Who is falling behind? Is AIDS-related mortality contributing to increased "income" mobility in KwaZulu-Natal, South Africa?

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Introduction

While HIV and AIDS have been described as a "disease of poverty" (see for example, Afrol News, 2002), empirical studies examining the relationship between poverty and the risk of HIV infection or AIDS mortality report mixed findings (Beegle, De Weerdt and Dercon 2008; Gillespie, Kadiyala and Greener 2007b). Recently, it has been argued that HIV is more strongly associated with inequality than poverty *per se* and therefore, the epidemic is more severe in countries undergoing economic transitions (Piot, Greener and Russell 2007). Thus, the universal relationship between poverty and HIV and AIDS tend to remain complex and exceptional (Gillespie et al. 2007a; Gillespie et al. 2007b).

The aims of this paper are first to describe income mobility in a population with high AIDS mortality in the period 2002 to 2006; and, second, to identify demographic and economic events, associated with upward or downward mobility across the income distribution. Of particular interest is the relationship between a households' experience of AIDS mortality and its income mobility. The households described in this paper are from a rural sub-district in northern KwaZulu-Natal, South Africa. The study population has experienced a severe HIV epidemic; in 2003/4, HIV prevalence was 22% in resident women aged 15-49 years and men aged 15-54 years (Welz et al. 2007). The district is one of the poorer in KwaZulu-Natal (Case

and Ardington 2004) and in South Africa (Klasen 1997; Leibbrandt and Woolard 1999, Carter and May, 2001), large inequalities are present in this community (Case, Paxson and Ableidinger 2004).

A plethora of studies have tried to provide an assessment of poverty and inequality trends in South Africa, especially since the political transition (Bhorat and Kanbur 2006). The results have failed to quantify these trends, precisely for reasons related to data quality (Bhorat and Kanbur 2006; Fedderke, Manga and Pirouz 2003). In addition, studies in South Africa have been mostly limited to the cross-sectional assessment of poverty and inequality due to the shortage of longitudinal datasets (Leibbrandt, Levinsohn and McCrary 2005). National household and labour force surveys are unable to reflect poverty dynamics or differentiate between chronic (permanent) and transitory poverty. In addition, cross-sectional data cannot be used to investigate causality about, for instance, the demographic dynamics behind distributional issues and labour market outcomes.

Income mobility has been defined as "*the changes in economic status from one time period or generation to another*" (Fields and Ok 1999), and is thus distinct from cross-sectional measures of poverty and inequality or marginal distributions in joint income distribution. Although we refer to 'income' mobility we, like Fields and Ok (1996), consider that income may be measured using any "*real-valued measure of socioeconomic position (consumption, earnings, occupational status index) among any well-defined recipient unit (e.g. households, workers, generations, per capitas, adult equivalents*". Given the available data, our indicator of income is constructed using household consumption (i.e. expenditure) data.

In South Africa only a few studies have focused specifically on income mobility (Carter and May 2001; Fields et al. 2003a, 2003b; Woolard and Klasen 2005; Woolard, Leibbrandt and Lam 2007) and most of them have used the same dataset, the KwaZulu-Natal Income Dynamics Study (KIDS). This is a panel of household that has already been used to produce

better estimates of the incidence of poverty as well as the reasons for its persistence. Carter and May (2001), used KIDS, a study of approximately 1200 African households to investigate income dynamics over 1993-98, they found that the poverty rate increased from 27% to 43% among that cohort, and that the distribution of scaled per capita expenditure (or well-being) became less equal. A skewed or class-based pattern of income mobility provides substance to these conclusions; the authors argue that "initially wealthier households have shown more upward mobility than initially poorer households" (Carter and May 2001).

In this paper, we adopt the approach of Woolard and Klasen (2005), by focusing on absolute mobility (and including movements in and out of poverty). We specifically examine changes in the rank of households (Fields and Ok 1999), as well as changes in the absolute well-being (and as a consequence poverty). As Woolard and Klasen (2005) highlight, income mobility is strongly linked to demographic and employment dynamics.

Data

Demographic data

This paper analyses longitudinal population-based data from the Africa Centre Demographic Information System (ACDIS). Since 2000, ACDIS has collected demographic and health data of approximately 85,000 people who are members of households located in a rural sub-district of northern KwaZulu-Natal, South Africa. ACDIS and the study population have been described in detail elsewhere (Hosegood and Solarsh 2005; Hosegood and Timaeus 2005; Tanser et al. 2007). Briefly, households are routinely visited every 6 months to identify births, deaths, and migrations, as well as, changes in the status of household members. Verbal autopsies are conducted subsequently to determine causes of death. Most round of fieldwork include supplementary questionnaires on topics such as socio-economic status, HIV and sexual behaviour.

Individual and household socio-economic data

Household socio-economic (HSE) data for individuals and households has been collected in five rounds of ACDIS since 2001. In our analysis we use data from the three socio-economic surveys in which detailed data on consumption was collected: HSE-2 (2003-2004), HSE-3 (2005) and HSE-4 (2006).

Measures of income mobility are sensitive to measurement error and missing consumption and income data (Cowell and Schluter 1998). We explored several approaches to handling missing consumption data in the three HSE surveys. Missing consumption data was a mixture of item non-response (i.e. data on one or more questions was missing for a household) and unit non-response (i.e. no HSE questionnaire was completed for a household). In this paper we present income mobility results under three scenarios, two in which missing data have been imputed and the other a naïve scenario in which no imputed data were included. To

impute missing values we used two methodologies: 1) a single imputation based on median expenditure of households belonging to the same area (crude imputation); 2) a customized (ad-hoc) approach based on multiple imputation of consumption data through the application of chained equation methods or MICE (Royston 2004, 2005; Van Buuren and Oudshoorn 1999). Details of the methodology underlying the imputations and rationale for the choice of the ad-hoc imputed measure for our calculations can be found in a paper by Garbero (2009).

Table 1 describes the ACDIS sample used in this analysis. Table 2 presents sample attrition and households' non-response pattern at HSE 2, 3 and 4. Of the total number of households present at either HSE 2, 3 or 4 (unbalanced panel, N=12032), 11% were only present at HSE 2, 9 % were missing at HSE 4, 5 % were missing at HSE 2, 4 % were missing at HSE 3, 4 % were only present at HSE 4 and 2% were missing at HSE 2 and HSE 4.

Table 1: Sample description, visit dates, rounds and number of households.

	Visit date	**Rounds**	**HH**
HSE 2	Feb 2003-Aug 2004	8,9,10	10821
HSE 3	Jan-Aug 2005	12	9769
HSE4	Jan-Aug 2006	14	9383

Source: Own calculations based on the ACDIS data.

Table 2: Sample attrition.

HSE 2 (N=10821)	HSE 3 (N=9769)	HSE 4 (N=9383)	Households non-response pattern	% of unbalanced panel
Present	Present	Present	7897	66
Present	Missing	Missing	1319	11
Present	Present	Missing	1124	9
Missing	Present	Present	542	5
Present	Missing	Present	481	4
Missing	Missing	Present	463	4
Missing	Present	Missing	206	2
			12032	100

Source: Own calculations based on the ACDIS data. *Balanced Panel 1) HH present at HSE 2/3/4 N=7897; 2) HH present at HSE 2 and 4 N=8378. Unbalanced panel HH present at either HSE 2 or 3 or 4, N=12032.

Relevant to the scope of this analysis, we are particularly interested in the number of households not interviewed at HSE 3, but present at HSE 2 and 4 (N=481, 4% of the unbalanced panel). Our results are suggestive of the fact that such households were probably

missed during the interviews as they were still present during the surveillance period after HSE 4 interview period (Table 3).

Table 3: Household not-interviewed at HSE 3.

HH residency end event	HH not interviewed in HSE 3 and in the core datasets	HH should have been interviewed (but present in the core datasets)	Total
migrated	2 (0)	67 (14)	69 (14)
dissolved	4 (1)	28 (6)	32 (7)
Visit	0	380 (79)*	380 (79)
Total	6(1)	475 (99)	481 (100)

Source: Own calculations based on the ACDIS data. *Still present in the sample (ended with visit) but missed at HSE 3. % in parenthesis.

Poverty and inequality indices are calculated cross-sectionally for each household socio-economic survey. Mobility indices, transition states and matrices are calculated on the balanced panels (N=7897 and N=8378, respectively). Lastly, the analyses contained in Table 14 and 15 (movements in and out of poverty) are conducted on the balanced panel that involves households present at HSE 2 and 4 only (N=8378) to capture household income mobility across the entire period 2003-2006.

Methods

Before describing the income mobility results, we present standard poverty indices based on imputed vs. non-imputed aggregates using the standard Foster, Greer and Thoerbecke (FGTs) measures which define the proportion poor, the depth and the severity of poverty respectively.

The extent of poverty and inequality changes with the definition of consumption (Lanjouw and Lanjouw 1997). In particular poverty indicators such as FGT class measures and also indices of inequality, change when different measures of consumptions are used. In empirical results, while the headcount (FGT0) seems fairly stable, FGT1 and FGT2 can take ambiguous directions while changing poverty line (Lanjouw and Lanjouw 1997).

Following the single and two-stages mobility indices approach used by Cowell and Schluter (1998), we also build *Shorrock's rigidity index* (using the Gini coefficient) and *transition matrices* [1] with both the imputed and non-imputed data.

The analytical form of the Shorrock's rigidity index, using the Gini coefficient is the following:

$$R = \frac{G(x+y+z)}{(\mu_x G_x + \mu_y G_y + \mu_z G_z)/(\mu_x + \mu_y + \mu_z)}$$

This index compares the Gini coefficient of the total consumption in the three periods (HSE2-3-4=x,y,z), with the weighted average of the Gini in each period. We also calculated the same index for HSE 2 and 4 (x and z).

Lastly, we investigate the determinants of income mobility (i.e. change in income mobility across two subsequent waves of the survey, specifically HSE 2 and 4) in order to assess the role of demographic events (specifically AIDS adult mortality) and economic events (including changes in employment status and access to government grants).

Studies estimating the impact of AIDS mortality on welfare proxies (e.g. poverty status, income and consumption measures, asset indices) should ideally control for initial "pre-mortality" household conditions (either economic or demographic characteristics) (Naidu and Harris 2005). Other authors use evidence from large-scale studies to argue that impact studies should control for pre-illness initial conditions, as well as, pre-death household initial conditions (Chapoto and Jayne 2006) In ACDIS, whilst data is not routinely collected about the timing and duration of illness episodes related to deaths, however, we are able to specifically control for pre-death household initial conditions.

[1]Transition matrices are calculated by dividing consumption or income data into quintiles or tertiles (n equal classes) for each year.

The first section of the paper examines univariate associations between demographic events and economic events that are mostly associated with movements in and out of poverty.

A multivariate analysis is then presented in which we explore the determinants of welfare changes for such households. The initial analytical form of the model is adapted from Woolard and Klasen (2005) and is described by the following first difference model:

$$\Delta \ln(C_i)_{HSE2-4} = f(E_i, \Delta E_i; D_i, \Delta D_i)$$

where $\Delta \ln(C)_{HSE2-4}$ is our dependent variable or the growth rate in the income mobility proxy for household *i* (natural logarithm of per capita expenditure between HSE 2 and 4)

E_i = endowments of household *i* (household consumption and assets)

D_i = economic and demographic events that influence the endowment level of household *i* .

Results

The consumption aggregate is defined by summing all expenditure items in each HSE module. Expenditures are adjusted for inflation as of 1st of January 2003. Given the absence of consensus on the appropriate adult equivalence criteria in South Africa, we report the expenditure adjusted for household size, i.e. per capita expenditure (PCE). Household size is defined as the number of resident members. Table 4 presents poverty indices calculated using the lower bound normative poverty line of 322 Rands in 2000 prices. The latter has also been adjusted for inflation and corresponds to 404 Rands in 2003 prices[2] .

[2] Inflation January 2000- January 2003: 76/60.6=25.4%; poverty line January 2003: 322 * 76/60.6=403.83.

Table 4: Poverty indices in the ACDIS dataset

		FGT(0)	FGT(1)	FGT(2)
HSE 2	Naïve scenario	0.82	0.55	0.41
HSE 3		0.84	0.53	0.38
HSE 4		0.89	0.61	0.46
HSE 2	Crude imputation	0.78	0.47	0.32
HSE 3		0.80	0.48	0.32
HSE 4		0.83	0.51	0.35
HSE 2	Ad-hoc imputation	0.80	0.49	0.34
HSE 3		0.81	0.47	0.32
HSE 4		0.84	0.50	0.34

Source: Own calculations based on the ACDIS data.

Using a fixed threshold, we can also assess to what extent the imputation procedures have an effect on the poverty indices. Looking at the results, we conclude that the poverty headcount (FGT0) increased from 2003 to 2006 (HSE4) in all scenarios.

In addition, results for the two imputations methodologies are consistent and both lower when compared to the naïve scenario. The naïve imputation tends to overestimate the proportion poor, by construction, because the large number of zeros and missing values are untreated. Such magnitudes are far lower for the FGT(1) and (2), the former indicating the distance separating the poor from the poverty line and the latter measuring inequality among the poor.

Inequality measures are even more sensitive to measurement error and missing data then poverty indices. In Table 5, we present the Gini coefficient, one of the most common inequality indices and analyse its sensitivity to each imputation scenario. The definition of the consumption aggregate is extremely relevant for our analysis of income mobility. The Gini coefficient is substantially larger in the absence of imputation. However results across imputed datasets are similar.

Table 5:Inequality indices using imputed and non imputed consumption aggregates

		Gini coefficient
HSE 2	Naïve scenario	0.621
HSE 3		0.547
HSE 4		0.570
HSE 2	Crude imputation	0.558
HSE 3		0.514
HSE 4		0.508
HSE 2	Ad-hoc imputation	0.564
HSE 3		0.507
HSE 4		0.488

Source: Own calculations based on the ACDIS data.

The Shorrocks rigidity indexes are presented in table 6. The latter ranges from 0 to 1 and the results show that there was substantial mobility from HSE 2 to 4 either considering mobility across three or two waves only. Results from the ad-hoc imputation procedure are more in line with the no-imputation scenario or naïve scenario. This corroborates the choice of the ad-hoc imputed per capita expenditure that will form the basis of the analysis of the determinants of mobility.

Table 6: Shorrocks Rigidity Index based upon the Gini Coefficient.

	HSE 2-3-4	HSE 2-4
Naïve scenario	0.140	0.093
Crude imputation	0.122	0.084
Ad-hoc imputation	0.125	0.089

Source: Own calculations based on the ACDIS data.

Table 7 presents transition states across the three (HSE 2, 3 and 4) and two (HSE 2 and 4) surveys. Regardless of imputation scenario, there was substantial mobility in the sample. The percentage of households “always poor” ranges from around 70% to 75% of the households present in the balanced panels (based on the imputed measure).

Table 7: Transition states

State in HSE 2-3-4 (N=7897)	% based on PCE (imputed-ICE)	% based on PCE (naive)
Poor, Poor, Poor	70.44	74.13
Non-poor, Non-poor, Non-poor	4.03	2.28
Poor, Poor, Non-poor	4.82	3.86
Poor, Non-poor, Non-poor	2.96	1.96
Non-poor, Non-poor, Poor	3.48	3.27
Non-poor, Poor, Poor	6.03	6.66
Poor, Non-poor, Poor	6.12	6.26
Non-poor, Poor, Non-poor	2.11	1.58
Total (N=7897)	100	100

State in HSE2-HSE4 (N=8378)	% based on PCE (imputed-ICE)	% based on PCE (naive)
Poor, Poor	75.26	79.29
Non-poor, Non-poor	6.8	4.33
Non-poor, Poor	8.07	6.02
Poor, Non-Poor	9.87	10.36
Total (N=8378)	100	100

Source: Own calculations based on the ACDIS data.

Table 8 present a more disaggregated picture of mobility, i.e. transition matrices according to an imputed consumption measure. The adjustment for measurement error and missing data significantly alters the number of households that stay at the top and bottom of the consumption distribution (tables available upon request). A general observation is that while according to the naïve scenario, 33% of households remained in the lowest quintile of the consumption distribution, this number is increased by 10% in the imputed scenarios (crude and ad-hoc).

For the remainder of our analysis we will adopt the consumption aggregate based on the ad-hoc imputation scenario. The latter seems to give a "medium" scenario, between a conservative estimate, the naïve scenario, and the extreme scenario, the crude imputation (Garbero, 2009).

The transition matrices show changes in the relative ranks of the consumption distribution. We divided each consumption distribution into quintiles at HSE 2, 3 and 4 respectively and

we compared two surveys at a time. Movements are assessed for the unbalanced panel (table 8) and for households that belong to the balanced panel (N=7897), Table 9. Focusing on transitions from HSE 2 to 4, a general observation is that there is quite a lot of persistence in top and bottom quintiles, across the various surveys.

Table 8: Transition matrices (row percentages). Consumption distribution. Ad-hoc scenario. (Unbalanced panel).

		Quintiles of HH in HSE 3				
Quintiles of HH in HSE 2		1	2	3	4	5
	1	0.42	0.28	0.14	0.08	0.07
	2	0.27	0.29	0.22	0.15	0.07
	3	0.14	0.23	0.3	0.23	0.12
	4	0.09	0.13	0.22	0.31	0.25
	5	0.09	0.06	0.12	0.23	0.5
N=9021						
		Quintiles of HH in HSE 4				
Quintiles of HH in HSE 3		1	2	3	4	5
	1	0.47	0.27	0.13	0.07	0.06
	2	0.26	0.31	0.24	0.12	0.06
	3	0.13	0.23	0.29	0.26	0.08
	4	0.06	0.13	0.24	0.33	0.24
	5	0.08	0.07	0.11	0.23	0.5
N=8439						
		Quintiles of HH in HSE 4				
Quintiles of HH in HSE 2		1	2	3	4	5
	1	0.43	0.26	0.15	0.09	0.07
	2	0.25	0.29	0.24	0.15	0.07
	3	0.15	0.21	0.26	0.24	0.13
	4	0.08	0.15	0.22	0.31	0.25
	5	0.08	0.09	0.13	0.23	0.47
N=8378						

Source: Own calculations based on the ACDIS data.

Table 9: Transition matrices (row percentages). Consumption distribution. Ad-hoc scenario. Balanced panel (N=7897).

		Quintiles of HH in HSE 3				
Quintiles of HH in HSE 2		1	2	3	4	5
	1	0.42	0.28	0.14	0.08	0.07
	2	0.27	0.29	0.22	0.15	0.07
	3	0.14	0.23	0.3	0.23	0.12
	4	0.09	0.13	0.22	0.31	0.25
	5	0.09	0.06	0.12	0.23	0.5
		Quintiles of HH in HSE 4				
Quintiles of HH in HSE 3		1	2	3	4	5
	1	0.47	0.27	0.13	0.07	0.06
	2	0.26	0.31	0.24	0.12	0.06
	3	0.13	0.23	0.29	0.26	0.08
	4	0.06	0.13	0.24	0.33	0.24
	5	0.08	0.07	0.11	0.23	0.5
		Quintiles of HH in HSE 4				
Quintiles of HH in HSE 2		1	2	3	4	5
	1	0.43	0.26	0.15	0.09	0.07
	2	0.25	0.29	0.24	0.15	0.07
	3	0.15	0.21	0.26	0.24	0.13
	4	0.08	0.15	0.22	0.31	0.25
	5	0.08	0.09	0.13	0.23	0.47

Source: Own calculations based on the ACDIS data.

The determinants of income mobility: univariate analysis.

We now turn to the study of the demographic and economic events that are specifically associated with households' movements in and out of poverty during two surveys, namely, HSE 2 and 4. The previous results underline the choice of an imputed per capita expenditure measure based an ad-hoc imputation scenario, when ranking poor vs. non-poor households.

Among demographic events, emphasis is given to adult (15-59 years) mortality events. The timing of such events is defined in terms of: stocks (i.e. cumulated number of demographic events that households experienced since the beginning of the surveillance) and flows (i.e. "inter-period" deaths occurring between the two socio-economic surveys; and deaths

occurring in the 3 years preceding the HSE 4 interview date) to test whether their impact is significantly different.

Table 10 summarizes demographic and economic characteristics of households present at each socio-economic survey. We include the number of adult deaths (15-59 years) by cause (deaths from communicable diseases excluding HIV-related, non-communicable diseases, injuries and HIV-related including TB); the number of births and the number of individual in-migrants (out-migrants). The latter include: both 1) members that either join (leave) the household and become (cease to be) members; and 2) existing members who were non-resident, in (out)-migrate and become (cease to be) resident members. These are stock measures and indicate cumulated number of demographic events that such households experienced since the beginning of the surveillance (1st of January 2000) up to each HSE interview date.

Table 11 presents the average difference (between HSE 2 and 4) in the number of adult deaths (15-59 years) differentiated by cause, by quintile of household per capita expenditure per resident member (imputed) at baseline (HSE 2). Such difference in the average number of deaths is calculated between stock quantities since the beginning of the surveillance. The purpose is to assess descriptively whether there are differences across quintiles of initial (log) per capita expenditure. Average differences for adult deaths due to AIDS are larger then the ones from adult deaths due to other causes: such difference declines across quintiles of per capita expenditure at baseline. This is not true for other causes of deaths where there is more homogeneity across quintiles.

Table 12 presents households initial conditions or characteristics at baseline (HSE 2), i.e. mean imputed per-capita expenditure, the mean number of assets owned, the number of births and the mean number of in-migrants and out-migrants before HSE 2.

Notwithstanding the decline in average per capita consumption for all households, across the three socio-economic surveys (table 10), we are specifically interested in assessing which demographic and economic events are most associated with movements in and out of poverty. Poverty is defined according to a poverty line of 404 Rands in 2003 prices (equivalent to a lower bound normative poverty line of 322 Rands in 2000 prices).

Therefore, the consumption distributions at HSE 2 and 4 are disaggregated into tertiles and movement across such tertiles are calculated, via transition matrices, from HSE 2 to 4 for households present at HSE 2 and 4. The timing of adult deaths (here the number of households experiencing any adult death versus no adult death, in the period occurring between HSE 2 to 4) is defined as events occurring between the two socio-economic surveys. The purpose is to assess where such "inter-period" deaths have an impact on mobility across tertiles. Is HIV-related mortality significantly associated with such movements? Table 13 presents the proportion of households with more than one adult death versus no deaths, differentiated by cause, occurring between HSE 2 and 4, by movements across tertiles (HSE 2-4) with N=8378. Chi square statistics was performed to detect an association between movements across states and adult mortality from various causes. Such associations were significant at .05 level for all causes of deaths except deaths from non-communicable diseases. Mortality due to AIDS and other communicable diseases is thus associated both with downward mobility among the better-off and failure of the poor to improve themselves. On the other hand, mortality from non-communicable diseases and injuries affect the rich but don't prevent upward mobility among the poor.

A further investigation of our data is performed and table 14 presents demographic events associated with movements in and out of poverty based on the 404 Rands poverty line. The timing of demographic events is defined here as events occurring in the 3 years preceding the HSE 4 interview date: the focus is here is whether short-term deaths are significantly associated with such mobility.

10% per cent of the households (N=827) belonging to the balanced panel present at HSE 2 and 4 (N=8327) which were above the poverty line in HSE 2, became poor in HSE 4 according to an imputed consumption criteria (ad-hoc scenario). The number of households that moved out of poverty was instead 7.5 % (N=628).

Chi-squared test statistics were calculated (based on 0.05 level of significance) in order to assess the association between moving in and out poverty and a number of selected demographic events. Such events included: adult deaths from various causes in the three years preceding HSE 4, the numbers of in-migrants and out-migrants, and the number of births. Among such events, the ones that were significantly associated with a movement into poverty were found to be adult deaths from HIV-related causes (15-59 age group) and the number of births in the three years preceding HSE 4 interview date. Mobility of individuals, specifically outmigration was instead significantly associated with a movement out of poverty.

9 % of households that moved into poverty during the period HSE2 to 4 had 1 to 3 adult deaths from HIV-related causes in the three years preceding HSE 4 interview date. 13 % of those households who moved out of poverty had 1 to 3 adult deaths from AIDS-related causes over the same period.

Table 10: Descriptive analysis by Socio-Economic Survey (HSE). ACDIS sample.

HSE	2				3				4			
	Mean	**SD**	**Min**	**Max**	**Mean**	**SD**	**Min**	**Max**	**Mean**	**SD**	**Min**	**Max**
Members	8.0	5.1	1	53	8.4	5.1	1.0	55.0	8.6	5.1	1	43
Resident members	5.6	3.8	1	38	5.5	3.7	1	37	5.5	3.6	1	38
Resident members <14	2.2	2.1	0	21	2.1	2.0	0	20	2.1	2.0	0	19
Residents 55+	0.5	0.7	0	4	0.6	0.7	0	4	0.6	0.7	0	5
Female Pensioners	0.3	0.5	0	3	0.3	0.5	0	3	0.3	0.5	0	3
Male Pensioners	0.1	0.3	0	2	0.1	0.3	0	2	0.1	0.3	0	2
Age of oldest resident	51.0	18.0	0	109	52.5	17.6	0	110	52.9	17.6	0	111
No. OAP	0.4	0.6	0	4	0.4	0.6	0	4	0.4	0.6	0	4
No. CSG	0.6	1.0	0	11	0.7	1.2	0	15	0.9	1.4	0	13
No. employed	1.6	1.4	0	13	1.7	1.5	0	14	1.7	1.5	0	12
No. unemployed	0.7	1.1	0	9	0.5	1.0	0	10	0.5	0.9	0	9
No. Females	3.7	2.3	1	20	3.4	2.2	1	19	3.5	2.2	1	22
Age of head	49.8	15.2	0	101	51.3	15.1	0	102	51.8	15.1	1	111
No of Assets	6.0	3.6	0	22	6.7	3.5	0	22	6.9	3.5	0	22
PCE Naïve	304.0	600.6	0	15179	274.8	497.5	0	13711	223.4	688.3	0	51072
PCE Crude	346.6	572.8	0	15179	304.7	447.0	0	11714	272.9	401.8	0	10017
PCE Ice	330.2	568.0	0	15179	304.7	445.6	0	11475	269.6	383.2	0	9981
No. of adult deaths (15-59) *												
Communicable diseases	0.1	0.3	0	4	0.1	0.3	0	4	0.1	0.3	0	4
Non-communicable diseases	0.1	0.3	0	3	0.1	0.3	0	3	0.1	0.4	0	4
Injuries	0.0	0.2	0	2	0.0	0.2	0	6	0.0	0.2	0	2
HIV-related including TB	0.3	0.6	0	6	0.3	0.7	0	6	0.4	0.7	0	7
Missing cause of death	0.0	0.1	0	2	0.0	0.2	0	2	0.0	0.2	0	2
No. of in-migrants *	0.6	1.4	0	15	0.8	1.6	0	17	1.0	1.9	0	21
No. of out-migrants *	1.3	1.9	0	21	1.7	2.2	0	24	2.0	2.5	0	23
Births *	0.0	0.2	0	3	0.0	0.3	0	4	0.1	0.3	0	4
Total No. of HH.	**10821**				**9769**				**9383**			

Source: Own calculations based on the ACDIS data. *Demographic events are computed since 1 of Jan 2000.

Table 11: Mean difference in the number of adult deaths (15-59 years) and total by cause, by quintile of household per capita expenditure per resident member at HSE 2 (imputed). Means, SD, across HSE2-HSE4. (N=7897)

Quintile of HH by initial PCE (imputed) HSE 2	No. of adult deaths (15-59)	HSE2-4	HSE2-4	HSE2-4	HSE2-4	HSE2-4
		Communicable diseases	Non-communicable diseases	Injuries	HIV-related including TB	Total Deaths
1	Mean	0.04	0.04	0.02	0.14	0.42
	SD	0.09	0.06	0.05	0.18	0.26
2	Mean	0.03	0.04	0.02	0.13	0.38
	SD	0.06	0.07	0.05	0.15	0.24
3	Mean	0.02	0.04	0.01	0.15	0.35
	SD	0.06	0.07	0.02	0.19	0.30
4	Mean	0.03	0.04	0.00	0.10	0.29
	SD	0.09	0.08	0.01	0.16	0.23
5	Mean	0.03	0.04	0.01	0.08	0.28
	SD	0.08	0.04	0.01	0.08	0.28
Total	Mean	0.03	0.08	0.04	0.13	0.36
	SD	0.08	0.07	0.03	0.17	0.27

Source: Own calculations based on the ACDIS data. *Demographic events are computed since 1 of Jan 2000.

Table 12: Household characteristics at HSE 2, by quintile of household per capita expenditure per resident member at HSE 2 (imputed). Means, SD. (N=7897)

Quintile of HH by initial PCE (imputed) HSE 2						
		PCE Ice	No of Assets	Numbers of Individuals moving in	Numbers of Individuals moving out	Births
1	Mean	58	4	0.95	1.68	0.05
	SD	18.5	3	1.84	2.29	0.25
2	Mean	108	5	0.69	1.48	0.04
	SD	14	3	1.49	1.94	0.21
3	Mean	171	6	0.62	1.33	0.04
	SD	23	3	1.31	1.81	0.22
4	Mean	296	7	0.52	1.15	0.03
	SD	55	4	1.18	1.63	0.18
5	Mean	1017	8	0.33	0.88	0.02
	SD	994	4	0.85	1.38	0.13
Total	Mean	330.2	6	0.62	1.31	0.03
	SD	568.0	4	1.39	1.86	0.20

Source: Own calculations based on the ACDIS data.

Table 13: Transition matrices by cause of adult death (15-59 years). Consumption distribution disaggregated into tertiles (HSE 2-4). Proportion of households experiencing more than one adult death versus households with no deaths in the inter-survey period (HSE 2 to 4), N=8378.

		No deaths			1+ deaths			Number of Households
	Tertiles	1	2	3	1	2	3	
HIV-related including TB*	1	0.589	0.280	0.131	0.614	0.301	0.085	2890
	2	0.324	0.427	0.249	0.386	0.440	0.174	2834
	3	0.134	0.317	0.549	0.198	0.374	0.428	2654
Non-communicable	1	0.596	0.283	0.121	0.585	0.299	0.115	2890
	2	0.333	0.430	0.237	0.365	0.425	0.210	2834
	3	0.142	0.322	0.536	0.166	0.369	0.465	2654
Communicable diseases*	1	0.589	0.291	0.121	0.671	0.208	0.120	2890
	2	0.332	0.432	0.236	0.391	0.391	0.218	2834
	3	0.141	0.323	0.536	0.220	0.394	0.385	2654
Injuries *	1	0.597	0.285	0.118	0.550	0.266	0.183	2890
	2	0.335	0.433	0.232	0.358	0.340	0.302	2834
	3	0.143	0.322	0.535	0.188	0.450	0.363	2654
Total no. of HH								8378

Source: Own calculations based on the ACDIS data. *Chi square statistic significant at .05 level.

Table 14: Demographic events associated with movements in and out of poverty (HSE2-HSE4)

Main event			
Demographic event		**Moved into poverty (HSE2-HSE4)**	**Moved out of poverty (HSE 2-HSE 4)**
Adult Deaths in the 3 years preceding HSE 4			
Communicable diseases			
No deaths	N	788	650
	%	95.28	96.15
1 death	N	38	24
	%	4.59	3.55
2-3 deaths	N	1	2
	%	0.12	0.3
HIV-related including TB		**Sig.***	
No deaths	N	754	587
	%	91	86.83
1 death	N	63	77
	%	7.62	11.39
2-3 deaths	N	10	12
	%	1.21	1.78
Injuries			
No deaths	N	795	653
	%	96.13	96.6
1 death	N	31	22
	%	3.75	3.25
2-3 deaths	N	1	1
	%	0.12	0.15
Non-communicable diseases			
No deaths	N	786	631
	%	95.04	93.34
1 death	N	39	42
	%	4.72	6.21
2-3 deaths	N	2	3
	%	0.24	0.44
In-migrations, in the 3 years preceding HSE 4			
No event	N	690	603
	%	83.43	89.2
1 event	N	92	53
	%	11.12	7.84
2-3 events	N	41	18
	%	4.96	2.66
>3 events	N	4	2
	%	0.48	0.3
Out-migrations, in the 3 years preceding HSE 4			***Sig.****
No event	N	601	566
	%	72.67	83.73
1 event	N	165	80
	%	19.95	11.83
2-3 events	N	56	28
	%	6.77	4.14

>3 events	N	5	2
	%	0.6	0.3
Births		**Sig.***	
No event	N	786	656
	%	95.04	97.04
1 event	N	34	20
	%	4.11	2.96
2-3 events	N	7	0
	%	0.85	0
Total HH	**N**	**827**	**676**
	%	**100**	**100**

Source: Own calculations based on the ACDIS data. *Chi-square statistics significant at .05 level.

Table 15 presents the same analysis for key "economic events" (i.e. the household no longer having a head that is employed; the household losing at least one old age pension or a child support grant, respectively). Not surprisingly the loss of the head employment and the loss of government subsidies such as the old age pension and the child support grant during the period were all significantly associated with a household movement into poverty. On the other hand only the increase in the number of government contributions was found to be significantly associated with a movement out of poverty.

12% of those households that moved into poverty had their head losing employment during the period; 18% of those moving out of poverty had their head obtaining employment. In terms of government subsidies, 20% of those who moved out of poverty gained at least an old age pension subsidy during the period.

As for the child support grant, 10% of those who moved into poverty lost at least one CSG and 14% of those who moved out of poverty gained at least one subsidy.

These findings are suggestive of the influential role of such contributions as poverty reduction strategies.

Table 15: Economic events associated with movements in and out of poverty (HSE2-HSE4)

Economic events (Period HSE 2-4)		Moved into poverty (HSE2- HSE4)	Moved out of poverty (HSE 2-HSE 4)
Head Employment		***Head losing employment****	***Head obtaining employment***
No	N	731	599
	%	88.39	88.61
Yes	N	96	77
	%	11.61	11.39
OAP		***Lost Old Age Pension****	***Got Old Age Pension****
No	N	804	540
	%	97.22	79.88
Yes	N	23	136
	%	2.78	20.12
CSG		***Lost a Child Support Grant****	***Got a Child Support Grant****
No	N	746	580
	%	90.21	85.8
Yes	N	81	96
	%	9.79	14.2
Total	**N**	**827**	**676**
	%	**100**	**100**

Source: Own calculations based on the ACDIS data.

After examining univariate associations between demographic events and economic events and movements in and out of poverty, we now turn to the multivariate analysis where we now look at the determinants of welfare changes for household belonging to HSE 2-4.

Multivariate analysis: determinants of income mobility

A multivariate analysis is presented (table 16) where we explore the determinants of welfare changes for such households. The initial analytical form of the model is adapted from Woolard and Klasen (2005) and is described by the following first difference model:

$$\Delta \ln(C_i)_{HSE2-4} = f(E_i, \Delta E_i; D_i, \Delta D_i)$$

where $\Delta \ln(C)_{HSE2-4}$ is our dependent variable or the growth rate in the income mobility proxy for household i (natural logarithm of per capita expenditure between HSE 2 and 4, imputed and deflated)

E_i = endowments of household i (vector of household characteristics at baseline (HSE 2), such as sex of head, maximum level of education in the household, quintiles of log per capita household consumption at HSE 2)

D_i = a vector of economic and demographic events that influence the endowment level of household i (change in: the number of in-migrants and out-migrants, household size, proportion of individuals employed; indicator variables for: whether the household experienced adults deaths due to HIV-related causes and injuries (no deaths, one, one-three, >3); whether the household lost government subsidies such as an old age pension (OAP) or child support grant (CSG) between HSE 2 and 4; whether the head changed employment status).

The consumption-based growth rate is regressed against the above mentioned predictors. This initial specification shows how the growth rate is significantly affected by household initial conditions at baseline. Age of head was not significant and thus was excluded from the model. The presence of a female head has a positive impact on the growth rate (8%). A unit increase in the level of education makes the growth rate decline by 1%.

In terms of differentiated variables, the change in the number of in-migrants and out-migrants decreases the growth rate by 0.5% and 0.2% respectively. Relative to those experiencing no adult deaths, having experienced at least 1 death due to HIV-related causes, in the 3 years preceding the HSE 4 interview date, contributes to a decline in the growth rate by 5% (significant at 0.05 level), 7% for 1 to 3 deaths and 10% for more than 3 deaths. The coefficient for adult deaths due to injuries is also negative but not significant.

Changes in household size, proportion of individual employed in the households, have a negative and positive impact on the growth rate, respectively. This is not consistent with the finding in the literature that consumption per head rises in larger households other things being equal (Deaton and Paxson 1997).

Losing an old age pension, contributes to an increase in the growth rate by 10%. The latter could be well related to mortality of a pensioner. The latter issue deserves further exploration empirically.

Table 16: Determinants of change in the growth rate of log per capita expenditure (imputed and deflated), HSE2-4.

	Coefficients (Absolute value of t statistics in parentheses)
Sex of head	0.083
	(3.87)**
Maximum level of education	-0.013
	(3.81)**
Change in the number of in-migrants	-0.0005
	(3.39)**
Change in the number of out-migrants	-0.0002
	(2.20)*
Adults deaths (15-59)HIV-related_1	-0.056
	(2.15)*
Adults deaths (15-59)HIV-related _2	-0.068
	(1.85)
Adults deaths (15-59)HIV-related _3	-0.099
	(0.68)
Adults deaths (15-59)Injuries _1	-0.070
	(1.48)
Adults deaths (15-59)Injuries _2	-0.196
	(1.32)
Adults deaths (15-59)Injuries _3	0.000
	(.)
Change in household size	-0.005
	(23.95)**
Change in the proportion employed in the hh	0.000
	(2.34)*
Whether the hh lost a OAP (Dummy variable)	0.093
	(2.24)*
Whether the hh lost a CSG (Dummy variable)	-0.090
	(3.66)**
Change in status of head employment _1 unemployed-employed	0.038
	(0.90)
Change in status of head employment _2 employed-unemployed	-0.105
	(3.44)**
Change in status of head employment _3 unemployed	-0.045
	(1.88)
Quintiles of HH PCEImputed at HSE2_2	-0.383
	(13.13)**
Quintiles of HH PCEImputed at HSE2_3	-0.615
	(20.88)**
Quintiles of HH PCEImputed at HSE2_4	-0.836
	(27.22)**
Quintiles of HH PCEImputed at HSE2_5	-1.304
	(35.83)**
Constant	0.706
	(13.48)**
Observations	4179
R-squared	0.39

* significant at 5%; ** significant at 1%

Source: Own calculations based on the ACDIS data.

Changes in the head employment status, other things being equal seem to have a significant effect relative to those that remained employed at both surveys. Losing employment decreases in fact the growth rate by 10% (significant at .1).

Conclusions

This study makes contributions in several areas. It adds to the South African literature on income mobility by making use of a large representative longitudinal survey; addresses issues of measurement error and missing data in consumption modules via customized imputation procedures; and contributes to the literature on the economic impact of HIV and AIDS by analysing the implications of mortality from AIDS and other causes for such movements**.**

After evaluating the performance of the various measures of mobility in the presence and absence of imputation, we observe that there was substantial mobility from HSE 2 to 4, regardless of the imputation scenario. The transition matrices show that there was also quite a lot of persistence in the top and bottom quintiles of the consumption distributions across the two socio-economic surveys.

Notwithstanding a general decrease in average per capita consumption for all households across the three socio-economic surveys (Table 10), we are specifically interested in assessing which demographic and economic events are most associated with movements in and out of poverty. We first find that households in the lowest quintiles of the consumption distribution at baseline experience the highest proportion of HIV-related mortality events when compared to the richer quintiles (Table 11).

We also find that inter-period deaths, defined as the ones occurring between the two socio-economic surveys, have an impact on mobility across tertiles of the consumption distribution at HSE 2 and 4. Such associations were significant at .05 level for all causes of adult deaths except deaths from non-communicable diseases.

Further investigation is conducted to unpack demographic and economic events which are most associated with movements in and out of poverty (based on the 404 Rands poverty line). The timing of demographic events is defined as events occurring in the 3 years preceding the HSE 4 interview date: the focus is to assess whether short-term deaths are significantly associated with such mobility. Among such events, the ones that were significantly associated with a movement into poverty were found to be adult deaths from HIV-related causes (15-59 years) and the number of births in the three years preceding HSE 4 interview date. Mobility of individuals, specifically out-migration was instead significantly associated with a movement out of poverty.

In terms of economic events, the loss of the head employment and the loss of government subsidies such as the old age pension and the child support grant during the period were all significantly associated with a household movement into poverty. On the other hand only the increase in the number of government contributions was found to be significantly associated with a movement out of poverty.

While these univariate findings are certainly important, a multivariate analysis is performed to study the determinants of welfare changes for such households.

The analytical form of the model is derived from Woolard and Klasen (2005). The model specifically takes into account both the "mobility literature" in South Africa, (Fields et al. 2003a, 2003b), and the "AIDS mortality impact literature" (Mather et al. 2004; Yamano and Jayne 2004). A future development of such model would be along the lines of the analytical specifications by Grimm (2006) and Carter and May (2007).

The significance level of the model (R-squared) is quite good (table 16). Such preliminary findings show, how controlling for household initial conditions at baseline (HSE 2), such as endowments levels and household characteristics, female headed households seem to fare

better then their male counterpart. Quintiles of initial household consumption (HSE 2) show the usual negative coefficients as underlined by the above mentioned literature, i.e. the classic regression to the mean effect. The higher the quintile to which the household belonged the more likely is the latter to experience a fall in the growth rate of per capita expenditure.

The multivariate analysis corroborates the importance of demographic and economic events; specifically, among the former, the role of HIV-related mortality in contributing to a decline in the household welfare proxy, the growth rate of log per capita expenditure. Relative to those experiencing no adult deaths, having experienced at least 1 death due to HIV-related causes, in the 3 years preceding the HSE 4 interview date, contributes to a decline in the growth rate by 5% (significant at 0.05 level), 7% for 1 to 3 deaths and 10% for more than 3 deaths. The coefficient for adult deaths due to injuries is also negative but not significant.

In terms of change variables, such as household size and proportion of individual employed in the households, we found that they have a negative and positive impact on the growth rate, respectively. The former is consistent with the demographic trap hypothesis (Woolard and Klasen 2005) in the sense that positive changes in household size contribute to a decline in the growth rate of log per capita expenditure.

Changes in the head employment status, other things being equal seem to have a significant effect relative to those that remained employed at both surveys. While losing employment decreases in fact the growth rate by 10% (significant at .1), losing an old age pension, increases the growth rate by 10% (also significant at .1). The latter could act as a proxy for funeral expenses related to the mortality of the pensioner. Rather than a labour market trap, such results seem to hint at the complex and multi-faceted role that particular government subsidies hold in the South African rural context, specifically the old age pension: as anti-poverty interventions and as potential indirect mitigation strategy for the negative economic effects of AIDS mortality. The old age pension holds a large role, in fact, protective of

"income" in high unemployment settings. The latter deserve further investigation, specifically vis a vis interventions aimed at favouring employment.

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