.232) |
| Born in Natal | -0.767*** | -0.760*** | -0.750*** | -0.733*** |
| | (0.218) | (0.219) | (0.210) | (0.209) |
| Born in | -0.875*** | -0.854*** | -0.855*** | -0.824*** |
| Eastern Cape | (0.226) | (0.224) | (0.217) | (0.214) |
| Father's job | No | Yes | No | Yes |
| Constant | -2.431*** | -2.941*** | -2.419*** | -2.917*** |
| | (0.246) | (0.272) | (0.237) | (0.265) |
| Constant | -2.398*** | -2.907*** | -2.386*** | -2.883*** |
| | (0.246) | (0.271) | (0.237) | (0.264) |
| Constant | -2.270*** | -2.777*** | -2.258*** | -2.753*** |
| | (0.247) | (0.273) | (0.239) | (0.266) |
| Constant | -2.133*** | -2.639*** | -2.121*** | -2.614*** |
| | (0.249) | (0.273) | (0.241) | (0.267) |
| Constant | -1.970*** | -2.474*** | -1.958*** | -2.449*** |
| | (0.250) | (0.272) | (0.241) | (0.265) |
| Constant | -1.783*** | -2.284*** | -1.770*** | -2.259*** |
| | (0.248) | (0.273) | (0.239) | (0.266) |
| Constant | -1.610*** | -2.109*** | -1.597*** | -2.083*** |
| | (0.248) | (0.274) | (0.239) | (0.267) |
| Constant | -1.344*** | -1.840*** | -1.331*** | -1.813*** |
| | (0.247) | (0.275) | (0.238) | (0.267) |
| Constant | -1.087*** | -1.579*** | -1.074*** | -1.552*** |
| | (0.244) | (0.273) | (0.235) | (0.266) |
| Constant | -0.813*** | -1.301*** | -0.800*** | -1.275*** |
| | (0.240) | (0.272) | (0.231) | (0.265) |
| Constant | -0.454* | -0.939*** | -0.441* | -0.913*** |
| | (0.240) | (0.269) | (0.231) | (0.262) |
| Constant | -0.0804 | -0.561** | -0.0672 | -0.535** |
| | (0.242) | (0.276) | (0.233) | (0.269) |
| Observations | 2,399 | 2,399 | 2,399 | 2,399 |

All specifications include year of birth dummies, province of birth dummies, and mother's education. Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

**Table 9**
**Regressions of health on treatment group, African men born 1976 – 1977, toddlers and small children**

| | General health | Specific illnesses | Long run health | Emotional health |
|---|---|---|---|---|
| Born in treated region in | -0.0506 | 0.313 | 0.877*** | 0.391 |
| treated years | (0.285) | (0.517) | (0.287) | (1.057) |
| Born 1 to 2 years before | -0.191 | -0.697* | -0.0483 | 2.220 |
| the shock | (0.335) | (0.406) | (0.485) | (1.664) |
| Born 2 to 5 years before | 0.0970 | 0.0144 | -0.0617 | 0.768 |
| the shock | (0.261) | (0.445) | (0.285) | (1.119) |
| Born in | -0.107 | 0.0950 | 0.594*** | -0.716 |
| Northwest | (0.197) | (0.396) | (0.218) | (0.898) |
| Born in Natal | -0.313* | -0.467 | 0.277 | 0.0951 |
| | (0.186) | (0.410) | (0.196) | (0.746) |
| Born in | 0.128 | 0.748** | 0.743*** | -0.0866 |
| Eastern Cape | (0.184) | (0.363) | (0.200) | (0.796) |
| Constant | -2.228*** | 43.35*** | -3.389*** | 33.43*** |
| | (0.277) | (0.888) | (0.478) | (1.590) |
| Constant | -1.533*** | | -3.363*** | |
| | (0.269) | | (0.465) | |
| Constant | -0.726*** | | -2.812*** | |
| | (0.260) | | (0.396) | |
| Constant | 0.145 | | -2.068*** | |
| | (0.268) | | (0.386) | |
| | | | -0.952** | |
| | | | (0.375) | |
| Observations | 2,556 | 2,549 | 2,559 | 2,528 |
| R-squared | | 0.128 | | 0.066 |

All specifications include year of birth dummies, province of birth dummies, and father's work dummies.
Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

**Table 10**
**Testing the effects of treatment on women born after the shock, toddlers, small children, and teenagers**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Born in treated region in treated years | -3.594* | -3.364* | -3.227 | -3.215 | -3.568* |
| | (1.951) | (1.935) | (1.964) | (1.955) | (1.987) |
| Born in the treated region 1 to 5 years after the shock | -1.030 | | | | |
| | (0.813) | | | | |
| Born 1 to 2 years before the shock | | 1.203 | | 0.323 | |
| | | (1.694) | | (1.768) | |
| Born 2 to 5 years before the shock | | | 2.322* | 2.241 | |
| | | | (1.327) | (1.398) | |
| Teenager during the shock | | | | | -0.960 |
| | | | | | (0.900) |
| Born in Northwest | 2.148** | 1.955* | 1.825* | 1.816* | 2.207** |
| | (1.075) | (1.030) | (1.058) | (1.046) | (1.056) |
| Born in Natal | 1.989** | 1.824** | 1.741* | 1.733* | 2.061** |
| | (0.889) | (0.877) | (0.889) | (0.888) | (0.900) |
| Born in Eastern Cape | 2.185** | 2.023** | 1.944** | 1.936** | 2.268** |
| | (0.955) | (0.930) | (0.937) | (0.934) | (0.968) |
| Age | 0.786* | 0.792** | 0.790* | 0.792** | 0.773* |
| | (0.401) | (0.403) | (0.404) | (0.402) | (0.408) |
| Constant | 143.6*** | 143.6*** | 143.7*** | 143.7*** | 143.8*** |
| | (8.562) | (8.572) | (8.566) | (8.544) | (8.663) |
| Observations | 3,865 | 3,865 | 3,865 | 3,865 | 3,865 |
| R-squared | 0.053 | 0.053 | 0.054 | 0.054 | 0.053 |

All specifications include year of birth dummies, province of birth dummies, father's job dummies and age.
Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

**Table 11**
**Ordered probit regression of educational attainment on treatment group, African women born 1976 – 1977, toddlers and small children**

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Born in treated region in | -0.173 | -0.177 | -0.214 | -0.219 |
| treated years | (0.222) | (0.233) | (0.222) | (0.233) |
| Born 1 to 2 years before | | | -0.0658 | -0.0701 |
| the shock | | | (0.266) | (0.270) |
| Born 2 to 5 years before | | | -0.373* | -0.378* |
| the shock | | | (0.224) | (0.216) |
| Born in | -0.360** | -0.356** | -0.322** | -0.319** |
| Northwest | (0.151) | (0.150) | (0.150) | (0.149) |
| Born in Natal | -0.523*** | -0.517*** | -0.492*** | -0.489*** |
| | (0.131) | (0.134) | (0.131) | (0.134) |
| Born in | -0.396*** | -0.366*** | -0.366** | -0.338** |
| Eastern Cape | (0.141) | (0.141) | (0.142) | (0.141) |
| Father's job | No | Yes | No | Yes |
| Constant | -2.212*** | -3.100*** | -2.222*** | -3.123*** |
| | (0.148) | (0.282) | (0.148) | (0.280) |
| Constant | -2.175*** | -3.062*** | -2.184*** | -3.085*** |
| | (0.148) | (0.282) | (0.148) | (0.280) |
| Constant | -2.070*** | -2.955*** | -2.080*** | -2.979*** |
| | (0.146) | (0.281) | (0.146) | (0.280) |
| Constant | -1.929*** | -2.812*** | -1.939*** | -2.836*** |
| | (0.146) | (0.279) | (0.146) | (0.277) |
| Constant | -1.758*** | -2.639*** | -1.768*** | -2.662*** |
| | (0.145) | (0.280) | (0.145) | (0.278) |
| Constant | -1.581*** | -2.459*** | -1.591*** | -2.483*** |
| | (0.145) | (0.278) | (0.145) | (0.277) |
| Constant | -1.419*** | -2.294*** | -1.430*** | -2.319*** |
| | (0.144) | (0.276) | (0.144) | (0.274) |
| Constant | -1.157*** | -2.028*** | -1.168*** | -2.053*** |
| | (0.141) | (0.274) | (0.141) | (0.272) |
| Constant | -0.908*** | -1.775*** | -0.920*** | -1.801*** |
| | (0.140) | (0.275) | (0.140) | (0.274) |
| Constant | -0.643*** | -1.507*** | -0.656*** | -1.533*** |
| | (0.143) | (0.280) | (0.143) | (0.278) |
| Constant | -0.277* | -1.133*** | -0.290** | -1.160*** |
| | (0.146) | (0.281) | (0.145) | (0.279) |
| Constant | 0.190 | -0.653** | 0.176 | -0.681** |
| | (0.146) | (0.281) | (0.146) | (0.279) |
| Observations | 3,954 | 3,954 | 3,954 | 3,954 |

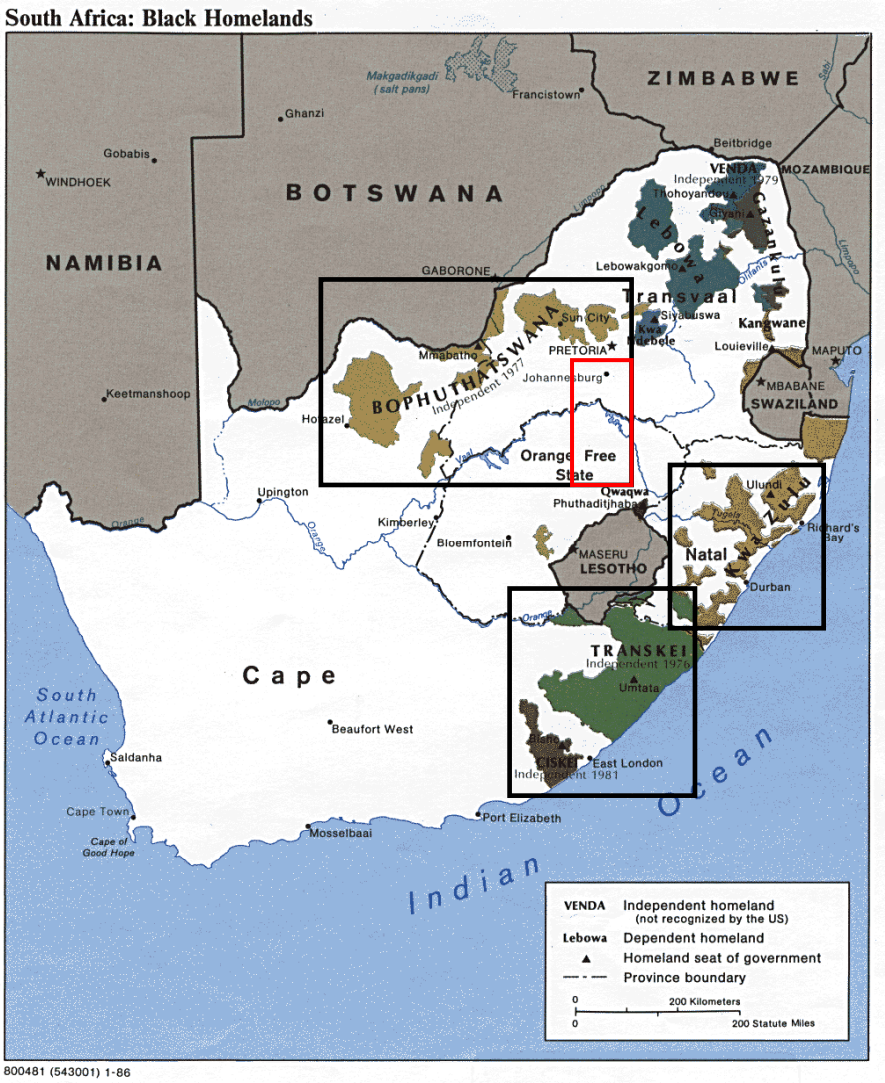
All specifications include year of birth dummies, province of birth dummies, and mother's education. Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

**Table 12**
**Regressions of health on treatment group, African men born 1976 – 1977, toddlers and small children**

| | General health | Specific illnesses | Long run health | Emotional health |
|---|---|---|---|---|
| Born in treated region in | -0.226 | -0.0229 | -0.571* | 0.148 |
| treated years | (0.228) | (0.755) | (0.316) | (0.980) |
| Born 1 to 2 years before | -0.161 | 0.363 | 0.184 | 0.0278 |
| the shock | (0.210) | (0.412) | (0.304) | (0.948) |
| Born 2 to 5 years before | -0.0571 | -0.586 | -0.219 | -0.244 |
| the shock | (0.213) | (0.447) | (0.235) | (0.816) |
| Born in | -0.165 | -0.0631 | -0.185 | -2.602*** |
| Northwest | (0.137) | (0.323) | (0.201) | (0.786) |
| Born in Natal | -0.295** | -1.046*** | -0.360* | -1.045* |
| | (0.114) | (0.326) | (0.186) | (0.616) |
| Born in | 0.143 | 0.673** | 0.191 | -1.028 |
| Eastern Cape | (0.135) | (0.337) | (0.198) | (0.641) |
| Constant | -2.114*** | 42.85*** | -5.525*** | 31.50*** |
| | (0.142) | (0.729) | (0.449) | (1.681) |
| Constant | -1.379*** | | -5.355*** | |
| | (0.137) | | (0.419) | |
| Constant | -0.469*** | | -4.506*** | |
| | (0.139) | | (0.372) | |
| Constant | 0.268* | | -3.624*** | |
| | (0.140) | | (0.375) | |
| | | | -2.593*** | |
| | | | (0.372) | |
| Observations | 4,111 | 4,095 | 4,102 | 4,084 |
| R-squared | | 0.148 | | 0.065 |

All specifications include year of birth dummies, province of birth dummies, and father's work dummies.
Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

**Figure 1**
**Provinces and homelands during apartheid**

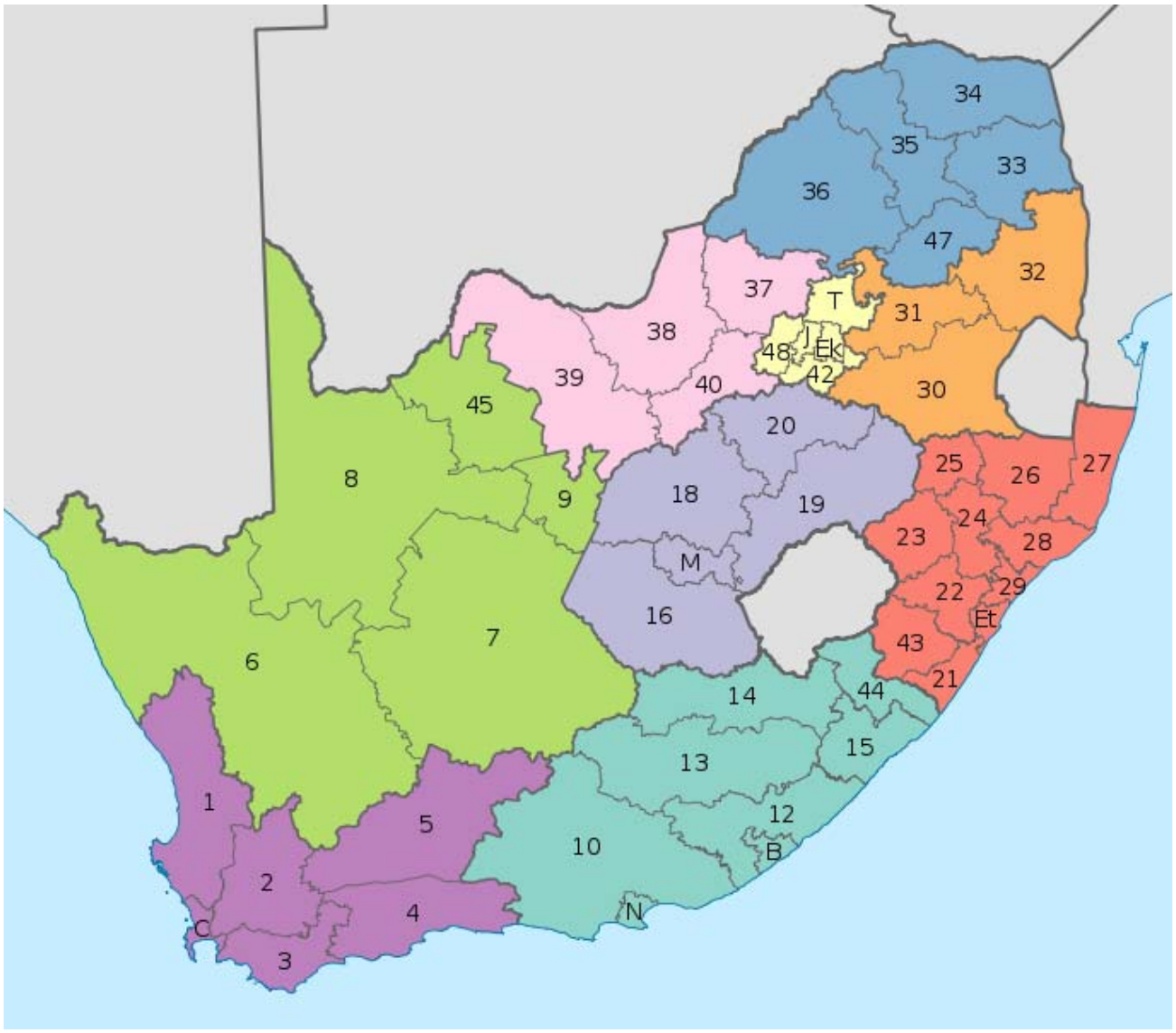



Bordered areas in black are the affected former homelands, bordered areas in red are the gold mining areas.
Source: University of Texas - Perry-Castañeda map collection.

**Figure 2**
**Provinces after 1994**


Source: worldmapz.org

**Figure 3**
**District Councils 2011**




Source: Based on Municipal Demarcation Board boundary data

**Figure 4**
**Kernel density estimates of height distributions of treatment and control groups**