The Effects of Poverty on the Susceptibility to Crime in South Africa[*]

D. Mark Anderson

Department of Economics

University of Washington

dma7@u.washington.edu

September 2008

[*] I am grateful to Claus Portner for his guidance. I owe thanks to Yoram Barzel, Shelly Lundberg and seminar participants at the Pacific Development Conference and the University of Washington for comments and suggestions. All remaining errors and omissions in this paper are solely mine.

ABSTRACT

This paper examines empirically the effects of household-level poverty, measured by household expenditures per capita, on the susceptibility to crime in South Africa. The paper uses an instrumental variables strategy combined with community fixed effects to account for potentially endogenous expenditures and unobserved between-community heterogeneity. Across all model specifications the probability a South African household is robbed is increasing in expenditures. When using instrumental variables, the positive effect of expenditures on the susceptibility to robbery increases substantially. In addition, the effect of expenditures remains positive and significant for "nonwhite" areas. This suggests that robberies are not only a problem for the rich who live in gated communities and hire private security, but also for the relatively "wealthy" that reside in poorer neighborhoods. Finally, this paper fails to find a statistically significant relationship between expenditures and the susceptibility to violent crimes such as murder, rape, and assault.

Keywords: Crime; Victimization; South Africa

JEL classification: K40; K42; O55

I. INTRODUCTION

Despite the fact that crime plagues many developing countries and can have significant negative effects on both economic growth and individual wellbeing, there is little research on who become victims of crime. This is somewhat disconcerting given that victim costs are regarded as the largest component of the cost of crime (Cohen 2005). As a result, the social and economic benefits associated with victimization research are potentially large.

This paper examines the relationship between poverty and the susceptibility to crime using data from a household survey in South Africa. The survey provides information on household victimization. An advantage of using victim crime reports is that issues associated with official crime statistics are potentially bypassed. Underreporting and police recording procedures that vary across jurisdictions are two problems that lead to measurement error in official statistics.[1]

This study is significant and unlike previous victimization research because it uses an instrumental variables strategy to account for potentially endogenous expenditures. A concern is that victimization may lead to a direct loss of wealth via theft or may hinder a household's ability to earn an income if a member is disabled or murdered in the event of a crime. Another concern is omitted variable bias. Specifically, household investments in private security goods are unobserved in the data. In addition, this paper uses community fixed effects to control for unobserved between-community heterogeneity. Across all model specifications, there is a positive relationship between

[1] A South African victim survey suggests that fewer than half of all crimes are reported to the police (Burton et al. 2004). Soares (2004) illustrates that wealthier countries report a higher fraction of committed crimes and finds that development (income per capita) does not impact crime rates when accounting for the reporting error in official records.

expenditures and the likelihood of being robbed. Furthermore, this effect becomes substantially stronger when controlling for the endogeneity of household expenditures. This implies that failing to control for potentially endogenous measures of household welfare may severely bias estimated effects of poverty on robbery and other crimes motivated by material gain. On the other hand, there appears to be no statistically significant relationship between household expenditures and being the victim of a violent crime such as murder, rape, and/or assault.

In South Africa, crime is not a new phenomenon, but long predates the closing stages of apartheid.[2] Centuries ago, colonialism was associated with a society where theft and violence occurred frequently. During apartheid, forced removal saw over three million blacks deposited in slums where crime ran rampant; police reported murders and assaults increased in the '60s and '70s while gang activity escalated (Gordon 2006). The '80s saw a rise in organized crime centered on narcotics trafficking and the smuggling of gold, diamonds, and other precious metals (Moller 2005). In the early '90s, during South Africa's transition to democracy, crime rates increased dramatically. In 1994, Interpol listed South Africa as the second most dangerous country in the world with upwards of 60 murders per day (Blackmore 2003). In the context of robbery, evidence suggests the wealthy bear a substantial burden of crime. Drivers of luxury vehicles are reported being hijacked at gun point and residents of wealthier neighborhoods are targets of home robberies. Many suburban South Africans live in homes guarded by dogs, razor wire, and security guards (Blackmore 2003). To further put South African crime in perspective, Figure 1 illustrates average homicide rates for a sample of countries over a

[2] It is no secret that widespread poverty is another challenge facing South Africa. In 1995, approximately 58% of all South Africans and 68% of the African population were living in poverty (Ozler 2007).

20-year period. Figure 2 compares crime rates in South Africa with those in the United States. The figures in Appendix A illustrate crime trends.

For developed countries, there is a substantial literature on the economic analysis of criminal activity and the effects of inequality and poverty on crime. [3] In contrast, evidence concerning the poverty and crime connection and related relationships in developing countries, while growing, is still limited. This is due, in large part, to a lack of available crime data for these countries. While much of the literature explores the link between crime and socioeconomic variables, other evidence points to significant relationships between criminal activity and the demographic/social composition of developing populations.[4]

Within the literature, the focus has been primarily on the connection between economic deprivation and the amount of crime in an area; little attention has been paid to the victims. Among the few existing victimization studies, Gaviria and Pages (2002) study patterns of victimization in Latin American cities and find that the probability of victimization increases with socioeconomic status, city size, and urban growth. Di Tella et al. (2006) study how crime impacts different income groups in the Buenos Aires metropolitan area. Their research suggests the rich are better able to insulate themselves against home robberies, but not street crimes. Most recently, Barslund et al. (2007) identify individuals and households with the highest risk of victimization in Mozambique and show individual-level income and household-level consumption to be positively associated with the incidence of victimization.

---

[3] See, for example, Becker (1968), Ehrlich (1973), Kelly (2000), Ludwig et al. (2001), and Raphael and Winter-Ebmer (2001).

[4] For example, Dreze and Khera (2000) find a negative correlation between murder rates and the female-male ratio in Indian populations.

To this point, there exists a wealth of descriptive statistics covering South African crime rates.[5] However, from an economic perspective and econometric framework, little work has been done. Demombynes and Ozler (2005) partially fill this void by analyzing the effects of local inequality on crime. They find that burglary rates are 25-43% higher in police precincts wealthier than their neighbors. Their results cover South Africa several years after apartheid and suggest that criminals travel to the wealthiest precincts to commit property crimes.

The remainder of this paper is organized as follows: Section II describes the data and variables; Section III provides a discussion of the estimation strategy; Section IV addresses instrument relevance, overidentification, and the endogeneity of household expenditures; Section V presents results; Section VI concludes.

II. DATA AND VARIABLES

While addressing the question of how victimization rates and crime type vary across poverty levels, this paper studies South Africa at a time when crime rates were increasing drastically. The data used in this paper were collected during the nine months leading up to the first democratic elections in South Africa and are from the 1993 South African Integrated Household Survey (SIHS) conducted by the South African Labour Development Research Unit (SALDRU). The survey is based on the Living Standards Measurement Surveys (LSMS) of the World Bank. The primary goal of the survey was to collect information regarding the living conditions of South Africans.

[5] For example, the South Africa Police Service (SAPS) and the Institute for Security Studies (ISS) publish detailed crime reports and articles.

The 1993 SALDRU survey questioned approximately 9,000 households grouped into 360 clusters. A community-level survey was conducted for each of the 360 clusters. Due to coding errors and missing values, there was complete information for slightly over 7,100 households. After data collection, the SALDRU constructed census raised weights to ensure a representative sample. The findings presented in this paper are based on the census weights; however, the results remain essentially the same without weights.

Dependent Variables

As previously mentioned, a benefit of using crime data from a household survey, as opposed to official statistics, is that measurement error problems can be mitigated. In studies where a measure of crime is the dependent variable, bias occurs when the measurement error is systematically related to one or more of the regressors. Much of the crime data used in the literature come from police precinct records. If a household has been a victim of a crime and the crime goes unreported, it will be excluded from the analysis. This happens when the expected returns from reporting are low.[6] It is likely that misreporting is also a function of police corruption.[7] For example, if poorer people are less likely to file a crime report because corrupt police favor the wealthy, then it is possible to observe a correlation between wealth and crime even if no correlation exists in the true relationship. This paper potentially avoids some of these issues by using crime reports from a household survey.[8] The 1993 SALDRU survey asks each household whether or not a household member has been a victim of a crime. If the answer is "yes",

[6] Duncan et al. (2007) discuss underreporting among minorities.
[7] In South Africa, corruption within the police force is widely prevalent (Newham 2002).
[8] It is important to note that Demombynes and Ozler (2005) find their result, that burglaries in South Africa are more likely to take place in wealthier areas that are unequal, to be robust when accounting for potential measurement error due to misreporting.

the respondent is asked to specify between murder, rape, abduction, robbery, assault, or other.

Crime, as defined in this paper, includes assault, robbery, rape, murder and abduction. Violent crime includes assault, rape, and murder. The dependent variables are discrete choice variables that take the value of one if, in the last 12 months, a household member has been a victim and zero otherwise. It is important to note that robbery is categorized as a violent crime in South Africa and most other countries (SAPS 2008). However, robbery is unique from other types of violent crimes in that it is likely motivated by material gain. As a result, robbery is examined separately. Unfortunately, robbery type is not observed. Each household is asked whether or not a member has been a victim of robbery, but is not asked to specify if it occurred at home, in the workplace, in a car, on the street, etc.[9]

Independent Variables

The independent variables are grouped into two categories: Variables describing household characteristics and variables describing community characteristics. Total monthly expenditures per household member (in South African rand) are used to proxy household wealth.[10] Dummy variables describing the presence and gender of the household head are also included.[11] In the United States, female headed households

[9] This is also a problem in Gaviria and Pages (2002). In their study, they only observe whether or not victimization occurs and make the assumption that their data correspond primarily to property crimes. Barslund et al. (2007) are able to observe where crimes take place, but it appears they do not take advantage of this in their study. They examine burglary and larceny separately, but do not control for crime locality.

[10] The components of the expenditure variable include expenditures on housing, utilities, food, vehicles, transportation, clothing, healthcare, insurance, savings, schooling, remittances and other non-food items. Expenditures on other non-food items include goods such as personal items (e.g. cigarettes or wine), childcare, and servants to name a few.

[11] A household head is considered to be present if he or she has been living in the house for at least 15 out of the last 30 days.

were found to be an important factor in determining why big cities have higher crime rates than rural areas (Glaeser and Sacerdote 1999). Additional regressors include variables indicating the age of the household head and the number of adults in the household.[12] Due to the "guardianship" factor, as discussed in Barslund et al. (2007), the risk of victimization would be expected to decrease as the number of adults in the household increases. However, with more members also comes the increased likelihood that any one individual in the household is victimized. It is also worth mentioning that, in principle, both household head age and the number of adults in the household could be altered by crime. Lastly, dummy variables indicating the highest level of education attained by the household head are added as independent variables. Gaviria and Pages (2002) find a positive association between the education of the household head and the probability of victimization, while Fajnzylber et al. (2000) fail to find a statistically significant relationship between years of schooling and victimization.

At the community level, dummy variables for whether or not the household lives in a rural community, the presence of homelessness in the community, and the availability of public transportation are considered. The public transportation indicator is included in light of evidence from Demombynes and Ozler (2005) that suggests criminals travel to wealthier areas to commit property crimes. A variable describing the percentage of the community that is non-white and a gini coefficient to capture within-community inequality are also included. The gini coefficient measures between-household per capita expenditure inequality within each community and is calculated as inequality from the perspective of each household. That is, household *i*'s expenditures are excluded when computing the gini coefficient for household *i* in community *j*. Numerous studies have

[12] An "adult" is defined as a household member of at least 14 years of age.

analyzed the connection between inequality and crime on aggregates larger than the household, but the results vary from paper to paper. Across countries, Fajnzylber et al. (1998) find the effect of inequality on robbery and homicides to be positive, while Stack (1984) finds a negative effect on property crimes. For U.S. counties, Kelly (2000) fails to find a significant effect of inequality on property crimes, murder, larceny, and car crimes. In this paper, it is the impact of community level inequality on the probability of household victimization that is considered. Besides Barslund et al. (2007), it appears that this issue has been left out of the victimization literature. In addition, provincial dummies are used in most of the model specifications. To control for unobservable factors impacting crime rates and poverty, such as police force activity, magisterial district dummies are used in several regressions.

Table 1 provides descriptive statistics of the variables. For all households, slightly over 10% reported being victimized within the last 12 months. Of those reports, nearly 7% were robberies. In communities where the majority of the residents are white, the robbery rate increases to 15% and violent crime rates drop. Robberies are reported at a lower rate in communities where the majority of the residents are non-white. All crimes are reported at a lower rate for rural households when compared to the entire sample. Table 2 reports victim of crime and household expenditure means. The mean log expenditure of households reporting robberies is significantly higher than for non-victims. However, one is unable to reject the hypothesis that mean log expenditures for victims of violent crime and non-victims are equal. These simple descriptive statistics conflict with the commonly held belief that poverty favors crime.

III. ESTIMATION STRATEGY

The relationship between poverty and crime is estimated with ordinary least squares (OLS). Because the dependent variable is binary, results below represent an OLS analysis of linear probability models (LPM). The linear probability estimation is based on the following

$$Crime_i = a + \delta totmex_i + \gamma_1 '\boldsymbol{hh}_i + \gamma_2 '\boldsymbol{c}_{ij} + \varepsilon_t \qquad (1)$$

where $Crime_i$ is a binary variable that is equal to 1 if a household member has been a victim of a crime and zero otherwise. $totmex_i$ is total monthly expenditures per household member, $\boldsymbol{hh}_i$ is a vector of household characteristics, and $\boldsymbol{c}_{ij}$ is a vector of community characteristics. For notational purposes, consider the following

$$Crime_i = \boldsymbol{x_i} '\mathbf{b_0} + \varepsilon_i$$

where $\boldsymbol{x_i}$ = (1, $totmex_i$, $\boldsymbol{hh}_i$, $\boldsymbol{c}_{ij}$)' and $\mathbf{b_0}$ is the vector of corresponding coefficients.

As mentioned previously, poverty is potentially endogenous. For example, causation may operate in the reverse direction, from crime to poverty.[13] If an increase in crime decreases household expenditures, then standard OLS estimates will be biased downward. As examples, consider a decrease in vehicle expenses if a car is stolen, a loss in household earnings if a wage earner is murdered or permanently disabled, or a decrease in general expenses if the household is robbed of a significant amount of cash

[13] Fafchamps and Minten (2006) treat the reverse causation problem by using a natural experiment. They look at the influence transitory poverty has on crime by taking advantage of a disputed presidential election in Madagascar. During this period, fuel supplies to the central highlands were reduced. The reduction in fuel supplies resulted in increased poverty levels. Their primary finding is that the increase in transitory poverty had a positive and significant effect on crop theft.

on hand.[14] Alternatively, OLS estimates will exhibit upward bias if crime increases expenditures. Consider an increase in health care expenses due to injuries incurred during victimization or investment in private security *ex post* victimization. Other sources of bias that may exist when estimating with OLS are due to between-household selection (i.e. which types of households are wealthy or poor) and between-community selection (i.e. which types of communities have wealthy households, poor households, are unequal, etc.). To address these issues, this paper controls for a range of household and community characteristics; however, omitted household and community characteristics that determine wealth and that impact the likelihood of victimization remain a concern. Specifically, the inability to observe household-level investments in private security devices could lead to biased estimates. OLS estimates will be biased downward to the extent that home security investments are positively correlated with household wealth and decrease the likelihood of victimization.

To address the issues above and to evaluate the individual effect of poverty on the susceptibility to crime, this paper estimates the LPM with an instrumental variables procedure, the generalized method of moments (GMM). One of the advantages of GMM over standard IV is that if heteroskedasticity is present, then the GMM estimator is more efficient than the conventional IV estimator. The GMM estimator weighs optimally all instrumental variables to generate the most efficient and asymptotically consistent estimates. However, if the error is homoskedastic, standard IV is preferred because the GMM estimator can have poor small sample properties (Baum et al. 2003). Pagan and

[14] Being robbed of cash on hand is likely to have the greatest impact on poorer households that are less apt to use a bank and more likely to have money, comprising a significant portion of their net wealth, stored at home.

Hall (1983) propose a test for the presence of heteroskedasticity when one or more of the regressors are endogenous.

GMM

The model allows for the possibility that elements of $\boldsymbol{x}_i$ may be correlated with the error term, ε_i. $totmex_i$ is an endogenous variable if

$$E[totmex_i \varepsilon_i] \neq 0.$$

If endogeneity is present, then results can be biased and inconsistent.

To mitigate potential endogeneity issues, let $\boldsymbol{z}_i$ represent a vector of instruments such that the following orthogonality conditions are satisfied

$$E[\boldsymbol{z}_i \varepsilon_i] = E[\boldsymbol{z}_i(Crime_i - \boldsymbol{x}_i'\mathbf{b_0})] = 0.$$

The two-step efficient GMM estimator is defined as

$$\hat{\mathbf{b}}(\hat{\boldsymbol{S}}^{-1}(\hat{\mathbf{W}})) = \arg\min_{\mathbf{b}}(n\mathbf{g}_n(\mathbf{b})'\hat{\boldsymbol{S}}^{-1}(\hat{\mathbf{W}})\mathbf{g}_n(\mathbf{b}))$$

where $\mathbf{g}_n(\mathbf{b}) = \frac{1}{n}\sum_{i=1}^{n}\boldsymbol{z}_i(Crime_i - \boldsymbol{x}_i'\mathbf{b_0})$ and the optimal weight matrix is the inverse of an estimate of the covariance matrix of orthogonality conditions.[15]

Instruments

For the potentially endogenous explanatory variable, three instruments are considered. The ideal set of instruments induce variation in household expenditures (i.e. are relevant), are exogenous, and impact the outcome of interest (i.e. the susceptibility to crime) only through the poverty channel (i.e. are excluded). A household sanitation variable, a water source variable, and an indicator for whether or not the household considers themselves wealthier than their parents used to be are utilized as instruments

[15] This exposition is based on Hayashi (2000).

for household expenditures. The household sanitation variable indicates whether the household has an indoor flush toilet and the water source variable indicates whether the household's water source is internally piped. The choice of instruments is based, in part, on the fact that household expenditures per member are highly correlated with sanitation levels, the water source and whether or not the household is richer than their parents used to be.

To further justify using these instruments the next section discusses relevance and overidentifying restrictions. In addition, to justify using instrumental variable procedures in the first place, testing for the endogeneity of household expenditures is also considered.

IV. INSTRUMENT RELEVANCE, ENDOGENEITY OF HOUSEHOLD EXPENDITURES, AND OVERIDENTIFYING RESTRICTIONS

To check instrument relevance, OLS is used and expenditures are regressed on all exogenous variables

$$totmex_i = \pi_0 + \pi_1 '\boldsymbol{hh}_i + \pi_2 '\boldsymbol{c}_{ij} + \pi_3 '\mathbf{z}_i + v_i . \qquad (2)$$

Equation (2) represents the first-stage regression in the standard two-step IV approach. Analyzing the first-stage regression will help determine whether expenditures are correlated with the proposed instruments. If expenditures and the instruments are only weakly correlated, then IV estimates can suffer from large asymptotic bias.[16] In addition, as the correlation between household expenditures and the instrumental variables approaches zero the finite sample bias of standard IV estimates approach that of OLS estimates (Bound et al. 1995).

[16] This can occur even when the instruments are only moderately correlated with ε .

Another requirement of an instrument is that it be uncorrelated with ε. This requirement cannot be tested because the error is unobserved. However, if there is more than one instrument, then whether or not some of the instruments are uncorrelated with the error term can be tested. Here, Hansen's J-statistic tests for overidentification (Hansen 1982). Under the null hypothesis, Hansen's test is that the instrumental variables are not correlated with the error term.

In testing the endogeneity of $totmex_i$ the following hypothesis test is considered

$$H_0 : E[totmex_i \varepsilon_i] = 0 \qquad (totmex_i \text{ is exogenous})$$

$$H_1 : E[totmex_i \varepsilon_i] \neq 0 \qquad (totmex_i \text{ is endogenous}).$$

Under the null hypothesis, the full model is examined. That is, the model that includes $totmex_i$ in the instrument set. Under the alternative hypothesis, $totmex_i$ is treated as if endogenous. For each model a Hansen's J-statistic is calculated. A C-statistic, defined as

$$C = J_{Full} - J_{Restricted},$$

is used to test the null.

Testing for endogeneity of household expenditures in the LPM can be carried out by a simple two-step procedure (Wooldridge 2003). First, the fitted residuals, $\hat{v}_i$, are obtained from equation (2). Second, the fitted residuals are added to the original equation

$$Crime_i = a + \delta totmex_i + \gamma_1 ' \boldsymbol{hh}_i + \gamma_2 ' \boldsymbol{c}_{ij} + \gamma_3 ' \hat{v}_i + \varepsilon_i . \qquad (3)$$

The significance of $\hat{v}_i$ in (3) is tested using an OLS regression. If the coefficient on $\hat{v}_i$ is statistically different from zero, it can be concluded that expenditures are endogenous.[17]

V. RESULTS

OLS

Table 3 illustrates the OLS relationship between crime and poverty. Although it is likely these estimates are biased, they serve as a useful reference for the instrumental variable results. The first row of Table 3 indicates a positive relationship between per member household expenditures and victimization. This relationship holds for an all inclusive measure of crime, violent crime, and robbery and is significant at the 1% level for four of the five model specifications. To better control for unobservables, such as police force activity, columns 4 and 5 report results obtained when magisterial district dummy variables are included. Here, the magnitudes of the results change little. By way of interpretation, a 10% increase in expenditures per household member is associated with over a .3% increase in the likelihood of being robbed. To put the magnitude of this result in perspective, consider that average monthly per capita expenditures are over four and a half times greater for households in "white" communities than for households in "African" communities and nearly three times as large for urban/metropolitan households than for rural households. Simply put, considering the impact of large changes in the expenditure measure is not unrealistic for South Africa because of the vast inequalities that exist between different groups. For violent crime, the positive relationship between

[17] If testing for endogeneity under the probit framework, a two-step procedure described by Rivers and Vuong (1988) can be implemented. The first step is the same as described above for the LPM. In the second step, instead of using OLS, probit estimation is used to test the significance of the fitted residuals.

expenditures and the probability of victimization is no longer significant at conventional levels when magistrate dummies are included. It should also be noted that the significant result for violent crime in column 2 is not robust when considering households that do not report being victims of multiple crimes (i.e. violent crime **and** robbery). This is discussed in further detail during the robustness checks of the results.

For robbery, there also appears to be a positive relationship between community inequality and victimization. This is consistent with Demombynes and Ozler's (2005) finding that, for South Africa, police precinct-level inequality is positively related to the incidence of burglary. The relationship between inequality and violent crime is not statistically significant. Again, this is consistent with Demombynes and Ozler (2005). They fail to find a correlation between within-police precinct inequality and aggravated assault, rape, or murder.

Instrument Relevance

Table 4 reports the first-stage regressions. Columns 1 and 2 illustrate results with province dummies and magistrate dummies, respectively. The instruments are, individually, highly significant. As one might expect, the coefficient estimates for the sanitation and water source indicators are positive in sign. That is, wealthier households are more likely to have an indoor flush toilet as opposed to some less sophisticated type of latrine and are more likely to have an internally piped water source. Also, not surprisingly, the wealthier-than-parents indicator is positively correlated with expenditures. Large F-statistics lead us to conclude that the instruments are jointly significant.

GMM Results

Table 5 presents the main results of the paper. For robbery, in both model specifications, the expenditure coefficient remains positive and significant. A key point to notice is that the magnitude of the coefficient estimate for expenditures increases when instrumenting for potential endogeneity. For the model with magistrate dummies, a 10% increase in expenditures leads to nearly a 1% increase in the likelihood of being robbed. As explained earlier, if reverse causation is an issue, such that a family's expenditures decrease after being robbed, then standard OLS estimates will be biased downward. This could be the case if the household is robbed of a significant portion of their wealth, if victimization decreases the household's propensity to purchase goods that will "just get stolen anyway", or if robbery decreases the household's ability to earn an income. The latter may hold if a household member is seriously injured or killed during a robbery.

In addition, omitted variables describing household or community characteristics could also bias estimates. For example, to the extent that magisterial district dummies do not sufficiently control for heterogeneity across police precincts, it is possible that being unable to observe police force activity will bias results. As an illustration, OLS estimates will be biased downward if police are allocated disproportionately to wealthier neighborhoods and are effective at reducing crime. A potentially important unobserved household characteristic is investment in private security. If investment in private security is positively correlated with wealth and decreases the likelihood of victimization, then OLS estimates will, again, exhibit downward bias. In the case of South Africa, this is of particular concern because the wealthy are often observed investing large amounts into home security. The hiring of personal private security guards and the building of

gated communities are not uncommon among high-income households and neighborhoods. Again, the result that standard OLS estimates exhibit substantial downward bias lends support to the notion that previous victimization studies, that fail to account for endogeneity, may be understating the relationship between measures of household welfare and victimization.

For violent crime, there appears to be no relationship between expenditures and victimization. Interestingly, households in communities with a larger percentage of nonwhite residents are more likely to be violent crime victims. A potential explanation is that race predicts crime through social isolation and feelings of hopelessness in black communities (Kelly 2000).

The last row in Table 5 illustrates large Pagan-Hall statistics for each model. The hypothesis that the disturbance is homoskedastic is rejected and the use of GMM over standard IV is justified.

Expenditure Quintiles

Table 6 illustrates results for expenditure quintiles and is included primarily to serve as a comparison to other victimization studies and to further investigate how victimization varies across poverty levels. Gaviria and Pages (2002) rank households by socioeconomic status and find that households in the top quintile are approximately eight percentage points more likely to have a member victimized than the bottom quintile. Here, per member household expenditures are broken up into five dummy variables that indicate to which expenditure quintile the household belongs. The results for robbery are quite strong in that all coefficients are significant and that the probability of victimization increases with wealth. For example, households in the third quintile are 2% more likely

to be robbed than the poorest quintile, while households in the wealthiest quintile are over 9% more likely to be robbed. Due to only having three instruments available, the second and third columns provide results where all but the fifth quintile are excluded from the regression equation. From the second column, households in the wealthiest quintile are over 6% more likely to be robbed than all other households. When instrumenting for the potential endogeneity of the expenditure measure, the magnitude of the coefficient on expenditures for the fifth quintile increases dramatically.

For the most part, the results for violent crime are insignificant. The OLS results favor the wealthiest households bearing slightly more violent crime than the poor, but, as discussed later, the 10% significant results in column 3 are not robust when we consider households that report being victim of a violent crime, but not robbery.

The results from Table 5 and Table 6 strongly suggest that the wealthy bear a disproportionate share of the risk of robbery in South Africa. Gaviria and Pages (2002) suggest two models with which this result is consistent. In the first model, the rich invest little in private protection and choose to bear some victimization risk because it is simply too costly to completely insulate themselves from all crime. In the second model, the rich invest more in private protection but the larger investments are insufficient to offset the greater probability of being victimized that is associated with the propensity criminals have for targeting the wealthy.

It is clear that each model applies better to different types of crime. For example, the first model explains offences such as street muggings, while the second model applies to more calculated crimes such as armed household robberies.

Instruments: Robustness

In this section, several versions of the basic GMM model are applied to the robbery outcome. Here, the interest lies in examining the robustness of the estimator to alternative specifications of the set of instrumental variables. The first column in Table 7 presents the main results when using the full instrument set. The last three columns provide results for all possible combinations when choosing two of the three instrumental variables. The effect of expenditures remains positive and significant at the 1% level. In addition, the magnitude of the expenditure coefficient changes little between regressions. Overall, the key result is robust across instrument set specifications.

The last row in Table 7 reports the J-statistic for testing overidentification. Here, the large p-value in each column leaves one unable to reject the null hypothesis that all instruments are uncorrelated with the error term. It is worthwhile to mention a benefit of including all three variables in the instrument set. Hansen's J-stat for testing overidentifying restrictions is suspect when all instruments share a common theme. If one instrument is invalid, then doubt is cast upon all of the instruments. A failure to reject the overidentifying restrictions in the model with the full instrument set provides more confidence in regards to the instruments' likely validity because the wealthier-than-parents indicator is based upon a different underlying theme than the sanitation and water source variables (Murray 2006).

The second and third to last rows provide statistics designed to test the exogeneity of household expenditures. The sufficiently high C-statistics reject the null that the household expenditures variable is uncorrelated with the error term. In addition, the coefficient estimates for the fitted residuals obtained from the first-stage regressions are

significantly different from zero when included in OLS regressions of the structural model. This, again, allows us to conclude that household expenditures are indeed endogenous. These results further justify the use of an instrumental variables strategy.

Robustness of the Results: Probit Model

As a robustness check of the results, a probit model is also estimated. Though relatively easy to interpret, the linear probability model has drawbacks. One disadvantage is that fitted probabilities can be negative or greater than one. Another disadvantage is that the partial effect of any explanatory variable is constant. To bypass these limitations more sophisticated binary choice models, such as probit, are sometimes preferred.

Table 8 illustrates the results for probit and probit with IV specifications. When instrumenting, the magnitude of the expenditure coefficient more than doubles and is comparable to the estimate obtained in the GMM specification. The findings are similar to those discussed above. This suggests the results are robust to the choice of estimation method.

Robustness of Results: Income as a Proxy for Poverty

To this point, household expenditures have been used as the proxy for poverty. It has been argued that expenditures are a more effective indicator of welfare than income because utility is derived from the consumption of goods and services (Lancaster et al. 1999). Additionally, due to less variation over time than income, consumption can be thought of as a better measure of "longer-term" welfare. Lastly, income data have been noted as unreliable because of the tendency for households to underreport their true level of income to avoid taxation (Lancaster et al. 1999). Despite the apparent disadvantages

of using household income over expenditures, it is worthwhile to report income results as another robustness check. Table 9 illustrates results for robbery with the log of household income per capita as the proxy for poverty. Though the magnitude of the income coefficient is slightly less than previous results for the expenditure coefficient, the sign remains positive and the effect significant. The magnitude of the coefficient increases significantly when instrumenting for potential endogeneity. It appears the results are robust to the choice of proxy for poverty.

Robustness of Results: Community Fixed Effects

As another robustness check of the results, Table 10 reports specifications with community fixed effects. These results correct for between-community heterogeneity. It may be that provincial or magistrate dummies do not capture some unobserved factors influencing crime rates. For example, in some rural South African communities, local farmers form armed self-defense units to combat farm attacks, while other communities organize neighborhood watch parties and street committees (Adams 2006; Gordon 2006). To the extent that these and other similar groups vary within provinces and magisterial districts, province and magistrate dummies will not account for potentially important unobserved variables. Additionally, community fixed effects likely control for heterogeneous police force activity more effectively than magistrate fixed effects because, in South Africa, police precinct and magisterial district boundaries do not perfectly align with each other (Schmitz and Stylianides 2002). In the first column of Table 10, the results for the robbery equation are similar to those illustrated in Table 3 and Table 5. Household expenditures per capita have a positive and significant impact on the susceptibility to robbery. Again, when using instrumental variables, the effect of

expenditures increases in magnitude. As for the violent crime equation, the community fixed effects specification still leads to the conclusion that expenditures and the probability of victimization are not correlated.

Robustness of Results: Considering Households with Multiple Victimization Reports

A small subsample of the victimized households reported being victims of both violent crime and robbery. For these cases, it is reasonable that some may have experienced the crimes simultaneously.[18] For example, it may be that a household member is robbed immediately after being victim of a violent crime. That is, a criminal may target an individual for assault, murder, or rape and decide to rob the victim only after committing the violent crime. Here, the victim's wealth may not have been a determinant of robbery. The following example illustrates how neglecting this issue may be problematic. Considering that household wealth is negatively correlated with the percent of nonwhite households in a community and to the extent that households in primarily nonwhite communities are more likely to be victims of violent crimes, then the effects of household wealth on the susceptibility to robbery may be underestimated when criminals have a propensity to rob their victims after committing a violent crime. Results from Table 11 address this issue by re-estimating the community fixed effects model for households that report being robbed but do not report violent crime. The results remain very much the same as those reported in Table 10.

In a similar vein, it may be that some criminals target wealthy households solely for robbery and end up committing a violent crime when met with resistance. If the poor are more likely to be victims of violent crimes, then it is possible this relationship will not

[18] It could also be that a victim of robbery, who was simultaneously assaulted, only reports robbery. Robbery, by definition, includes acts of taking property by violence. It seems this would most likely be the case for robbery victims who are assaulted than for robbery victims who are murdered or raped.

be observed when some of the multiple reports originate from robbery victims that are assaulted, murdered, or raped. Table 11 illustrates results for households that report violent crime victimization but do not report robbery. There remains no observable relationship between household wealth and the susceptibility to violent crime.[19] Lastly, it also appears that violent crime is positively influenced by whether or not the household head is female. This result is in line with previous research (e.g. see Glaeser and Sacerdote (1999) and Kelly (2000)).

Robustness of Results: Community Racial Composition

Results in this paper indicate that the likelihood of being robbed decreases as the percentage of nonwhite households in the community increases. It is possible that "white" neighborhoods are driving the observation that household per capita expenditures share a positive relationship with the susceptibility to robbery. To investigate this further, Table 12 examines separate regressions for "white" and "nonwhite" communities. The result that household wealth and the susceptibility to robbery share a positive relationship holds for both community types. The effect of household expenditures is less pronounced among "nonwhite" areas, but the coefficient remains positive and significant at the 1% level. Despite the overall rate of robbery being lower in poorer communities (i.e. "nonwhite" areas), the relatively wealthy in these areas face a greater likelihood of being robbed. Again, the pattern of robbery is consistent with the predictions of the economic theory of crime. Though not reported in Table 12, the results for violent crime remain the same. There is no significant relationship between poverty and the susceptibility to violent crime.

[19] It is also worth noting that the statistically significant relationships observed under OLS between violent crime and household expenditures in Table 3, column 2 and Table 6, column 4 become insignificant when analyzing households that report being violent crime victims but not robbery victims.

VI. CONCLUSION

This paper avoids reporting errors common to official crime statistics by utilizing victimization questions from a 1993 South African household survey. Increases in household expenditures per capita, the chosen proxy for poverty, are not related to the rate of violent crime victimization, but lead to an increase in the probability that a South African household is robbed. The magnitude of the positive effect of household expenditures on the susceptibility to robbery is significant across all model specifications and holds up to a series of robustness checks. A contribution of this paper to the victimization literature is the use of an instrumental variables strategy that addresses the potential endogeneity of household expenditures. When using instrumental variables, the magnitude of the positive effect of expenditures on the susceptibility to robbery increases significantly. This suggests that research failing to consider the endogenous nature of a measure for poverty may severely misestimate the effects of poverty on robbery and other crimes motivated by material gain. The results above strongly suggest that relatively wealthy households in South Africa bear a disproportionate share of robberies. Here, crime is not simply a problem of the poor.

Unfortunately, this paper is unable to discern robbery type (e.g. street muggings vs. residential burglaries). To get a better understanding as to why the relatively wealthy face higher rates of robbery in South Africa, it is imperative to be able to pin down where crimes take place. It may be that the costs of avoiding all incidences of home robbery for the relatively wealthy are prohibitively high. On the other hand, to the extent that the wealthy do not mimic the poor outside the home, then we would expect the rational criminal, facing the decision of whom to mug on the street or which car to hijack, to

choose the target where expected returns are greatest. Consequently, further investigation is required before suggestions on how to direct crime prevention policies, such as police force allocation, can be made. In addition, subsequent research should also be aimed at identifying household-level determinants that leave households more susceptible to violent crimes such as murder, assault, and rape.

Future analyses of household-level victimization could benefit from improved survey strategies. Household surveys designed to measure living standards sometimes contain victimization questions; however, these questions often fall short of providing the researcher with important crime information. Additional inquiries designed to reveal where crimes take place and the number of times they occur could go a long way in aiding victimization studies. Alternatively, data from victimization specific surveys often lack detailed household demographics and information regarding community characteristics. Attempts to integrate questions addressing these aspects in victimization surveys could prove beneficial to future research in this area.

References

Adams, S., 2006. Farmer Armies in the Killing Fields. Saturday Star, p. 2. 23 Sept. 2006.

Barslund, M., Rand, J., Tarp, F., Chiconela, J., 2007. Understanding Victimization: The Case of Mozambique. World Development 35, 1237-1258.

Baum, C., Schaffer, M., Stillman, S., 2003. Instrumental Variables and GMM: Estimation and Testing. Stata Journal 3, 1-31.

Becker, G., 1968. Crime and Punishment: An Economic Approach. Journal of Political Economy 76, 169-217.

Blackmore, F., 2003. A Panel Data Analysis of Crime in South Africa. South African Journal of Economic and Management Sciences 6, 439-458.

Bound, J., Jaeger, D., Baker, R., 1995. Problems with Instrumental Variables Estimation When the Correlation Between the Instrumentals and Endogenous Explanatory Variables is Weak. Journal of the American Statistical Association 90, 443-450.

Burton, P., du Plessis, A., Leggett, T., Louw, A., Mistry, D., van Vuuren, H., 2004. National Victims of Crime Survey: South Africa 2003. Institute for Security Studies Monograph Series No. 101.

Cohen, M., 2005. The Costs of Crime and Justice. New York: Routledge.

Demombynes, G., Ozler, B., 2005. Crime and Local Inequality in South Africa. Journal of Development Economics 76, 265-292.

Di Tella, R., Galiani, S., Schargrodsky, E., 2006. Crime Distribution and Victim Behavior During a Crime Wave. William Davidson Institute Working Paper No. 849.

Dreze, J., Khera, R., 2000. Crime, Gender, and Society in India: Insights from Homicide Data. Population and Development Review 26, 335-352.

Duncan, G., Holzer, H., Ludwig, J., Schanzenbach, D., 2007. The Economic Costs Of Poverty in the United States: Subsequent Effects of Children Growing Up Poor. Center for American Progress, Washington, D.C.

Ehrlich, I., 1973. Participation in Illegitimate Activities: A Theoretical and Empirical Investigation. Journal of Political Economy 81, 521-565.

Fafchamps, M., Minten, B., 2006. Crime, Transitory Poverty, and Isolation: Evidence from Madagascar. Economic Development and Cultural Change 54, 579-603.

Fajnzylber, P., Lederman, D., Loayza, N., 1998. Determinants of Crime Rates in Latin America and the World: An Empirical Assessment. World Bank Latin American and Caribbean Studies, Washington, D.C.

Fajnzylber, P., Lederman, D., Loayza, N., 2000. Crime and Victimization: An Economic Perspective. Latin American and Caribbean Economic Association. Economia 1, 219-302.

Federal Bureau of Investigation (FBI), 2005. Crime in the United States. On-line at: <http://www.fbi.gov/ucr/05cius/index.html>.

Gaviria, A., Pages, C., 2002. Patterns of Crime Victimization in Latin American Cities. Journal of Development Economics 67, 181-203.

Glaeser, E., Sacerdote, B., 1999. Why is There More Crime in Cities? Journal of Political Economy 107, S225-S258.

Gordon, D., 2006. Transformation & Trouble: Crime, Justice, and Participation in Democratic South Africa. Ann Arbor, MI: The University of Michigan Press.

Hansen, L., 1982. Large Sample Properties of Generalized Method of Moments Estimators. Econometrica 50, 1029-1054.

Hayashi, F., 2000. Econometrics. Princeton, NJ: Princeton University Press.

Kelly, M., 2000. Inequality and Crime. The Review of Economics and Statistics 82, 530-539.

Lancaster, G., Ray, R., Valenzuela, M., 1999. A Cross-Country Study of Household Poverty and Inequality on Unit Record Household Budget Data. Economic Development and Cultural Change 48, 177-208.

Ludwig, J., Duncan, G., Hirschfield, P., 2001. Urban Poverty and Juvenile Crime: Evidence from a Randomized Housing Mobility Experiment. Quarterly Journal Of Economics 116, 655-679.

Moller, V., 2005. Resilient or Resigned? Criminal Victimisation and Quality of Life In South Africa. Social Indicators Research 72, 263-317.

Murray, M., 2006. Avoiding Invalid Instruments and Coping with Weak Instruments. Journal of Economic Perspectives 20, 111-132.

Newham, G., 2002. Tackling Police Corruption in South Africa. Centre for the Study of Violence and Reconciliation. Johannesburg, South Africa.

Ozler, B., 2007. Not Separate, Not Equal: Poverty and Inequality in Post-Apartheid South Africa. Economic Development and Cultural Change 55, 487-529.

Pagan, A., Hall, D., 1983. Diagnostic Tests as Residual Analysis. Econometric Reviews 2, 159-218.

Powdthavee, N., 2005. Unhappiness and Crime: Evidence from South Africa. Economica 72, 531-547.

Raphael, S., Winter-Ember, R., 2001. Identifying the Effect of Unemployment on Crime. Journal of Law and Economics 44, 259-283.

Rivers, D., Vuong, Q., 1998. Limited Information Estimators and Exogeneity Tests for Simultaneous Probit Models. Journal of Econometrics 39, 347-366.

Schmitz, P., Stylianides, T., 2002. Mapping Crime Levels and Court Efficiency per Magisterial District in South Africa. Submission for the 6th Annual International Crime Mapping Research Conference. Denver, CO.

Shaw, M., van Dijk, J., Rhomberg, W., 2003. Determining Trends in Global Crime and Justice: An Overview of Results from the United Nations Surveys of Crime Trends and Operations of Criminal Justice Systems. Forum on Crime and Society 3, 35-63.

Shaw, M., 1998. Of Crime and Country: Reported Crime Trends in South Africa (1980-1997) and Future Scenarios. Nedbank Institute for Security Studies Crime Index 2.

Soares, R., 2004. Development, Crime and Punishment: Accounting for the International Difference in Crime Rates. Journal of Development Economics 73, 155-184.

South Africa Labour Development Research Unit (SALDRU), 1994. South Africans Rich and Poor: Baseline Household Statistics. School of Economics, University of Cape Town, South Africa.

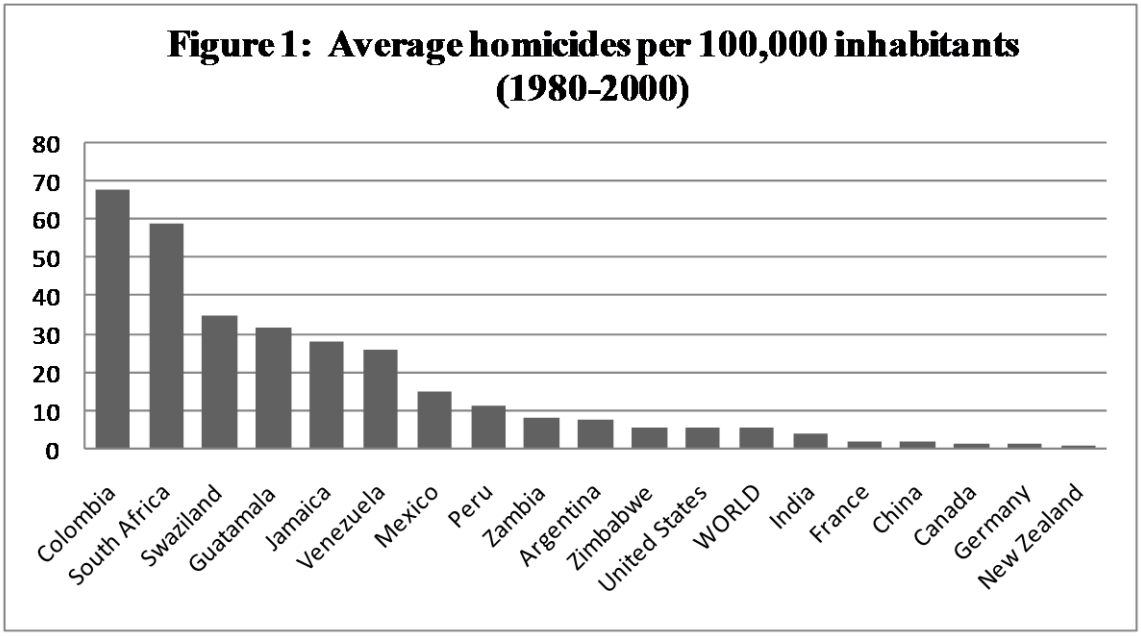
South African Police Services (SAPS), 2008. Crime Situation in South Africa, Summary. On-line at: <http://www.saps.gov.za/statistics/reports/crimestats/2008/docs/introduction2008.pdf>.

South African Police Services (SAPS), 2006. Crime Statistics. On-line at: <http://www.saps.gov.za/statistics/reports/crimestats/2006/crime_stats.htm>.

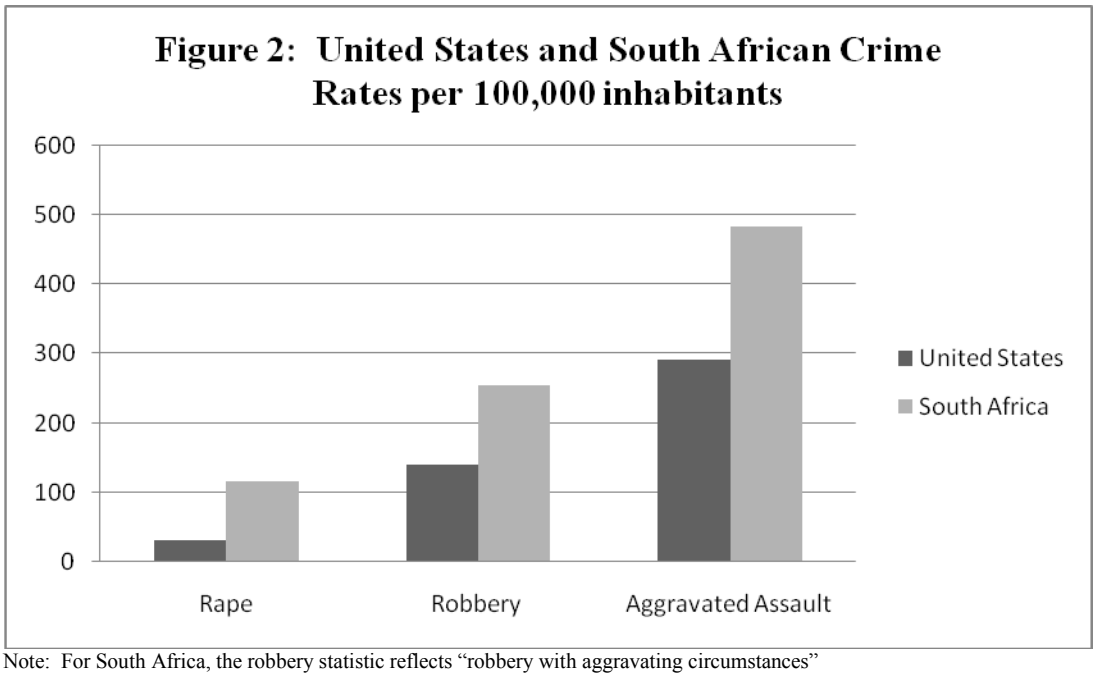
South African Police Services (SAPS), 2004. Crime Statistics. On-line at: <http://www.saps.gov.za/statistics/reports/crimestats/2004/crime_stats.htm>.

Stack, S., 1984. Income Inequality and Property Crime: A Cross-National Analysis of Relative Deprivation Theory. Criminology 22, 229-256.

Wooldridge, J., 2003. Introductory Econometrics. Mason, Ohio: South-Western.



Source: Shaw et al. (2003).



Note: For South Africa, the robbery statistic reflects "robbery with aggravating circumstances" and the assault statistics reflects "assault with the intent to inflict grievous bodily harm".
Sources: FBI (2005) and SAPS (2006).

Table 1: Descriptive Statistics

	Entire Sample (N=7,173)		Community Type: White (N=1,191)		Nonwhite (N=5,982)		Rural (N=3,287)		Urban/Metro (N=3,886)	
Variable	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Household										
Crime[a]	.103	.304	.170	.376	.089	.285	.064	.244	.136	.343
Robbery[a]	.066	.248	.149	.356	.050	.217	.033	.179	.094	.292
Violent[a]	.038	.192	.024	.154	.041	.199	.029	.168	.046	.210
Log(expenditures)	5.744	1.088	7.178	.719	5.459	.909	5.202	.893	6.202	1.026
Expenditures	.578	.830	1.674	1.360	.359	.414	.287	.391	.823	1.006
Age of head	47.581	15.149	44.104	14.631	48.273	15.157	49.999	15.835	45.535	14.228
Female head[b]	.286	.452	.201	.401	.303	.460	.308	.462	.268	.443
Head present[b]	.904	.295	.988	.108	.887	.316	.824	.381	.972	.165
No education[b]	.222	.416	.050	.219	.256	.437	.344	.475	.119	.324
General education[b]	.588	.492	.303	.460	.644	.479	.577	.494	.597	.491
Further education[b]	.107	.309	.312	.464	.066	.249	.047	.213	.157	.364
Higher education[b]	.083	.276	.334	.472	.033	.179	.032	.177	.126	.332
Community										
Expenditure gini	.349	.099	.313	.076	.357	.102	.360	.112	.340	.086
Population type[c]	.458	.498	.056	.231	.538	.499	-----	-----	-----	-----
Pct. nonwhite	.847	.329	-----	-----	-----	-----	.972	.117	.741	.406
Homelessness[c]	.312	.463	.107	.310	.353	.478	.384	.487	.227	.419
Public transport[c]	.779	.415	.603	.490	.814	.390	.767	.423	.789	.408
Instruments										
Richer than parents[b]	.246	.431	.385	.487	.218	.413	.219	.414	.268	.443
Indoor flush toilet[b]	.356	.478	.954	.210	.235	.424	.089	.285	.579	.494
Water piped[b]	.383	.486	.974	.159	.265	.441	.103	.304	.619	.486

[a] One if household is a victim of crime or robbery, zero otherwise.
[b] One for households or household heads with attribute, zero otherwise.
[c] One for household's community having this attribute, zero otherwise.
·Education levels refer to the household head.
·Log(expenditures) are calculated as the log of the total monthly expenditures (in rand) per household member.
·Expenditures are total monthly expenditures (in thousands of rand) per household member.
·For a white community, percent nonwhite < .5.
·For a nonwhite community, percent nonwhite > .5.

Table 2: Victim of Crime and Household Expenditure Means, by Category[a]

Categories	No. of observations	%	Mean log(expenditures)[b]
Crime (all)			
Victim	737	10.27	6.230
Non-victim	6,436	89.73	5.688
			(12.95)
Robbery			
Victim	474	6.61	6.512
Non-victim	6,699	93.39	5.690
			(16.17)
Violent Crime			
Victim	275	3.83	5.792
Non-victim	6,898	96.17	5.742
			(.740)

[a]Values in parentheses are the absolute values of t-statistics based on the test that the two populations have equal means.
[b]Expenditures are measured as the log of total monthly expenditures (rand) per household member.

Table 3: OLS Results for South African Households

Variable Names Dependent Variable:	Crime (all)	Violent Crime I	Robbery I	Violent II	Robbery II
Log[household expenditures per member	.038*** (.006)	.008*** (.003)	.033*** (.006)	.006 (.004)	.032*** (.005)
Age	-.002 (.002)	-.001 (.001)	.000 (.001)	-.001 (.001)	.001 (.001)
[Age]^2	.000 (.000)	.000 (.000)	.000 (.000)	.000 (.000)	.000 (.000)
Female headed household	.009 (.008)	.006 (.006)	-.000 (.007)	.004 (.006)	-.006 (.007)
Household head present	.002 (.012)	-.000 (.008)	.008 (.008)	.004 (.009)	.017* (.009)
General education	-.014 (.009)	-.005 (.006)	-.010 (.008)	-.002 (.006)	-.011 (.007)
Further education	-.014 (.018)	-.015 (.009)	-.003 (.016)	-.004 (.010)	-.005 (.015)
Higher education	.019 (.018)	-.021** (.009)	.027 (.016)	-.013 (.010)	.022 (.019)
Number of adults in household	.016*** (.003)	.007*** (.002)	.009*** (.002)	.005*** (.002)	.008*** (.002)
Expenditure gini	.034 (.070)	-.043 (.030)	.067 (.065)	-.027 (.043)	.194*** (.065)
Population type	.002 (.013)	-.006 (.008)	.009 (.010)	.004 (.016)	-.047** (.022)
Percentage nonwhite	-.002 (.019)	.033*** (.010)	-.028 (.018)	.047*** (.014)	-.096*** (.023)
Homelessness reported in community	.006 (.010)	-.001 (.006)	.004 (.009)	-.020** (.010)	-.003 (.013)
Public transportation available	.010 (.012)	.005 (.007)	.010 (.012)	.021** (.010)	-.002 (.016)
Provincial Dummies					
Western Cape	-.031 (.024)	-.003 (.013)	-.017 (.020)	…	…
Northern Cape	.000 (.032)	.049** (.022)	-.059*** (.023)	…	…
Eastern Cape	-.063*** (.015)	-.029*** (.011)	-.032*** (.010)	…	…
Free State	-.086*** (.023)	-.033*** (.011)	-.054*** (.021)	…	…
Mpumalanga	-.086*** (.021)	-.025* (.014)	-.065*** (.014)	…	…
Limpopo	-.091*** (.017)	-.044*** (.010)	-.053*** (.013)	…	…
North West	-.124*** (.016)	-.055*** (.010)	-.072*** (.012)	…	…
Gauteng	-.000 (.019)	-.011 (.011)	.014 (.018)	…	…
Constant	-.067 (.060)	.029 (.036)	-.131*** (.051)	.007 (.044)	-.131 (.145)
Magisterial district dummies included	NO	NO	NO	YES	YES
F-stat	11.69	6.58	7.07	2.15	9.56

·N = 7,173
·Omitted province is KwaZulu-Natal.
·Omitted education level is no education.
·Population Type = 1 if rural.
·For the first three columns, standard errors are in parentheses and are clustered at the community level.
·For the last two columns, robust standard errors are in parentheses and the F-stat tests the null that the independent variables, excluding the magistrate dummies, are jointly significant.
* Significant at 10% level.
** Significant at 5% level.
*** Significant at 1% level.

Table 4: OLS Estimates of Excluded Instrumental Variable Coefficients in Expenditure Equation

Variable Names Dependent Variable: log(expenditures)	I	II
Indoor flush toilet	.414*** (.071)	.475*** (.057)
Water piped	.239*** (.073)	.151*** (.048)
Wealthier than parents	.203*** (.022)	.191*** (.019)
Provincial dummies included	YES	NO
Magisterial district dummies included	NO	YES
F-test on instruments[a]	59.35 [.000]	80.47 [.000]

·N = 7,172
·Standard errors are in parentheses and are clustered at the community level.
·P-values are given in squared brackets for F-statistics.
[a]F-stat tests the null hypothesis that the coefficients on the excluded instruments are equal to zero.
* Significant at 10% level.
** Significant at 5% level.
*** Significant at 1% level.

Table 5: GMM Results for South African Households

Dependent Variable:	Robbery I	Robbery II	Violent Crime I	Violent Crime II
Log(expenditures)	.073*** (.018)	.098*** (.018)	-.002 (.012)	.009 (.013)
General education	-.021** (.009)	-.024*** (.008)	-.006 (.007)	-.005 (.007)
Further education	-.037* (.020)	-.050*** (.019)	-.007 (.013)	-.006 (.013)
Higher education	-.017 (.024)	-.043* (.025)	-.010 (.015)	-.016 (.016)
Number of adults in household	.015*** (.003)	.017*** (.003)	.005** (.002)	.006** (.002)
Expenditure gini	.084 (.063)	.213*** (.065)	-.038 (.032)	-.021 (.043)
Population type	.021* (.011)	-.038* (.022)	-.007 (.008)	.011 (.016)
Percentage nonwhite	.006 (.024)	-.035 (.028)	.024* (.014)	.046*** (.017)
Constant	-.400*** (.132)	-.628*** (.179)	.092 (.090)	-.019 (.104)
Provincial dummies	YES	NO	YES	NO
Magisterial district dummies	NO	YES	NO	YES
Pagan-Hall test statistic	475.432 [.000]	797.364 [.000]	183.594 [.000]	448.921 [.000]

·N = 7,173
·Omitted education level is no education
·Population type = 1 if rural.
·For the first and third columns, standard errors are in parentheses and are clustered at the community level.
·For the second and fourth columns, robust standard errors are in parentheses.
·P-values are given in squared brackets for Pagan-Hall statistics.
·I instrument household expenditures with a household sanitation dummy, a water source dummy, and a dummy variable for whether or not the household is wealthier than their parents were.
·Other regressors included, but omitted from the table, are age, age squared, and indicator variables for female headed households, household head presence, community homelessness, and public transportation.
* Significant at 10% level.
** Significant at 5% level.
*** Significant at 1% level.

Table 6: Expenditure Quintiles

Dependent Variable:	Robbery I (OLS)	Robbery II (OLS)	Robbery III (GMM)	Violent I (OLS)	Violent II (OLS)	Violent III (GMM)
Second Quintile	.016** (.007)	…	…	.010 (.008)	…	…
Third Quintile	.019** (.008)	…	…	.016* (.009)	…	…
Fourth Quintile	.041*** (.012)	…	…	.011 (.009)	…	…
Fifth Quintile	.094*** (.017)	.062*** (.014)	.340*** (.094)	.020* (.011)	.008 (.008)	-.030 (.050)
Province dummies	YES	YES	YES	YES	YES	YES

·N = 7,173
·Omitted quintile is first quintile.
·Standard errors are in parentheses and are clustered at the community level.
·I instrument household expenditures with a household sanitation dummy, a water source dummy, and a dummy variable for whether or not the household is wealthier than their parents were.
·Other regressors included, but omitted from the table, are household head age and age squared, the number of adults in the household, an expenditure gini, dummy variables describing the education of the household head, the percentage of nonwhite households in the community and indicator variables for female headed households, household head presence, community homelessness, population type, and public transportation.
* Significant at 10% level.
** Significant at 5% level.
*** Significant at 1% level.

Table 7: Robustness of the Instruments: Robbery

Instrument Set:	Indoor flush toilet, water piped, wealthier than parents	Indoor flush toilet, water piped	Indoor flush toilet, wealthier than parents	Water piped, wealthier than parents
Log(expenditures)	.073*** (.018)	.079*** (.020)	.079*** (.036)	.068*** (.018)
Number of adults in household	.015*** (.003)	.016*** (.003)	.015** (.003)	.014*** (.003)
Expenditure gini	.084 (.063)	.089 (.063)	.103 (.065)	.095 (.064)
Population type	.021* (.011)	.022* (.012)	.023* (.012)	.019* (.011)
Percentage nonwhite	.006 (.024)	.013 (.026)	.011 (.024)	.002 (.024)
Constant	-.400*** (.132)	-.445*** (.149)	-.447*** (.139)	-.374*** (.132)
Provincial dummies	YES	YES	YES	YES
F-stat	7.11	6.92	7.12	7.10
Exogeneity testing:				
residual expenditure	.049*** (.017)	.052*** (.019)	.053*** (.018)	.039** (.017)
C-stat	12.608 [.000]	11.987 [.001]	14.248 [.000]	7.518 [.006]
Hansen's J-stat for overidentification	1.816 [.403]	1.354 [.245]	.413 [.521]	.083 [.773]

·N = 7,173
·Population Type = 1 if rural.
·Standard errors are in parentheses and are clustered at the community level.
·P-values are given in squared brackets for C-statistics and J-statistics.
·Other regressors included, but omitted from the table are household head age and age squared, and indicator variables for levels of education obtained by the household head, female headed households, household head presence, community homelessness, and public transportation.
* Significant at 10% level.
** Significant at 5% level.
*** Significant at 1% level.

Table 8: Probit Results for South African Households

Variable Names Dependent Variable:	Robbery	Robbery (IV)
Log(expenditures)	.030*** (.004)	.067*** (.015)
Number of adults in household	.008*** (.002)	.013*** (.003)
Expenditure gini	.047 (.045)	.074* (.044)
Population type	.006 (.008)	.017 (.011)
Percentage nonwhite	-.011 (.010)	.018 (.016)
Provincial dummies	YES	YES

·N = 7,173
·Marginal effects reported.
·Population Type = 1 if rural.
·Standard errors are in parentheses and are clustered at the community level.
·I instrument household expenditures with a household sanitation dummy, a water source dummy, and a dummy variable for whether or not the household is wealthier than their parents were.
·Other regressors included, but omitted from the table, are household head age and age squared, and indicator variables for levels of education obtained by the household head, female headed households, household head presence, community homelessness, and public transportation.
* Significant at 10% level.
** Significant at 5% level.
*** Significant at 1% level.

Table 9: OLS and GMM Results using Income as Proxy for Poverty

Dependent Variable:	Robbery (OLS)	Robbery (GMM)
Log(income)	.015*** (.003)	.051*** (.013)
General education	-.007 (.007)	-.022** (.009)
Further education	.009 (.017)	-.032 (.021)
Higher education	.050*** (.017)	-.003 (.024)
Number of adults in household	.007*** (.002)	.011*** (.003)
Expenditure gini	.053 (.067)	.047 (.062)
Population type	.006 (.010)	.021** (.011)
Percentage nonwhite	-.034* (.019)	.003 (.024)
Constant	-.012 (.042)	-.231** (.096)
Provincial dummies	YES	YES
Exogeneity testing:		
residual income		.044*** (.013)
C-stat		16.415 [.000]
J-stat		3.28 [.194]

·N = 6,997
·Omitted quintile is first quintile.
·Standard errors are in parentheses and are clustered at the community level.
·P-values are given in squared brackets for C-stat and J-statistics.
·Other regressors included, but omitted from the table, are household head age and age squared, the number of adults in the household, an expenditure gini, dummy variables describing the education of the household head, the percentage of nonwhite households in the community and indicator variables for female headed households, household head presence, community homelessness, population type, and public transportation.
·I instrument household income with a household sanitation dummy and a dummy variable for whether or no the household is wealthier than their parents were.
·Other regressors included, but omitted from the table are household head age and age squared, and indicator variables for female headed households, household head presence, community homelessness, and public transportation.
* Significant at 10% level.
** Significant at 5% level.
*** Significant at 1% level.

Table 10: Community Fixed Effects

Dep. Variable:	Robbery (OLS)	Robbery (GMM)	Violent (OLS)	Violent (GMM)
Log(expenditures)	.030*** (.006)	.051** (.020)	.004 (.004)	-.009 (.014)
Female headed households	-.004 (.007)	-.001 (.007)	.006 (.006)	.006 (.006)
Household head present	.012 (.009)	.015 (.009)	.002 (.009)	.001 (.009)
Number of adults	.007*** (.002)	.010*** (.003)	.005*** (.002)	.004 (.002)

·N = 7,173
·Robust standard errors are in parentheses.
·I instrument household expenditures with a household sanitation dummy, a water source dummy, and a dummy variable for whether or not the household is wealthier than their parents were.
·Other regressors included, but omitted from the table are household head age and age squared, and indicator variables for levels of education obtained by the household head.
* Significant at 10% level.
** Significant at 5% level.
*** Significant at 1% level.

Table 11: Community Fixed Effects. Households with Single Crime Reports.

Dep. Variable:	Robbery (OLS) (no violent crime)	Robbery (GMM) (no violent crime)	Violent (OLS) (no robbery)	Violent (GMM) (no robbery)
Log(expenditures)	.026*** (.005)	.048** (.019)	-.000 (.003)	-.014 (.013)
Female headed households	.001 (.006)	.004 (.007)	.011** (.005)	.009* (.005)
Household head present	.007 (.009)	.010 (.009)	-.003 (.008)	-.004 (.008)
Number of adults	.006*** (.002)	.009*** (.003)	.004*** (.001)	.002 (.002)

·N = 7,173
·Robust standard errors are in parentheses.
·I instrument household expenditures with a household sanitation dummy, a water source dummy, and a dummy variable for whether or not the household is wealthier than their parents were.
·Other regressors included, but omitted from the table are household head age and age squared, and indicator variables for levels of education obtained by the household head.
* Significant at 10% level.
** Significant at 5% level.
*** Significant at 1% level.

Table 12: Community Racial Composition. Coefficient Estimates for Log(expenditures).

Variable Names Dependent Variable:	Robbery I (OLS)	Robbery II (GMM)	Robbery III (GMM)
Percent nonwhite < 25% (N = 994)	.087*** (.021)	.128*** (.044)	.125*** (.049)
Percent nonwhite > 90% (N = 5,785)	.027*** (.005)	.061*** (.015)	.102*** (.022)
Provincial dummies	YES	YES	NO
Magisterial district dummies	NO	NO	YES

·Coefficient estimates are for log(expenditures).
·Robust standard errors are in parentheses.
·These regressions use the same set of controls as listed in Table 5.
* Significant at 10% level.
** Significant at 5% level.
*** Significant at 1% level.

Appendix A: Reported Crime Trends in South Africa

Figure A-1: Murder (Reported Incidents)

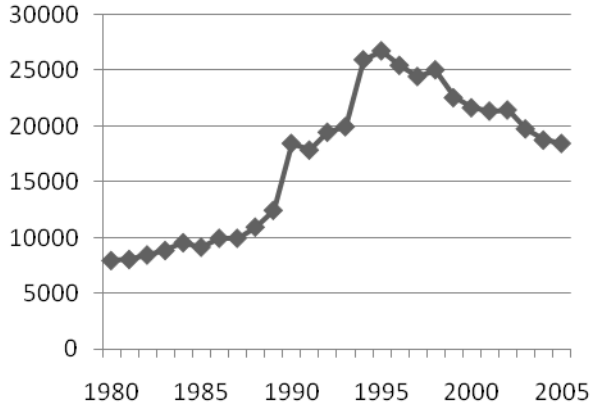


Figure A-2: Murder (per 100,000 inhabitants)

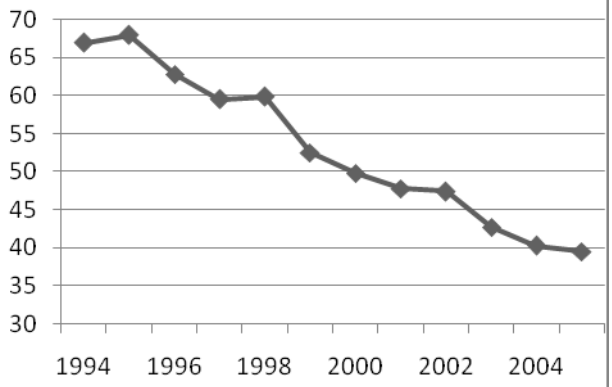


Figure A-3: Assault (Reported Incidents)

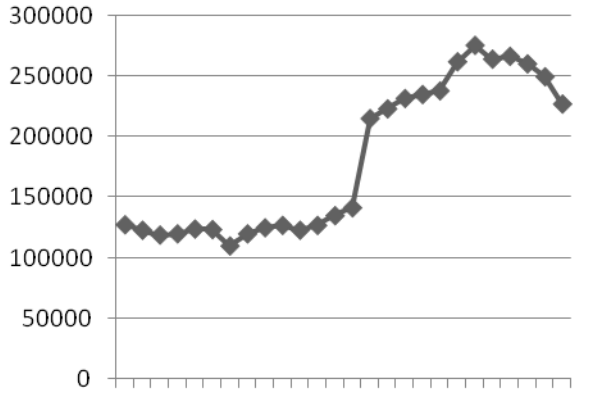
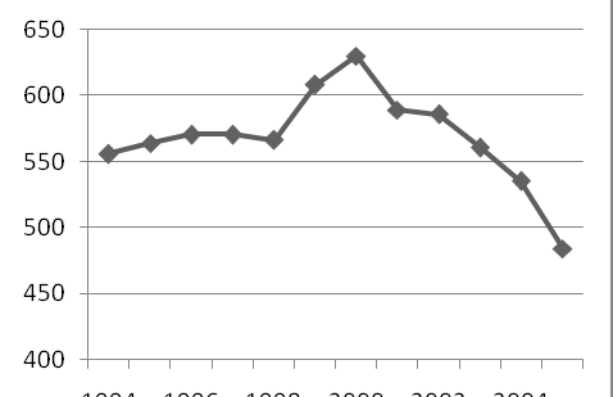
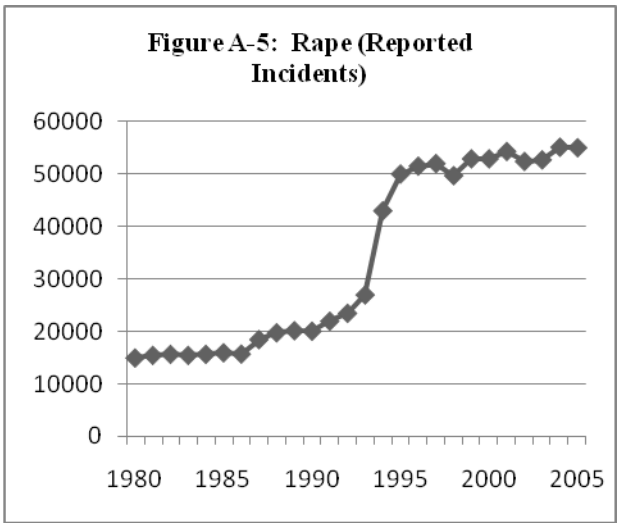
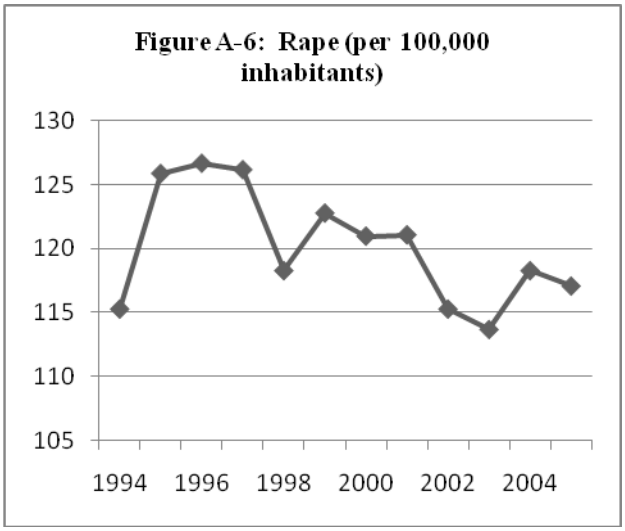
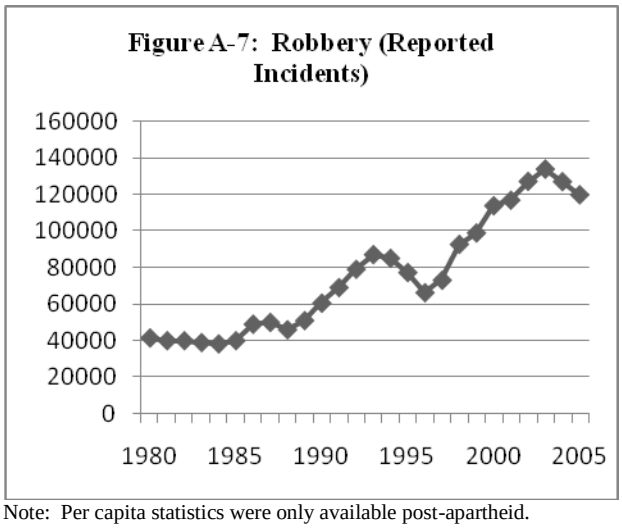


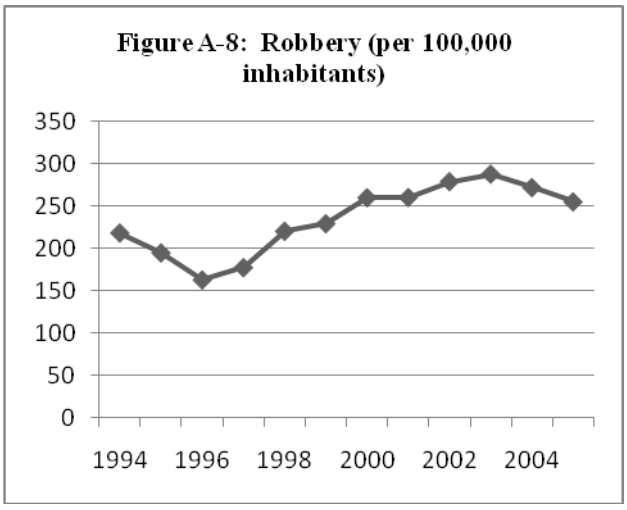
Figure A-4: Assault (per 100,000 inhabitants)











Note: Per capita statistics were only available post-apartheid.
Sources: SAPS (2004), SAPS (2006), and Shaw (1998).

Table A-1: Correlations Among Variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) crime	1.00														
(2) violent crime	0.58	1.00													
(3) robbery	0.79	0.14	1.00												
(4) log(expenditures)	0.15	0.01	0.19	1.00											
(5) age	-0.05	-0.01	-0.06	-0.25	1.00										
(6) female head	-0.02	0.00	-0.04	-0.18	0.23	1.00									
(7) head present	0.02	-0.00	0.04	0.17	0.03	0.11	1.00								
(8) general education	-0.03	0.03	-0.05	-0.17	-0.13	-0.01	-0.08	1.00							
(9) further education	0.04	-0.01	0.07	0.32	-0.17	-0.08	0.07	-0.42	1.00						
(10) higher education	0.09	-0.02	0.12	0.42	-0.11	-0.08	0.08	-0.37	-0.11	1.00					
(11) expenditure gini	-0.06	-0.05	-0.04	-0.18	0.01	0.02	-0.00	-0.02	-0.04	-0.02	1.00				
(12) population type	-0.12	-0.04	-0.12	-0.47	0.15	0.05	-0.26	-0.01	-0.18	-0.18	0.11	1.00			
(13) percentage nonwhite	-0.10	0.04	-0.15	-0.60	0.11	0.10	-0.14	0.27	-0.31	-0.41	0.16	0.36	1.00		
(14) homelessness	0.02	0.04	-0.00	-0.07	0.02	0.04	-0.00	0.13	-0.05	-0.13	0.02	-0.14	0.21	1.00	
(15) public transportation	-0.01	0.01	-0.03	-0.07	0.01	0.02	-0.02	0.10	-0.05	-0.08	0.04	-0.00	0.19	0.10	1.00