Internal Migration of Blacks in South Africa: Self-selection and Brain Drain

by

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INTERNAL MIGRATION OF BLACKS IN SOUTH AFRICA: SELF-SELECTION AND BRAIN DRAIN

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ABSTRACT
Migrations historically have led to fears of “brain drain” from the sending regions because many studies show that the more highly skilled and motivated people are more likely to migrate. South Africa provides a natural testing ground for the study of brain drains because the Apartheid system, which ended in the early 1990s, had long constrained the locational choices of black migrants of all skill levels. As apartheid was being dismantled, new opportunities for movement opened up to black workers, leading to a surge in internal migration. We first analyze whether migration patterns of Black South Africans during the period 1992 to 1996 match the predictions of the two seminal papers, Roy (1951) and Sjaastad (1962), where individuals are hypothesized to be income-maximizers. The results from conditional logit regressions on individual choices among 318 locations show that they do. Individuals prefer localities with higher expected log wages regardless of their educations and skills. More importantly, workers with at least some matriculation tend to favor areas where a higher share of the population attended high school. In contrast, workers who did not attend high school find such areas less attractive. Over the study period, brain drain arose among blacks within South Africa: the share of high-educated residents in areas with high shares of high schooling increased.

Keywords: Internal Migration, South Africa, Self-Selection, Brain Drain

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1. INTRODUCTION

The issue of brain drain is often a significant part of discussions of migration. Most studies suggest that migration leads to self-selection of highly motivated and more educated workers (Polachek and Horvath, 1977 and Plane, 1993). As a result, many areas experiencing out-migration complain of drains of skilled and more productive workers and establish policies to prevent such a drain. For example, many states in the South in the U.S. during the 1910s established laws limiting activities by labor agents who were recruiting productive black workers to move North and work in mining and manufacturing (Higgs, 1980). Meanwhile, many countries try to find ways to prevent the potential loss of highly skilled workers from international migration.

South Africa at the end of apartheid provides an excellent setting for examining the movements of skilled and unskilled workers in internal migrations. Between 1947 and 1991 the South African government had established an Apartheid system with up to 317 laws that discriminated against black workers. Quite a few of the laws restricted the locations where blacks could live and work. This system of Apartheid was dismantled in the mid 1980s through early 1990s, with the final official limit on movement ending when the Group Areas Act of 1950 was repealed in 1991. The elimination of apartheid released black workers and households to migrate to all sorts of new locations in the 1990s. This nationwide elimination of the artificial constraint on movement offers a quasi-experimental opportunity to examine how the migration patterns of skilled and unskilled workers differ.

Building on the insights from A. D. Roy (1951), George Borjas et al. (1992) and Gordon Dahl (2002) have developed empirical models for the migration patterns of skilled and unskilled workers. Generally, they find that skilled workers tend to migrate to areas where the returns to skill are higher. Building on the work of Borjas et al. (1992), we develop two measures of the
returns of individual black workers. The first is returns to individuals’ observable characteristics such as age and schooling. The second is a measure of returns for each worker that is attributable to characteristics not observed by the researcher. These skills are unobservable to the researcher but might well be observed by the participants in the market. We develop a proxy measure of this unobservable skill by estimating wage regressions as a function of schooling, age, and other traditional measures. The normal standardized residual from that regression for each individual is then used as a measure of skill unobservable to the econometrician.

To measure the return to skills, we estimate wage regressions for each of 318 administrative districts in South Africa. For each region we therefore have a measure of the returns to observable characteristics – the predicted log wage. As a measure of the returns to skills unobservable to the econometrician, we need two factors – the normal standardized residuals from the wage regressions as a measure of each individual’s unobservable skills and the standard deviation of those residuals, which can be used as a proxy for the returns to the unobservable skills. We then multiply the individual’s unobservable skill by the proxy for returns to estimate the total returns to unobservable skills for each individual at each specific area. According to traditional theoretical papers, Roy (1951) and Sjaastad (1962), individuals are hypothesized to be income-maximizers. Hence, blacks South Africans are also expected to prefer higher returns to both observable characteristics and unobservable characteristics.

Whilst testing the income-maximizing hypothesis, we test if the internal migration after the formal elimination of apartheid engenders brain drain within South Africa. We include the share of people who attended high school in an area as a regional characteristic that individuals either favor or disfavor based on their educational attainments. We expect that more highly educated workers tend to move to areas in which there is a higher share of the population who are more highly educated, holding constant other regional characteristics. Similarly, lower educated
workers tend to avoid moving to areas where there are higher shares of the population who are more highly educated.

Using the sample of individual black male workers, we then estimate a conditional logit (CLOGIT) model in which individuals choose among 318 magisterial districts in South Africa. The model incorporates information about the characteristics of the magisterial districts, and nonparametrically incorporates the characteristics of the individuals’ educational levels. We first investigate the income-maximizing behavior of individuals predicted by theoretical models in migration literature. The coefficients of the predicted log wage and the returns to unobservable characteristics will test the hypothesis conditional on other amenities. The results confirm that economic incentives are critical factors when black South Africans made migration decisions, controlling for other regional characteristics. However, our measure of the returns to unobservable characteristics does not play a statistically significant role in the blacks’ choice of locations. More importantly, while workers with at least some high school attendance tend to favor areas where the share of the population with high schooling is higher, workers with less education disfavor those areas, holding constant other regional characteristics. Over the study period, brain drain arose among blacks within South Africa, as the share of high-educated residents in areas with high shares of high schooling increased.

2. Apartheid Policy and The Effect of Its Demise

Apartheid means ‘Separateness’ in Afrikaans. It was a system of racial segregation that was enforced in South Africa from 1948 to 1991. Apartheid was legally established in South Africa through 317 laws that restricted nearly every aspect of black living. A partial list of apartheid laws is found in Table 1. The restrictions placed on the black South Africans dealt with matters
such as land issues, jobs, housing, living areas, personal relationships, constitutional rights, and general rights.

Apartheid was officially incorporated into the South African government when the white Afrikaner Nationalist Party came to power in 1948. In 1949 and 1950, the apartheid government enacted the *Mixed Marriages* and *Immorality Acts*. Under these laws, marrying a person of a different race was illegal and it was also a criminal offense for a white person to have any sexual relations with a person of a different race. Around this time, the *Population Registration Act* required all citizens of South Africa to be classified into categories according to their race. The categories established were white, black (African), and colored⁴. In 1950, the *Group Areas Act* divided the lands in which blacks and whites resided into distinct residential zones. This act established the distinct areas of South Africa in which members of each race could live and work, typically setting aside the best urban, industrial, and agricultural areas for whites. Blacks were restricted from renting or even occupying property in the areas deemed as ‘white-zones’ unless they had received permission from the state to do so.

The establishment of the *Bantu Self-Government Act* in 1950 created the ‘bantustans’ (homelands) for the black population based upon their tribal groupings. Blacks were stripped of their rights to participate in the national government of South Africa when the *Bantu Authorities Act* was established. Ratified in 1951, the *Bantu Authorities Act* created a basis for ethnic government in African reserves, known as the ‘homelands’. These homelands were established by the national government to function as independent states.⁵ Black Africans were assigned to a homeland based on their tribal grouping, which was in accordance with their record of origin. In reality, however, a majority of black South Africans had never resided in these ‘homelands’. Voting and all other political rights were restricted to the designated homeland. The objective of

⁴ Colored corresponds to racially mixed individuals.
⁵ There were 10 different homelands in South Africa. Among these, four were nominally independent, so-called TVBC states of the Transkei, Venda, Bophuthatswana and the Ciskei. The other six had limited self-government. In practice, however, the apartheid government had a strong influence over these homelands.
creating homelands was to force Africans to maintain loyalty to their respective homeland, thereby relinquishing their South African citizenship. The government hoped that this would result in blacks not being able to participate in the South African Parliament. The homeland administrators, who sought to maintain political rights within the country as a whole, refused official independence. As a result, Africans living in these homelands needed passports to enter South Africa. Blacks became foreigners in their own country.\textsuperscript{6}

Along with the Bantu Authorities Act, the Pass Laws Act enacted in 1952 influenced blacks’ decisions about their residential choices because it required black South Africans over the age of 16 to carry a pass book, known as a ‘dompas’ (‘stupid pass’ in Afrikaans), everywhere and at all times. The ‘dompas’ was similar to a passport, but it contained pages filled with more extensive information than a normal passport. Within the pages of an individual’s ‘dompas’ were their fingerprints, photograph, personal details of employment, permission from the government to be in a particular part of the country, qualifications to work or seek work in the area, and an employer's reports on worker performance and behavior. A pass, and the mobility that it afforded, was issued only to a black person with approved work. Spouses and children had to be left behind in non-white areas\textsuperscript{7}. Many white households employed blacks as domestic workers who were allowed to live on the premises - often in small rooms external to the family home. If a worker displeased their employer and their employer in turn declined to endorse the book for the pertinent time period, the worker's right to stay in the area was jeopardized. A pass was issued for one ‘magisterial district’ (usually one town) confining the holder to that area only. As codified in the Pass Law, government officials possessed the power to expel the worker from the area by adverse endorsement in the passbook. This technique was known as ‘endorsing out’ and could be carried out at any time and for any reason. Officials were not required to provide an explanation.

\textsuperscript{6} Under apartheid, Africans were not allowed to be permanent residents in urban areas and could have legal residence only in ‘homelands’. These homelands comprised 13 percent of the land area of South Africa.

\textsuperscript{7} Although it is expected that family migration would increase after the demise of apartheid, in 1996 there still existed a large number of migrant workers who left the rest of their families behind.
for their actions. Forgetting to carry the ‘dompas’, misplacing it, or having it stolen rendered one liable to arrest and imprisonment. Each year, over 250,000 blacks were arrested for technical offenses under the Pass Laws. As a result, the ‘dompas’ became the most despised symbol of apartheid.

The Bantu Education Act of 1953 was instituted to provide black students with different expectations and future goals than white students. These differences were incorporated to make sure that blacks had different syllabi and schooling facilities than white children. For black students, the emphasis was placed on technical education, equipping them for practical work as opposed to the education received by white students, which equipped them for a professional job. Only a few of the black students in the public schools aspired to go beyond their mediocre training to higher education levels. Those who did possess higher ambitions were segregated into black universities under the Extension to University Education Act. Only 14 percent of black students reached secondary schools, and even fewer furthered their education at the university level.

The South African government’s official discrimination policy was strongly resisted from the earliest stages of apartheid. Through most of the 20th century, the African National Congress (ANC) fought the Pretoria regime and the Nationalist government in hopes of escaping the domination of apartheid, colonialism, racism, and fascism. Their struggle came mainly in the form of peaceful protests. It was not until the 1960’s that an armed struggle began. In 1961, the ANC and the South African Communist Party formed a people’s army to fight the government. In the 1970’s, the liberation of surrounding countries provided hope for the struggling South Africans. In the 1980’s, the ANC, along with oppressed black South Africans, entered into a complete revolution against the government. This revolution included political and religious struggles, trade activities, women's campaigns, school boycotts, revolts and military actions. Due
to these struggles and the implementation of UN sanctions in 1977, the government of South Africa was significantly weakened, but did not fall.

Although the system of pass laws was repealed in South Africa in 1986, apartheid was not abolished until the early 1990’s. More importantly, the repeal of the last discriminatory laws that affected the migration of black South Africans came into effect during June 1991.\(^8\) In 1986, the United States Congress decided to involve itself in South African politics by encouraging peace and supporting negotiations between the South African government, the ANC and their affiliates. The U.S. Congress’ hoped that a democracy would be established in South Africa.

In 1989, F.W. de Klerk became the president of South Africa. Instead of supporting apartheid, which was expected, he proclaimed, “white domination will have to disappear. Otherwise there will never be peace in South Africa.” In 1990, Nelson Mandela was released from jail, and he quickly gained supporters. His continued determination to end apartheid strengthened the movement even more. As a result, the government repealed the last laws supporting apartheid in 1991, allowing democracy to be ushered into the country slowly but surely. In 1993, de Klerk and Mandela shared the Nobel Peace Prize for their efforts in bringing peace to South Africa.

This paper investigates the brain drain issue within South Africa after the formal end of apartheid between 1991 and 1996, with emphasis on the shifting of skilled workers. Although all blacks had been under the same discriminatory policy, the changes in the early 1990s likely affected blacks with different degrees of skills and educational attainments quite differently. Apartheid had placed many restrictions on the various aspects of blacks’ life. Despite dramatic political, social and economic changes in the country (including the abolition of migration control measures such as influx control and the Group Areas Act), Kok et al. (2003) found no significant

\(^8\) One of the representative laws affecting the choice of localities is the Group Areas Act enacted in 1950, which established the distinct areas of South Africa in which members of each race could live and work. In June 1991, the House of Assembly passed the repeal of the Group Areas Act of 1950.
changes in the overall level of migration between the periods 1975-1980 and 1992-1996. Very poor rural people, trapped in the legacy of the apartheid homeland policy, have probably found it difficult to escape from their situations. Furthermore, since low-skilled blacks worked for industries like mining, construction and manufacturing sectors where they were not restricted to work even under the white government, we expect that relatively high-skilled blacks faced more opportunities after the end of the discriminatory policy.

In particular we expect that some areas lose highly educated blacks to receiving areas. Figure 1 plots for the districts the change in the proportion of the population with at least some matriculation education between 1991 and 1996 in each district against the share of the population with at least some post-matriculation education in 1991. Areas with higher proportions of people with high school educations in 1991 experienced greater increases in the number of individuals with high schooling. On the other hand, Figure 2 shows another aspect of self-selection in migration. Workers migrate into areas where they can maximize their income based on educational attainments. While workers with high educational attainments choose areas with high returns to skill (education), low-educated workers choose the opposite.

3. LITERATURE REVIEW

Most of the empirical work on internal migration is based on two seminal theoretical papers by Roy (1951) and/or Sjaastad (1962). In both articles, individuals are hypothesized to choose localities as they seek to maximize their income. Following those studies, individuals in our paper are also assumed to behave to maximize their income. Greenwood (1975) provides a comprehensive review of the literature on internal migration in the United States. As mentioned in the article, distance and unemployment rate are also critical regional characteristics when individuals determine their migration decisions.
Most migrants are well known to be highly motivated and more educated workers. Polachek and Horvath (1977) and Plane (1993) find that migration propensities vary over a person’s life cycle. Geographic mobility peaks when people are in their early to mid-twenties and then declines with age thereafter because the time horizon over which gains from migration can be realized grows shorter. These studies also find that the propensity to migrate increases with education. Highly educated workers operate in labor markets that compete across broad geographic areas, whereas workers with low levels of education operate in more geographically isolated labor markets. Workers with more education also may be better informed about opportunities outside their local labor market and better able to evaluate that information. In that sense, it would be an interesting question to test if specific areas loose their highly skilled/educated workers to other areas – the issue of brain drain.

Much of the migration literature has paid attention to self-selection issues in individuals’ migration decision. Nakosteen and Zimmer (1980) described a model where the endogenous nature of the migration decision is explicitly recognized and thus fully accounts for the problem of migrant self-selection. They were among the first to provide evidence of positive-selection into migration. Robinson and Tomes (1982) and Gabriel and Schmitz (1995) also find favorable self-selection. Borjas, Bronars, and Trejo (1992), Dahl (2002), and Hunt and Mueller (2004) use a Roy model of comparative advantage to explain migration. Across regions in the United States, for example, wage distributions differ in their means and in their returns to skills (variance). Borjas et al. (1992) find evidence that higher-skilled individuals self-select into regions with higher returns to skills, conditional on mean wages. Conversely, they observed that lower-skilled individuals self-selected into regions with lower returns to skill, again conditional on mean wages. In more recent works, Dahl (2002) finds that correcting for selection bias substantially changes the estimated returns to education in a way that supports the role played by returns to skill in mobility decisions. The empirical results in Dahl’s study are also consistent with the theoretical
prediction that workers are self-selecting based on their educational attainment. Hunt and Mueller (2004) reconfirm the self-selection pattern consistent with the Roy model using both the U.S. and Canadian Census data.

Although none of the literature we reviewed intended to test either the income maximizing hypothesis in the decision of the location choice (Roy, 1951 and Sjasstad, 1962) or brain drain issue utilizing data on African countries, there is some literature on internal migration in South Africa. Some interesting findings are reported by Posel and Casale (2003). They found that labor migration in South Africa increased between 1993 and 1999. This rise was driven by the rising proportion of women leaving rural areas. Kok et al. (2003) comprehensively discuss many different issues relevant to the post-apartheid patterns of internal migration in South Africa from 1992 through 1996. Inter-provincial migration is associated mainly with differentials in employment, racial dominance, crime, and income between the provinces of origin and destination. The South African results also show that migration decreases with age and increases with education, as found in many other studies.

4. ECONOMETRIC SPECIFICATION

In our model, we hypothesize that individuals seek to maximize their expected income in choosing locations. Further, we intend to test the brain drain issue by showing that individuals with similar levels of education are likely to cluster at the same areas. A potential migrant chooses between 354 possible locations. The outside option is to remain in the origin; the utility of this option is normalized to 0. The other (354-1) options in the potential migrant’s choice set represent migrating to one of the remaining 353 districts in South Africa. The utility of the \( i^{th} \) potential migrant, originating in district \( o \) and migrating to \( j \) can be expressed as
(1) \[ U_{ij} = U\left(\ln(w_{ij}), SH_j, UR_j, \ln(D_j), CR_j\right) \text{ for } j \neq o \]

where

\[ \ln(w_{ij}) \text{ is individual } i \text{'s log of the expected wage in area } j, \]

\[ SH_j \text{ is the share of high schooling (at least some post-matriculation education) in area } j, \]

\[ UR_j \text{ is the unemployment rate in area } j, \]

\[ \ln(D_j) \text{ is the distance between origin and area } j, \]

\[ CR_j \text{ is the crime rate in area } j, \]

(2) \[ U_{ij} = 0 \text{ for } j = o. \]

We assume that the worker will choose the area \( j \) that maximizes his or her utility. The random utility model indicates that we need to estimate counterfactual wages of individual \( i \) across potential locations. We explain below why the number of potential locations is (318-1) magisterial districts.

The wage of individual \( i \) in area \( j \) can be estimated by the following Mincerian-style log wage equation

(3) \[ \ln(w_{ij}) = \beta_0^j + \beta_1^j EDU_i + \beta_2^j AGE_i + \beta_3^j AGE_i^2 + \beta_4^j MS_i + \beta_5^j PT_i + u_{ij} \]

where \( EDU = \text{highest school class completed} \)

\( AGE = \text{age} \)

\( MS = \text{marital status} \)

\( PT = \text{part-time work status} \)

and \( \beta_k^j \) and \( u_{ij} \) represent coefficient vectors of observable characteristics and error term with mean zero respectively. We estimate Equation (3) with OLS separately for each of the 354 magisterial districts.
Equation 4 shows that the natural log of the expected wage for individual in district \( j \) will be a function of the estimated returns to a characteristic and the individual’s own characteristic.

However, the expected wage does not include the error term, which itself can be interpreted as the total gain or loss in wages associated with the unobserved characteristics in Equation (3). To develop a measure of the contribution of characteristics unobserved by the econometrician, we need to compute each individual’s own residual for each of the magisterial districts. This cannot be directly estimated, because we can only get an estimate of the actual wage offered to the individual in the district where they actually work. We do not observe the actual wage offers in the other 353 magisterial districts.

We can indirectly come up with an estimate of the rate of return to the unobserved characteristics in each district using the following logic. The error term can be decomposed further into

\[
\begin{align*}
\hat{u}_{ij} &= \hat{\varepsilon}_{ij} \cdot \sigma_j \\
\hat{\varepsilon}_{ij} &= \frac{\hat{u}_{ij}}{\hat{\sigma}_j} \\
&= \frac{\hat{u}_{ij}}{\sqrt{\text{Var}(\hat{u}_{ij})}}
\end{align*}
\]

where \( \hat{\varepsilon}_{ij} \) denotes a normal standardized residual, while \( \sigma_j \) is the standard deviation of blacks’ residual earnings (the price of unobserved skills) in magisterial district \( j \). Since \( \text{Var}(u_{ij}) = \sigma_j^2 \), \( \hat{\varepsilon}_{ij} \) can be estimated as follows.

We assume that the normal standardized residual of individual \( i \) (the unobservable skill level of individual \( i \)) is constant across different magisterial districts, \( \hat{\varepsilon}_{ij} = \hat{\varepsilon}_i \) (where \( j \neq l \)), to compute a counterfactual residual for individual \( i \) in all of the 354 magisterial districts.
(7) \[ \hat{u}_{ij} = \hat{e}_{ij} \cdot \hat{\sigma}_j \] (\( j = 1, \ldots, 354 \)).

Then, we can rewrite the utility function of an individual \( i \) in area \( j \) in Equation (1) as

(8) \[ U_{ij} = U \left( \ln(w_{ij}), \hat{u}_{ij}, SH_j, UR_j, \ln(D)_j, CR_j \right). \]

In order to estimate this model, we must first specify a functional form of the utility function. We assume the linear random utility model, which leads to the function

(9) \[ U_{ij} = \delta_1 \cdot \ln(w_{ij}) + \delta_2 \cdot \hat{u}_{ij} + \delta_3 \cdot SH_j + \delta_4 \cdot UR_j + \delta_5 \cdot \ln(D)_j + \delta_6 \cdot CR_j + \tau_{ij}. \]

The key parameters of interest in our utility function are the marginal utility/disutility of the expected wage and the share of high schooling (\( \delta_1 \) and \( \delta_3 \)) in area \( j \) to the potential migrants. As in Sjaastad (1962), higher regional expected income generates greater utility to the potential migrants. If internal migration within South Africa after the formal end of apartheid caused a brain drain, the coefficient of the share of people in the area with at least some high school education should be positive for relatively highly educated individuals, but negative for the low educated ones. Additionally, we estimate the marginal disutility to the potential migrant of distance traveled to the destinations, unemployment rates, and crime rates. We include \( \tau_{ij} \), an idiosyncratic error term representing the unobserved utility to each choice to the individual model.

When the data consist of choice-specific attributes instead of individual-specific characteristics, a conditional logit model can be utilized to estimate the coefficients above. Let \( Y_{ij} \) represent a dummy variable, which is equal to 1 if individual \( i \) from origin \( o \) chooses to migrate into region \( j \), and zero otherwise. McFadden (1973) shows that if the \( \tau_{ij} \) terms are distributed extreme value type 1,

(10) \[ F(\tau_{ij}) = \exp(-e^{-\tau_{ij}}) \]

then the probability of the representative individual choosing the \( j^{th} \) region can be represented as
\[ \Pr(Y_{ij} = 1) = \frac{\exp(\eta_{ij})}{1 + \sum_{j=1}^{353} \exp(\eta_{ij})} \quad \text{for } j \neq o \]

\[ \Pr(Y_{ij} = 1) = \frac{1}{1 + \sum_{j=1}^{353} \exp(\eta_{ij})} \quad \text{for } j = o \]

where \( \eta_{ij} = \delta_1 \cdot \ln(w_{ij}) + \delta_2 \cdot \hat{u}_{ij} + \delta_3 \cdot SH_j + \delta_4 \cdot UR_j + \delta_5 \cdot \ln(D) + \delta_6 \cdot CR_j \).

This conditional logit model can then be estimated by maximum likelihood, where the log likelihood function is

\[ \ln L(\delta | Y, \ln(w_{ij}), \hat{u}_{ij}, SH_j, UR_j, \ln(D), CR_j) = \sum_{i=1}^{N} \sum_{j=1}^{354} Y_{ij} \cdot \Pr(Y_{ij} = 1) \].

5. Data

We use data from the 1996 South African census to examine the migration patterns after the elimination of apartheid. The 1996 Population Census is a 10% unit level sample of (a) all households and (b) all persons as enumerated in South Africa. Since this study investigates location choice, it is essential to understand the geographic hierarchy because an analysis of migration patterns will generate varying results depending on the definition of migrant. Moreover, the geographical unit selected for the analysis will influence how we define our migrants. At the broadest level, South Africa is composed of nine geographic provinces. At the most detailed level, there are 354 magisterial districts spread over the nine provinces. The magisterial district level of activity was chosen as a geographic unit for our analysis because the 1996 South African census reports each individual’s residential location at the magisterial district.

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\(^9\) None of the geographic categories in the South African Census can identify whether an area is restricted or unrestricted under the apartheid system. For instance, there could be both restricted and unrestricted areas relating to black South Africans even within a small magisterial district.
level for both the current residence as well as previous residences.\textsuperscript{10} Moreover, there are quite a large number of people who moved into new districts since 1992, which coincided with the demise of Apartheid. According to the 1996 census (see table 2), 14.5\% of black South Africans changed their location across magisterial districts during our four-year period of study, between 1992 and 1996. As Table 3 indicates the migration rates are higher when we focus only on the employed black South Africans for the same period of time.

Although we only focus on the migration patterns of black South Africans in this paper, the comparison of socioeconomic status across different ethnicities in South Africa will provide insight as to the extent to which blacks were deprived of socioeconomic opportunities under apartheid. Table 2 provides summary statistics of the sample for black South Africans as well as other races. As an initial observation, it is important to note that blacks in 1996 still had relatively low socioeconomic status. Not only did they experience high unemployment rates, but they were also less educated and earned much less than other individuals from other ethnic groups. The mean income levels of whites were roughly three times more than those of blacks. Figure 3 shows the comparison of income distribution between blacks and whites. The black’s distribution is skewed much more to lower incomes, centered on the fourth income category, while the white distribution is centered on the ninth income category.

There are also a few important differences worth noting between black migrants and non-migrants (Table3). We find that, on average, the movers are younger than the non-movers (Sjaastad, 1962). Migrants are more educated and earn more than non-migrants. The employment rate variable suggests a sharp difference within the South African labor market in comparison with markets in other more developed countries. The unemployment rate of blacks is 36\% for the entire sample and movers are more likely to be employed (Sibanda and Zuberi, 2004).

\textsuperscript{10} The Census also provides geographic information for both the current residence as well as previous residences at a higher category such as provinces. However, since the province is too broad to serve as a geographic unit for this study, we use magisterial districts as a basis for empirical analysis.
5.1. VARIABLES

In Tables 2 and 3, the extent to which South Africa is segregated depending on ethnicities is defined. Those individual characteristics are used to compute predicted wages and returns to unobservable characteristics as described in the previous section. However, for the regression analysis on the location choices, regional characteristics are used. In the following sub-section, we discuss in detail our definition of a migrant and the specifics of how variables are defined.

5.1.1. MIGRANT

Our sample restricts black male workers to the cohort between ages 18 and 62 and includes only those who are paid employees, report positive monthly earnings and are not enrolled in school. We exclude female workers because their migration is likely to be tied to their spouse’s choice, which is empirically confirmed in the family migration literature. It appears that the results will be attenuated if female workers are included.\(^\text{11}\) After applying some more reasonable restrictions\(^\text{12}\), we end up with 34,778 observations on those who migrated (movers) and 162,542 observations on those who remained in the same magisterial district during the study period (non-movers). We know the locations of households among 354 magisterial districts spread over nine provinces both in 1996 as well as the previous residential location of workers\(^\text{13}\) who moved into a

\(^{11}\) The wife and children often move because of their relationship to the father/husband and not necessarily because of their own attempts to secure employment. The exclusion of the economically inactive allows us to reveal more about the role of economic imperatives in their behavior.

\(^{12}\) Some blacks report a foreign country as their previous residential areas. We drop those from the analysis because we cannot compare the regional characteristics of magisterial districts to foreign countries.

\(^{13}\) The South African Census has a slightly different questionnaire on the \textit{previous residence} variable from the U.S. Census. For example, while the U.S. Census asks about the residential information from five years ago, the South African Census collects information on the most recent migration activities. As a result of the wording of this question, if an individual migrated multiple times during a particular census period, only the most recent movement will be captured in the data.
new location between 1991 and 1996.\textsuperscript{14} We will define migrants as individuals who migrated across magisterial districts after the demise of the Apartheid system, between 1992 and 1996. About 14.5\% of black South Africans migrated across districts during the above period (see table 3). While this mobility rate is higher than the rates for both Asian/Indian and Colored groups, the blacks’ mobility is lower than the whites’ mobility during the democratic era (See Table 2). Table 3 shows summary statistics for the employed black South Africans comparing movers with stayers. According to the Table, a higher proportion of blacks (17.6\%) migrated across magisterial district among employed blacks in South Africa.

5.1.2. Predicted Log Wages

Economic models based on Roy (1951) and Sjaastad (1962) predict that individuals choose areas where they can maximize their expected income. There are two main factors that affect individuals’ expected incomes: area effects and individual characteristics. As described in section 4, equation (3) is first estimated to obtain the coefficient estimates used to compute the predicted log wages for each individual $i$ in district $j$ in equation (4). Then we also compute returns to unobservable characteristics across 354 magisterial districts for each individual. Although there are 354 magisterial districts in South Africa, we were unable to include all those districts in our analysis because 36 out of 354 include fewer than 30 observations in the sample. We drop those magisterial districts to reduce measurement error in estimating district expected wages so that the actual number of magisterial districts used in the study is 318.

The 1996 census provides individual characteristics in equation (3), but the detailed wage information for each individual is unavailable. In the South African Census, however, income from all sources for the 12 months preceding the census is reported. Other income sources might

\textsuperscript{14} In the South African Census of 1996, the respondent was asked for the year in which the person moved to the dwelling of usual residence and then for the location of the previous residence if the person had ever moved.
be additional work activities, remittances from family members living elsewhere, state pensions or grants, other pensions or grants, as well as income from investments. Although these issues could be solved to a degree by using other information such as whether one receives a pension or full-time or part-time employment status, we note that monthly income is coded in 14 categories: no income, 1-200 rand, ..., 30,001 rand or more. We converted each category to its midpoint. However, the last interval of income category is open-ended. As Henson (1967) suggested, we utilized the Pareto Curve to estimate a mid-point of the open-ended interval, and the last interval is converted into 42,007 rand. After taking the log of the converted income variable, we estimate the parameters in equation (3) for each of the magisterial districts. Then by using the estimated parameters, we computed the log predicted wage of each individual for (318-1) potential magisterial district as well as the predicted wage for their current area.

5.1.3. Returns to Unobservable Characteristics/Skills

There still exists a discrepancy between the predicted wages and actual wages in the previous section. It is reasonable to expect that individuals respond to differences across districts in the returns to characteristics (skills) that the econometrician cannot observe when they choose to move to a magisterial district. As described in section (4), we estimate the returns to unobservable characteristics for each individual to each of the magisterial districts. We normalized the residuals,

\[ MD = 10^{(301/v)}(X_i) \]

where \( X_i \) is the lower limit of the open-ended category. And \( v \) can be calculated by taking the log of the percentage of people in the open-ended category plus the percentage of people in the category immediately preceding the open-ended one minus the log of the former number, divided by the log of the lower limit of the open-ended category minus the log of the lower limit of the category immediately preceding the open-ended one. We used this formula to estimate \( v \) prior to calculating the median value:

\[ v = \frac{\log(92) - \log(35)}{\log(3001) - \log(16001)} = 2.05. \]
which is why the summary statistics in Table 3 show a mean of zero and a standard deviation of one. When the own residuals are multiplied by the estimated return to unobservable skills in Table 4, we now can compute returns to unobservable skills. Along with the predicted wages, these are expected to affect each individual’s location choice.

5.1.4. Share of Individuals with at Least Some Matriculation

Ultimately we intend to investigate the brain drain issue within South Africa after the formal end of apartheid. Rather than including the interaction term between the shares of high schooling in each district and each individual’s schooling level, we divide our sample into two groups: individuals with at least some matriculation in high school and ones who did not attend high school. As displayed in Figure 4, the proportion of workers with at least some matriculation is about 6% among black South Africans. For the internal migration to have contributed to a brain drain phenomenon, we should expect to see that blacks with more schooling are more likely to choose areas where the share of the population with some high school is higher. In contrast, less educated blacks will tend to disfavor the areas with high shares of the population with high schooling. Figure 1 provides some weak evidence of the brain drain phenomena, i.e. areas with relatively low shares of high school grads in 1991 experienced smaller growth in the high school share between 1991 and 1996 and even some negative change. On the other hand as the 1991 high school share rises, the incidence of negative growth drops off in favor of positive growth.

5.1.5. Unemployment Rate

While black unemployment in South Africa remains a significant issue, it is a well-known fact that the country experienced very high unemployment during the study period. Hence the variations in unemployment rates across magisterial districts should be a significant factor to migration decisions. According to the migration literature, areas with higher unemployment rates
might be expected to experience both more out-migration and less in-migration. Our unemployment variable is constructed from Census 1996 at the magisterial district level as one minus the number of employed black South Africans divided by the number of black South Africans in the labor force.

5.1.6. DISTANCE

As a number of researchers point out, distance is another important factor to be considered in a migration model. The fact that migration to a more distant area is lower has been attributed to the fact that distance serves as a proxy for both transportation and psychic costs of movement, as well as for the availability of information (Greenwood, 1975). The distance between the previous and the current location for each individual is proxied by the distance between two centroids of the previous and new districts.\footnote{South African Census 1996 provides GIS data file as a supplementary package. We created 354*354 distance matrix through ArcGIS program.} Table 5 displays the distance measure. Although it does not provide interpretable measures, it is worthwhile to consider how educational attainment is correlated with migration distance. Contrary to what we would expect, on average, higher educational attainments reduce the migration distance among black South African migrants for this study period, 1992 - 1996.

5.1.7. CRIME RATE

Traditionally crime rates have been high in South Africa, and were so in the early 1990s. Hence, crime information could be a good potential non-economic component that people consider when choosing their residential location. In this study, we utilize crime data that were obtained from the South Africa Police Service (SAPS) in 1996. The crime information is a comprehensive database of crimes reported for the entire country by police precinct. It includes 37 different types of crime
such as residential burglary, vehicle theft, serious assault, rape, armed robbery with aggravated circumstances, murder, etc. The relative crime level was computed by dividing the sum of the number of crimes reported by the population of each magisterial district. Table 4 shows that there existed substantial variation of crime levels across districts in South Africa in 1996. As found by Kok et al. (2003), it is expected in this paper that relatively high crime rate would provide disutility to black South Africans.

5.2. CONTEXTUAL DATA SET STRUCTURE

The contextual data structure integrates two dimensions. Consider the first individual in the sample. This person has $J = 318$ alternative destinations from which to choose (318 magisterial districts). So, for the first individual observation, there will be $J$ rows in the data array. Each of these rows will contain area information. This data structure is repeated for all $N$ individuals in the sample. The total number of rows in the contextual data set is $N \times J$. The dependent variable, $Y_{ij}$, is equal to 1 if the individual $i$ chooses $j$ as his locality. Under this data format, our sample should be multiplied by as many of the alternatives into which workers can migrate. Furthermore, normally census data sets are one of the largest among micro data sets. Since the size of our sample is constrained by the number of data array rows, we were unable to include the entire set of observations of people who did not matriculate in high school. I developed a random sample for this group with the same number of observations as the group with high schooling, and then estimated the model.

5.3. ENDOGENEITY ISSUE AND LIMITATION OF DATA
As found in Nakosteen and Zimmer (1980), there could be a positive selection among non-migrants. Robinson and Tomes (1982) and Gabriel and Schmitz (1995) also find favorable self-selection. Then our predicted log wage and estimated returns to unobservable characteristics can be biased estimates. We admit that our economic variables are not free from this type of endogeneity.

Other issues arise related to the timing of data collection. Migrants in this study determined their migration and location decision between 1992 and 1996. However, regional characteristics such as unemployment rates and crime rates were collected in 1996. There may be some simultaneity bias that arises from using information on the districts at the end of the period.

### 6. Estimation Results

To identify the marginal utility of the model in Equation (9), conditional logit (CLOGIT) models are estimated by maximum likelihood. To ensure continuity with the prediction of our empirical model, the coefficient of the expected wage, $\delta_1$, is expected to be positive regardless of educational attainments because workers are assumed to prefer higher income, conditional on other regional characteristics. Although the effect of other regional characteristics are interesting, our analysis of the brain drain phenomena causes us to focus more of our discussion on the coefficient of the share of high schooling in equation (9). If people tend to cluster in areas where others have similar levels of education, the coefficient of the share of high schooling, $\delta_3$, should be positive for the group with high levels of education, holding other regional characteristics constant. However, a high share of the population with high schooling would provide disutility to those with low levels of education.

The set of estimated coefficients are reported in Table 6 and 7 for two different samples based on the levels of education. We provide estimation results for 4 different specifications of
the model to check the robustness of the main coefficients of interest. The coefficients in Table 6 for workers who did not matriculate in high school have signs consistent with our predictions. Although both high expected wage and returns to unobservable characteristics generate positive utility to workers, as predicted in Sjaastad (1962), returns to unobservable characteristics are statistically insignificant. In terms of other amenities, distance, unemployment rates, and crime rate consistently engender disutility. More importantly, the coefficient of the share of high schooling in area \( j \) minus the share of high schooling in the origin is negative and statistically significant across various specifications. This result is consistent with our expectation that individuals with low levels of education disfavor areas with populations with a high share of high schooling.

To examine further the issue of brain drain, we need also to check the response of people with high levels of education to the share of high schooling. The results in Table 7 are based on the regressions with the sample where everybody has had at least some matriculation in high school. More highly educated individuals migrate into areas where they can obtain a higher predicted wage. High unemployment rates engender disutility to workers, and people tend to migrate shorter distances.

Another form of human capital would be higher levels of skill that we have not been able to measure directly. Based on migration theory we would expect that people with higher levels of this unmeasured skill would move to areas where the returns are higher. Our measure of returns to this unmeasured skill is the standard deviation of the residuals from the wage regression in each area. Contrary to our expectation, however, the coefficient on the standard deviation of the residual is negative in Table 6.

Our main focus is on the coefficient of the share of the high schooling variable from which we can confirm whether the removal of apartheid contributed to a brain drain from sending areas. As expected, in this sample of people with some high school education, they tended to be
attracted to areas where a higher percentage of people had some high school education. Therefore, the migration contributed to a reshuffling of the distribution of more educated people toward areas with more educated populations.

7. CONCLUDING REMARKS

The repeal of the Apartheid laws occurred between 1986 and June 1991. In this paper, we use the traditional Roy (1951) and Sjaastad (1962) models to examine the patterns of internal migration within South Africa during the democratic era. Although there are several works on internal migration issues in South Africa\(^\text{18}\), our study is the first to investigate black South Africans’ migration from the prospective of an income-maximizing hypothesis model. In addition to testing the hypothesis of individuals’ income-maximizing behavior, we implement additional analyses of the consequence of internal migration within South Africa after the formal elimination of apartheid with emphasis on brain drain issue. The study also provides new information about internal migration in a developing country, where a large share of the population has lived in segregated, poverty-ridden areas.

Our findings are consistent with the general economic models that predict that people migrate in responses to changes in expected income. Migrants tended to be more educated and the shifts after the end of apartheid led to a redistribution of the residences of people with different education levels. Further, there are signs more educated blacks, freed from the constraints of Apartheid, tended to move to areas where there were higher percentages of the population with some high schooling, while those who had not attended high school tended to

\[^{18}\text{Kok et al. (2003) show that while three provinces, Gauteng, Western Cape, and Mpumalanga, attract more workers and indicate positive net migration rates the rest of other six provinces in South Africa lose their residents to other provinces.}\]
find areas where the population was less educated more attractive. Thus, the migration process contributed to a brain drain in areas where populations were more poorly educated on average.
REFERENCES


Figure 1: Scatter diagram relating the change in the share of high schooling from 1991 to 1996 with the share of high schooling in 1991.

Note: since individuals are more likely to upgrade their education at their young age, we restrict our sample above age 23 for this figure. The line indicates a quadratic fitted line weighted with the population of each magisterial district in 1991.

Figure 2: Scatter diagram relating the change in the share of high schooling from 1991 to 1996 with returns to education in 1996.
Figure 3: Comparison of Income Distributions between Blacks and Whites

Note: monthly income is coded into 14 categories in the census 1996 of South Africa: no income, 1-200 rand, ..., 30,001 rand or more. Figure 2 displays the income distribution of blacks and whites for those who reported positive monthly earnings.

Figure 4: Comparison of Educational Attainment between Blacks and Whites
Table 1: Laws under Apartheid

<table>
<thead>
<tr>
<th>Name of laws</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prohibition of Mixed Marriages Act (1949-1985)</td>
<td>prohibited marital union between persons of different races.</td>
</tr>
<tr>
<td>Immorality Act (1950-1985)</td>
<td>made it a criminal offence for a white person to have any sexual relations with a person of a different race.</td>
</tr>
<tr>
<td>Population Registration Act (1950-1991)</td>
<td>required all citizens to be registered as black, white, coloured or Indian.</td>
</tr>
<tr>
<td>Suppression of Communism Act (1950-1993)</td>
<td>banned organizations that supported communism. Most of the Act was repealed in 1982 and in 1991, with the last provisions of it repealed in 1993.</td>
</tr>
<tr>
<td>Group Areas Act (1950-1991)</td>
<td>partitioned the country into different areas, with different areas being allocated to different racial groups. This law represented the very heart of apartheid because it was the basis upon which political and social separation was to be constructed.</td>
</tr>
<tr>
<td>Bantu Authorities Act (1951)</td>
<td>created separate government structures for black people.</td>
</tr>
<tr>
<td>Native Building Workers Act (1951)</td>
<td>blacks not to perform skilled construction.</td>
</tr>
<tr>
<td>Native Services Levy Act (1952)</td>
<td>imposes monthly taxes on employers of urban blacks</td>
</tr>
<tr>
<td>Pass Law Act (1952-1986)</td>
<td>made it compulsory for all black South Africans over the age of 16 to carry a &quot;pass book&quot; at all times.</td>
</tr>
<tr>
<td>Amendments to the Native Consolidation Act (1952, 1955, and 1957)</td>
<td>restrictions on blacks in urban areas, could only remain without a pass under special conditions.</td>
</tr>
<tr>
<td>Reservation of Separate Amenities Act (1953-1989)</td>
<td>prohibited people of different races from using the same public amenities.</td>
</tr>
<tr>
<td>Natives (Settlement of Disputes) Act (1953)</td>
<td>bars blacks from registering trade unions.</td>
</tr>
<tr>
<td>Bantu Education Act (1953)</td>
<td>brought all black schooling under government control, ending mission-run schools.</td>
</tr>
<tr>
<td>Bantu Urban Areas Act (1953)</td>
<td>curtailed black migration to the cities.</td>
</tr>
<tr>
<td>Mines and Work Act (1956)</td>
<td>formalized racial discrimination in employment.</td>
</tr>
<tr>
<td>Native Administration Act (1956)</td>
<td>permits government to send Africans into exile in remote parts of the country.</td>
</tr>
<tr>
<td>Promotion of Black Self-Government Act (1959-1993)</td>
<td>set up separate territorial governments in the homelands, designated lands for black people where they could have a vote. The aim was that these bantustans would eventually become independent of South Africa.</td>
</tr>
<tr>
<td>Bantu Investment Corporation Act (1959)</td>
<td>set up a mechanism to transfer capital to the homelands in order to create jobs in the black homelands.</td>
</tr>
<tr>
<td>Extension of University Education Act (1959)</td>
<td>created separate universities for Blacks, Coloureds, and Indians.</td>
</tr>
<tr>
<td>Physical Planning and Utilisation of Resources Act (1959)</td>
<td>allowed the government to stop industrial development in 'white' cities and redirect such development to homeland border areas. The aim was to speed up the relocation of blacks to the homelands by relocating jobs to homeland areas.</td>
</tr>
<tr>
<td>Prohibition of Political Interference Act (1968)</td>
<td>racially mixed parties are illegal.</td>
</tr>
<tr>
<td>Bantu Laws Amendment Act (1970)</td>
<td>job reservation - made possible the prohibition of the employment of blacks in any job, in any area or in the service of any employer.</td>
</tr>
<tr>
<td>Black Homeland Citizenship Act (1970)</td>
<td>changed the status of the inhabitants of the 'homeland' so that they were no longer citizens of South Africa. The aim was to ensure whites became the demographic majority within South Africa.</td>
</tr>
</tbody>
</table>
Table 2: Summary Statistics—Comparison across Different Ethnicities

<table>
<thead>
<tr>
<th></th>
<th>Black</th>
<th>Colored</th>
<th>Indian/Asian</th>
<th>White</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unemployed</td>
<td>0.360</td>
<td>0.173</td>
<td>0.113</td>
<td>0.041</td>
</tr>
<tr>
<td></td>
<td>(0.48)</td>
<td>(0.38)</td>
<td>(0.32)</td>
<td>(0.20)</td>
</tr>
<tr>
<td>Monthly wage</td>
<td>1385.65</td>
<td>1804.50</td>
<td>3164.06</td>
<td>6317.35</td>
</tr>
<tr>
<td></td>
<td>(1753.34)</td>
<td>(2098.33)</td>
<td>(3568.13)</td>
<td>(6508.65)</td>
</tr>
<tr>
<td>LN(wage)</td>
<td>6.787</td>
<td>7.093</td>
<td>7.699</td>
<td>8.352</td>
</tr>
<tr>
<td></td>
<td>(0.99)</td>
<td>(0.93)</td>
<td>(0.86)</td>
<td>(0.96)</td>
</tr>
<tr>
<td>Migrant</td>
<td>0.145</td>
<td>0.108</td>
<td>0.103</td>
<td>0.210</td>
</tr>
<tr>
<td></td>
<td>(0.35)</td>
<td>(0.31)</td>
<td>(0.30)</td>
<td>(0.41)</td>
</tr>
<tr>
<td>Years of Schooling</td>
<td>7.041</td>
<td>8.266</td>
<td>10.906</td>
<td>12.423</td>
</tr>
<tr>
<td></td>
<td>(4.27)</td>
<td>(3.61)</td>
<td>(2.73)</td>
<td>(2.47)</td>
</tr>
<tr>
<td>Age</td>
<td>35.432</td>
<td>34.431</td>
<td>35.774</td>
<td>37.606</td>
</tr>
<tr>
<td></td>
<td>(10.43)</td>
<td>(10.67)</td>
<td>(11.13)</td>
<td>(11.29)</td>
</tr>
<tr>
<td>Married</td>
<td>0.437</td>
<td>0.509</td>
<td>0.703</td>
<td>0.687</td>
</tr>
<tr>
<td></td>
<td>(0.50)</td>
<td>(0.50)</td>
<td>(0.46)</td>
<td>(0.46)</td>
</tr>
<tr>
<td>Part-time</td>
<td>0.052</td>
<td>0.069</td>
<td>0.061</td>
<td>0.038</td>
</tr>
<tr>
<td></td>
<td>(0.22)</td>
<td>(0.25)</td>
<td>(0.24)</td>
<td>(0.19)</td>
</tr>
<tr>
<td>N</td>
<td>388,113</td>
<td>61,751</td>
<td>20,619</td>
<td>76,300</td>
</tr>
</tbody>
</table>

Note: standard deviation in parenthesis; unemployment rate is computed by following a standard definition, the number of employed divided by those who are in the labor force; individuals who reported positive monthly earnings are used for the estimates of average wage.

Table 3: Summary Statistics - Employed Black Population

<table>
<thead>
<tr>
<th></th>
<th>Entire sample</th>
<th>Movers</th>
<th>Stayers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>STD</td>
<td>Mean</td>
</tr>
<tr>
<td>Area unemployment rate</td>
<td>0.360</td>
<td>(0.480)</td>
<td>0.248</td>
</tr>
<tr>
<td>Wage</td>
<td>1385.894</td>
<td>(1592.451)</td>
<td>1453.809</td>
</tr>
<tr>
<td>LN(wage)</td>
<td>6.828</td>
<td>(0.949)</td>
<td>6.862</td>
</tr>
<tr>
<td>Migrant</td>
<td>0.176</td>
<td>(0.381)</td>
<td>1.000</td>
</tr>
<tr>
<td>Years of schooling</td>
<td>7.231</td>
<td>(4.331)</td>
<td>7.730</td>
</tr>
<tr>
<td>Age</td>
<td>36.845</td>
<td>(10.034)</td>
<td>33.584</td>
</tr>
<tr>
<td>Married</td>
<td>0.547</td>
<td>(0.498)</td>
<td>0.473</td>
</tr>
<tr>
<td>Part-time</td>
<td>0.068</td>
<td>(0.252)</td>
<td>0.084</td>
</tr>
<tr>
<td>Own residuals</td>
<td>0.004</td>
<td>(1.004)</td>
<td>0.011</td>
</tr>
</tbody>
</table>

Note: standard deviation in parenthesis; the sample is restricted to those only who are paid workers, neither self-employed nor family workers.
Table 4: Regional Characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Observations</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Returns to education</td>
<td>318</td>
<td>0.091</td>
<td>0.037</td>
<td>-0.007</td>
<td>0.190</td>
</tr>
<tr>
<td>Mean of predicted wage</td>
<td>318</td>
<td>6.626</td>
<td>0.621</td>
<td>4.352</td>
<td>8.192</td>
</tr>
<tr>
<td>Price to unobservable skills</td>
<td>318</td>
<td>0.801</td>
<td>0.109</td>
<td>0.194</td>
<td>1.119</td>
</tr>
<tr>
<td>Share of high schooling</td>
<td>318</td>
<td>0.051</td>
<td>0.042</td>
<td>0.000</td>
<td>0.207</td>
</tr>
<tr>
<td>Unemployment rate</td>
<td>318</td>
<td>0.342</td>
<td>0.190</td>
<td>0.000</td>
<td>0.830</td>
</tr>
<tr>
<td>Crime rate</td>
<td>318</td>
<td>0.640</td>
<td>0.455</td>
<td>0.006</td>
<td>3.279</td>
</tr>
</tbody>
</table>

Note: crime data were obtained from the South Africa Police Service in 1996; the relative crime level was computed by dividing the sum of the number of crime reported by the population of each magisterial district.

Table 5: Mean Distance for Migrants

<table>
<thead>
<tr>
<th></th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary or less</td>
<td>14,721</td>
<td>2.04</td>
<td>2.52</td>
<td>0.05</td>
<td>15.20</td>
</tr>
<tr>
<td>Some secondary</td>
<td>12,140</td>
<td>1.75</td>
<td>2.32</td>
<td>0.05</td>
<td>15.22</td>
</tr>
<tr>
<td>Secondary</td>
<td>5,654</td>
<td>1.62</td>
<td>2.06</td>
<td>0.07</td>
<td>14.88</td>
</tr>
<tr>
<td>Secondary +</td>
<td>2,206</td>
<td>1.48</td>
<td>2.05</td>
<td>0.07</td>
<td>15.56</td>
</tr>
<tr>
<td>Total</td>
<td>34,721</td>
<td>1.83</td>
<td>2.36</td>
<td>0.05</td>
<td>15.56</td>
</tr>
</tbody>
</table>

Note: data source from a supplementary package of the 1996 South African Census which includes GIS data file.
Table 6: Conditional Logit Regression - Sample with Less than High School

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicted log wage in j minus predicted log wage in origin based on individual i's characteristics</td>
<td>1.706</td>
<td>1.734</td>
<td>1.705</td>
<td>1.734</td>
</tr>
<tr>
<td>(Std. Dev. of residual in j minus Std. Dev. of residual in origin) times normalized residual for individual i in region j</td>
<td>(28.67)</td>
<td>(29.04)</td>
<td>(28.65)</td>
<td>(29.03)</td>
</tr>
<tr>
<td>The share of high schooling in j minus the share of high schooling in origin</td>
<td>-7.206</td>
<td>-5.162</td>
<td>-7.196</td>
<td>-5.156</td>
</tr>
<tr>
<td>Distance between region j and origin</td>
<td>-8.301</td>
<td>-8.317</td>
<td>-8.302</td>
<td>-8.318</td>
</tr>
<tr>
<td>Crime rate in region j minus crime rate in origin</td>
<td>-0.391</td>
<td>-0.391</td>
<td>-0.391</td>
<td>-0.391</td>
</tr>
<tr>
<td>N</td>
<td>10,929</td>
<td>10,929</td>
<td>10,929</td>
<td>10,929</td>
</tr>
<tr>
<td>LR chi2</td>
<td>91998.98</td>
<td>92191.54</td>
<td>92000.08</td>
<td>92192.34</td>
</tr>
<tr>
<td>Pseudo R2</td>
<td>0.7305</td>
<td>0.732</td>
<td>0.7305</td>
<td>0.732</td>
</tr>
</tbody>
</table>

Note: z-values are in the parenthesis.

Table 7: Conditional Logit Regression - Sample with at least Some High School

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicted log wage in j minus predicted log wage in origin based on individual i's characteristics</td>
<td>1.546</td>
<td>1.684</td>
<td>1.523</td>
<td>1.658</td>
</tr>
<tr>
<td>(Std. Dev. of residual in j minus Std. Dev. of residual in origin) times normalized residual for individual i in region j</td>
<td>(23.56)</td>
<td>(24.63)</td>
<td>(23.12)</td>
<td>(24.12)</td>
</tr>
<tr>
<td>The share of high schooling in j minus the share of high schooling in origin</td>
<td>3.287</td>
<td>3.489</td>
<td>3.501</td>
<td>3.662</td>
</tr>
<tr>
<td>Distance between region j and origin</td>
<td>-7.446</td>
<td>-7.441</td>
<td>-7.440</td>
<td>-7.436</td>
</tr>
<tr>
<td>Unemployment rate in region j minus unemployment rate in origin</td>
<td>1.447</td>
<td>-1.384</td>
<td>-9.18</td>
<td>-8.72</td>
</tr>
<tr>
<td>Crime rate in region j minus crime rate in origin</td>
<td>-0.350</td>
<td>-0.329</td>
<td>-10.15</td>
<td>-9.41</td>
</tr>
<tr>
<td>N</td>
<td>10,928</td>
<td>10,928</td>
<td>10,928</td>
<td>10,928</td>
</tr>
<tr>
<td>LR chi2</td>
<td>90626.49</td>
<td>90745.36</td>
<td>90654.15</td>
<td>90757.68</td>
</tr>
<tr>
<td>Pseudo R2</td>
<td>0.7196</td>
<td>0.7206</td>
<td>0.7198</td>
<td>0.7207</td>
</tr>
</tbody>
</table>

Note: z-values are in the parenthesis.
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