Inter-temporal changes in well-being during economic chaos: Evidence from Zimbabwe

Catherine Larochelle
Department of Agricultural and Applied Economics, Virginia Tech, Blacksburg 24061, USA.
Fax:1.540.231.7417
Telephone number: 1.540.231.5382
claroche@vt.edu.

Jeffrey Alwang
Department of Agricultural and Applied Economics, Virginia Tech, Blacksburg 24061, USA.

Nelson Taruvinga
Zimbabwe National Statistics Agency (ZIMSTAT), Harare, Zimbabwe

Acknowledgments:
The authors would like to thank Bradford Mills, George Davis, Gregory S. Amacher, Praveen Kumar, Nadia Piffaretti and several anonymous referees for very useful comments. The authors also thank the Central Statistical Office (now ZIMSTAT) in Zimbabwe for providing the data and information on its use. This analysis was supported by a World Bank trust fund on poverty analysis. All views are those of the authors and do not reflect the views of ZIMSTAT, the World Bank, or its member countries. We alone are responsible for errors.

Inter-temporal changes in well-being during a period of hyperinflation: Evidence from Zimbabwe

Abstract

In the last decade, the economy of Zimbabwe underwent unprecedented stress and change. Starting in 2000, land reform began with farm invasions. This process eventually evolved into government-guided fast-track land reform. During this process, the international community imposed sanctions, and these factors, together with a severe drought, led to a reduction in availability of the main food staple. Inflationary pressures built and were exacerbated by foreign exchange shortages. The economy slowed due to debt overhang and dwindling investment caused in part by increased uncertainty. Several factors contributed to deterioration of the value of the Zimbabwean Dollar and by mid-2007, hyperinflation became rampant. The economic crisis began to abate in 2008 and political agreements signed in 2008 and implemented in 2009 led to further stabilization. As Zimbabwe moves forward, it is important to understand the conditions faced by the poor, and how they have changed during the period of hyperinflation. To do so, this paper uses 2001 and 2007/8 nationally representative household data and an asset index to avoid reliance on money-metric measures during the period of hyperinflation. An asset index is constructed using polychoric principal component analysis for both periods. A profile of well-being in 2001 is obtained using consumption expenditures, which helps calibrate asset index poverty lines. The 2001 data are used to generate small-area poverty estimates for both survey years and to validate the robustness of the findings from the asset index. The asset index holds its own when compared to standard consumption expenditure methods and small area estimation-based predictions, providing confidence in our findings. Urban asset poverty declined during 2001-2007, but extreme poverty increased. Rural asset poverty and extreme poverty worsened between 2001 and 2007. For the best-educated households, poverty increased significantly. Conditions of communal and resettlement workers deteriorated, reflecting worsening economic conditions in rural areas.

Inter-temporal changes in well-being during conditions of hyperinflation: Evidence from Zimbabwe

1. Introduction

The decade beginning in 2000 was extremely difficult for Zimbabweans as economic and social crises contributed to widespread hardship. Economic stress grew out of trends evident during the latter years of the past millennium. Beginning in the early 1990s, the country began a process of structural adjustment that cut public sector employment, reduced government involvement in key sectors, and liberalized trade and foreign exchange markets. It was hoped that these actions would stimulate private sector growth, but into the 2000s the economy was not generating sufficient employment, and key sectors such as agriculture and mining were under-performing. A growing trade imbalance and shortage of foreign currency drove down the value of the Zimbabwean dollar, drove up food prices, and created shortages of fuel and food staples. For various reasons, the International Monetary Fund stopped budgetary support to Government in 1999 and the situation rapidly spiraled out of control. Toward the end of the 1990s, foreign investors began to abandon the country as investment risks rose.

Social tensions increased with continued failure to address economic problems. Several food riots occurred in 1998, and unrest grew as people became impatient with the slow pace of economic improvement. In rural areas, social conflict resulted from land invasions beginning in the late 1990s. Starting in 2000, land reform began with farm invasions which eventually evolved into a government-guided process of fast-track land reform. Together with a severe drought, these land disruptions led to reduced availability of the main food staple—maize. Maize exports felt dramatically and exacerbated foreign

exchange problems. By mid-2007, hyper inflationary forces were consuming the economy[1]. Confidence in the Zimbabwean dollar plummeted and people increasingly turned to transactions in foreign currencies such as the US dollar, South African Rand, and Euro.

Prospects for increased stability grew following the political agreements for power sharing reached following the 2008 national election. These agreements brought promise of a more stable economy. International donors are turning their focus away from short-term relief toward long-term investments to reinvigorate the economy and promote pro-poor growth. Since Independence in 1980, poverty reduction has been a focus of the Zimbabwean government, but there is widespread concern that recent economic instability has exacerbated an already precarious situation[2]. As Zimbabwe moves forward, it is important to understand conditions faced by the poor, how these conditions have changed over time, and how they vary among population sub-groups. Household asset bases, which contributed to income growth, have likely deteriorated during 2001-8, but the pattern of change and its implications for recovery are unknown.

Part of the challenge facing policy-makers is insufficient information upon which to make decisions. Analysis of the impacts of the crisis on households has been hampered by lack of nationally representative household data. Periods of pronounced inflationary pressure lower the reliability of more conventional money-metric measures of household well-being and poverty. It is now accepted wisdom that consumption expenditures are the preferred indicator of household well-being in developing countries

[1] The official rate of inflation at the start of 2009 was 231 million percent.
[2] Estimates of national poverty indicate that since at least the 1990s, more than 50 percent of Zimbabweans are poor (PASS, 2005).

(A. Deaton, 1997; Ravallion, 1992) but challenges to measurement of real consumption expenditures during periods of hyperinflation are daunting. Fortunately, alternatives to money-metric analysis exist; for example, there is a growing literature on use of asset indices to reflect household long-term economic status (Bollen et al., 2007; Filmer and Pritchett, 2001; Moser and Felton, 2007; Sahn and Stifel, 2000, 2003a; Wall and Johnston, 2008). This literature is expanding as interest is increasing in multidimensional poverty grows among policy makers (Alkire and Foster, 2011; Bourguignon and Chakravarty, 2003; Tsui, 2002)

This paper uses newly available data from identical nationally representative household surveys conducted in 2001 and 2007/8 to evaluate how well-being and asset positioning of Zimbabwean households have changed. The objectives are to: (i) test the use of an asset index to distinguish between households of different economic status; and (ii) understand how the profile of well-being and poverty has changed.

The Income, Consumption and Expenditure Surveys (ICES) of 2001 and 2007/8[3], conducted by the Central Statistical Office (CSO) of Zimbabwe[4] are used. These surveys produce information for national accounts and cost of living indices, and contain information on household demographics, asset ownership, schooling and health care, labor market participation, and household enterprises (Alwang et al., 2001a; Alwang et al., 2002). A money-metric measure of well-being is constructed using consumption expenditures from the 2001 ICES and asset indices from both survey periods are constructed using polychoric principal components analysis (Kolenikov and Angeles, 2009; Moser and Felton, 2007). The 2001 expenditure data are used to benchmark the

[3] The latter period is henceforth referred to as 2008.
[4] Now known as ZIMSTAT.

asset index. This benchmarking involves transforming the **2001 consumption** expenditure poverty lines into asset index cutoff values. These cutoffs reflect minimum levels of assets needed to avoid unsatisfactorily low levels of household well-being and are used to make well-being comparisons between periods. Robustness checks use other indicators of well-being and a regression-based model of poverty.

Findings show that the asset-based approach is a good means of profiling changes in well-being. The asset index approach produces similar findings to those of small area estimation-based poverty predictions while not requiring the use of consumption expenditure data. Rural asset poverty and extreme asset poverty grew significantly over time; overall asset poverty fell in urban areas, but extreme asset poverty grew. The 2001-8 period was more favorable for female-headed than male-headed households. Asset poverty decreased for households headed by a permanent paid employee, an indication of the economic stability associated with this employment type. Increased asset poverty and extreme poverty in rural provinces is due in part to the higher prevalence of poverty amongst households of communal and resettlements workers. These households owned fewer durable goods in 2008 than they did in 2001, suggesting that asset selling was employed to cope with the crisis. Non-poor households living in rural areas own significantly less livestock in 2008 compared to 2001, another indication of coping.

2. Conceptual framework and methods

Economic analyses of poverty usually employ money-metric measures of well-being with consumption expenditures being the preferred measure for use in developing countries (A. Deaton, 1997). A large literature has emerged on poverty measurement

using expenditures and it is now standard practice for development practitioners to create poverty profiles as a preliminary step in designing poverty-reduction interventions.

In the face of inflationary pressures, such as those experienced in Zimbabwe during 2007/8, use of household consumption measures to assess poverty is difficult, if not impossible. With monthly inflation rates exceeding 10,000 percent, the real value of consumption expenditures will depend on exactly when the product was purchased. While the ZIMSTAT collects data on prices, it is done once a month and, during 2007/8, prices were changing hourly or more frequently[5]. Although consumption expenditures were used by the CSO of Zimbabwe as measures of household well-being in its earlier poverty analyses (CSO 1998 & 2005), assessing changes in well-being during the highly inflationary context of 2007/8 requires an alternative measure. An excellent candidate is the asset-based methodology since it does not require the use of consumption expenditure data, and allows the analyst to avoid the problem of hyperinflation to examine well-being changes over time.

In addition to its intrinsic appeal in presence of high inflation, an asset-based approach has other attractive properties. First, it bears a close correspondence to long-term economic status (Filmer and Pritchett, 2001) and provides a closer representation of the permanent income hypothesis. In the short-run, expenditures will vary (although, generally, not by as much as income) in response to transitory shocks to income (Alwang et al., 2001b; Siegel and Alwang, 1999). However, changes in durable asset ownership usually result from long lasting shocks rather than transitory shocks (Filmer and Scott,

[5] Zimbabweans recall that in retail outlets prices of products would change between the time a queue was entered and the sale point was reached.

2008). An asset index measure will evolve slowly while measured consumption may fluctuate substantially (Booysen et al., 2008; Filmer and Pritchett, 2001; Sahn and Stifel, 2003a). While emergency programs need information on transitory poverty, longer-term development policies should be targeted to those living in permanent or frequent recurring poverty, which are more likely to be correctly identified by an asset index (Moser and Felton, 2007).

Second, an asset-based approach has instrumental value to risk management and long-term growth. As households face short-run fluctuations, strong asset bases help them manage risks. Recovery from shocks can be quicker if the household has a stronger asset base. Public investments to stimulate income and well-being growth can be more effective when household asset bases are strong (Jalan and Ravallion, 1998; Siegel and Alwang, 1999)

Third, the asset index overcomes liabilities associated with expenditure-based measures, such as price deflation to address differences over time and space, and lessens recall and measurement error biases. In addition, bypassing the need to collect consumption expenditures simplifies data collection and reduces its costs.

A challenge to employing an asset index is how to combine information on ownership of various assets into a single index. Researchers have overcome this problem by using techniques such as principal component analysis (PCA), factor analysis (FA) or multiple correspondence analysis (MCA); these methods allow the data to determine the appropriate weights of individual assets base on their statistical association. Using these techniques, an asset index score can be computed for each household as:

$$AI_i = \sum_{j=1}^{g} w_j a_{ij} \quad , \qquad (1)$$

where AI_i represents the asset index score of household i, a_{ij} is the ownership status of asset j, and w_j's are the weights to be estimated. Methods to estimate asset weights rely on different assumptions and some are more appropriate in certain contexts.

The main assumption behind PCA is that there is an underlying (unobserved) latent variable assumed to represent long-term well-being (AI_i), which can be observed through ownership of various assets (a_{ij}). The set of assets normally includes durable goods, housing characteristics, and access to public services and are expressed in the form of dummy variables (categorical variables are split into multiple binary variables). Weights are estimated according to the correlation structure and correspond to the eigenvectors of the first principal component of the covariance matrix. PCA is similar to Ordinary Least Squares (OLS), but residuals are minimized relative to all variables in PCA as opposed to only the dependent variable in OLS. PCA is more suited for use with continuous variables (Adbi and Valentin, 2007), and in the presence of ordinal data the assumptions that variables must be positively correlated with the latent variable and each other, and normally distributed are violated. In fact, when an ordinal variable is split into a set of dummy variables, the negative correlation between the variables brings noise to the estimation process (Kolenikov and Angeles, 2009).

FA and PCA are similar, but slightly different assumptions underpin them. In FA, the covariance matrix is assumed to represent a small number of unobserved common factors. Consequently, additional assumptions to define the model structure are needed (Sahn and Stifel, 2003a). PCA and FA yield asset indices with nearly identical ranking despite relying on different assumptions and mathematical structures (Filmer and Scott, 2008). MCA is a generalization of PCA allowing analysis of correlations between

categorical variables as opposed to only continuous variables. Categorical variables are split into multiple binary variables as for PCA and FA. As MCA is designed to deal with ordinal variables and produces weights for assets that are consistent with the natural ranking of the variable in question. However, this is not always true when weights for categorical variables are obtained through PCA (Booysen et al., 2008).

Kolenikov and Angeles (2009) and Moser and Felton (2007) argue that in the presence of categorical variables, polychoric PCA (p-PCA) is most appropriate. In p-PCA, weights are obtained by estimating a polychoric correlation matrix and not a covariance matrix. Before deriving weights using p-PCA, categorical variables are ranked according to their natural ordering as opposed to being split into binary variables as with PCA, FA, and MCA. By ordering the data, the researcher brings additional information, improving efficiency. Polychoric PCA also provides separate weights for owning and not owning an asset, allowing the index to reflect asymmetries in the ownership/well-being relationship (Kolenikov and Angeles, 2009).

We build on the asset index approach discussed above and combine it with a more traditional approach to a poverty profile. p-PCA is employed to compute asset weights and an asset index score for each household. The 2001 asset index is compared to observed consumption expenditures as an indicator of economic status for that year. Asset poverty profiles are prepared with the index and changes in poverty patterns over the two survey periods are compared. A robustness check involves comparing findings with alternative methods.

3. Data

The fourth ICES[6], was implemented from January through December 2001 containing 12,192 rural and 6,490 urban observations. This was compared with the fifth ICES, conducted from July 2007 through June 2008 and containing 11,221 rural and 2,973 urban observations. Questionnaires are virtually identical, but consumption expenditure data from the fifth ICES are not suitable for use due to hyperinflation.

A good measure of consumption expenditures was constructed using the 2001 data. The measure includes the value of all goods and services consumed in the previous month. The value of all foods, other non-durable goods and directly consumed services, such as education and health[7], are included, as are flows of consumption values from ownership of durable assets, the value of housing services for owner-occupied housing[8], and values of gifts, transfers and remittances. Two poverty lines were constructed using 2001 price data: the food poverty line (FPL), corresponding to the food basket providing at minimum cost household food energy needs, and the total poverty line (TPL), which accounts for non-food basic needs (CSO, 1998). Households with real per capita consumption expenditures[9] below the TPL are considered poor and those below the FPL, extremely poor.

[6] The ICES contains information on socio-demographic characteristics, incomes, economic activities, and expenditures on more than 230 food and 330 non-food items. Estimated values of consumption of own-account production items, gifts, transfers, and in-kind payments are also recorded in the survey.
[7] Angus Deaton and Zaidi (2002) argue that health expenditures should not be included in construction of a consumption aggregate. We include them here because it is the consistent practice of ZIMSTAT to do so. Sensitivity analysis shows that the results are not sensitive to this inclusion.
[8] The value of owner-occupied housing was computed using a hedonic regression for houses for which rents were reported. Predicted rents from separate regressions were used to impute housing values for each survey year. Details are available from the authors.
[9] Prices were deflated using month- and province-specific price indexes. We follow the Zimbabwean convention and do not adjust for economies of scale or adult equivalents (Alwang, et al., 2002).

4. Construction and estimation of the asset index

The asset index is a multi-dimensional measure of poverty. It captures a money-metric dimension, through ownership of private assets, and a welfare one, through access to quasi-public assets such as sanitation. The asset index is computed using p-PCA and includes variables that met two criteria: i) variables with returns that are unlikely to change over time, and ii) variables that can differentiate between poor and non-poor households based on the 2001 poverty analysis using per capita expenditures as the welfare measure. The first criterion is referred as the stability or stationary assumption (Christiaensen et al., 2012; Stifel and Christiaensen, 2007). To limit potential bias resulting from departures from this assumption, some durable goods are excluded, such as cellular phones, whose prices have changed over time. Assets linked to human capital are also excluded, as returns to these assets are prone to change, especially during periods of economic turmoil.

Thirteen variables met the criteria and are grouped into three categories: i) durable goods, which includes radio, television, refrigerator, bicycle, automobile, sewing machine, stove, and heater; ii) housing characteristics, comprised of dwelling type, main source of cooking fuel, and access to electricity; and iii) access to sanitation, which encompasses type of toilet facility and main source of drinking and cooking water (table 1).

[Table 1]

Preliminary investigations indicate that rural poverty would be overstated and urban poverty underestimated (based on 2001 per capita consumption expenditures) if a unique index is estimated for both locations. The propensity of the asset index to rank

rural households poorer than per capita expenditures is discussed in Filmer and Pritchett (2001), Christiaensen et al. (2012), and Booysen *et al.* (2008). Filmer and Pritchett (2001) conduct their analysis using either only rural data, or when pooling data, control for location. Christiaensen et al. (2012) estimate three asset indices: one for rural Kenya, urban Kenya, and Nairobi. Because of differences in the asset/well-being relationship, estimated weights should be location-specific (Jamal, 2005; Lindelow, 2006; Montgomery et al., 2000; Sahn and Stifel, 2003a; Stifel and Christiaensen, 2007; Vyas and Kumaranayake, 2006).

Estimated coefficients are derived by pooling the 2001 and 2008 survey data[10], increasing the precision of the estimates. Weights are referred to as "pooled weights" instead of "baseline" or "year-specific weights" and are averages over 2001-2008 (Booysen et al., 2008). The "year-specific" and "pooled" weights are similar and yield asset indices with coefficient of correlations near one (ρ=0.999), validating our strategy.

Asset index scores

While difficult to interpret, the p-PCA coefficients (table 2) reflect the benefit of owning or the penalty of not owning a particular asset or owning an asset of inferior quality. A positive (negative) coefficient reflects a higher (lower) relationship between asset ownership and household well-being. An individual household's asset index score must be interpreted relative to other scores.

[Table 2]

To improve our understanding of the source of changes, the asset index can be decomposed into three sub-components,

[10] The following used pooled data: Stifel et al. (1999), Sahn and Stifel (2000), and Moser and Felton (2007)

$$AI_i = \sum_{j=1}^{n} w_j a_{ij} = \sum_{j=1}^{k} w_j DG_{ij} + \sum_{j=k+1}^{m} w_j HD_{ij} + \sum_{j=m+1}^{n} w_j AS_{ij} \quad (2)$$

where components DG_{ij} represents durable goods, HC_{ij} housing characteristics, and AS_{ij} access to sanitation for household *i.* Changes in each sub-component are examined for different population sub-groups between 2001 and 2008 to understand how structural changes in the economy have affected different dimensions of household well-being.

$$\Delta AI_{2001,2008} = \Delta DG_{2001,2008} + \Delta HC_{2001,2008} + \Delta AS_{2001,2008} \quad (3)$$

F statistics test statistical significance of each component.

Establishing poverty lines

In contrast to studies employing arbitrary cut-off values as poverty lines, e.g. the 25th and 40th percentiles, asset poverty lines are determined endogenously to replicate measured 2001 consumption expenditure poverty levels. Cumulative distribution functions (CDFs) of the 2001 asset index are calculated for rural/urban households separately. These CDFs are used as reference points to identify asset index values that preserve the poverty headcounts for the poor and extremely poor in 2001. These cut-off values[11] represent the asset poverty lines for 2001 and 2008.

Correspondence between the asset index and expenditures per capita in 2001

Various factors affect the congruence between the asset index and per capita expenditures. First, agreement tends to be higher for middle-income countries compared to low-income countries (Howe et al., 2009). Second, in countries with few transitory shocks, expenditures and asset indices will be both closely linked to the concept of

[11] Specific index values are -.04305 (0.3451) for urban (rural) poverty and -2.1405 (-0.3756) for urban (rural) extreme poverty.

permanent income and thus, more likely to be highly correlated. Third, asset indices are more connected to the non-food component of consumption expenditures. Thus, countries where food expenditures represent a large part of total expenditures have weaker agreement between asset indices and consumption expenditures (Filmer and Scott, 2008). According to standard classification Zimbabwe is a poor country, where shocks are common, and food expenditures are the bulk of total expenditures. Therefore, a smaller correlation is expected between the asset index and consumption expenditures compared to studies where conditions for high convergence between the two measures are met.

The Spearman rank correlation coefficient between consumption and asset-based well-being using 2001 data is 0.4155 for rural areas and 0.3616 for urban areas. These values are consistent with expectations due to the specific economic situation of Zimbabwe, and are within ranges reported in previous studies with similar context. Filmer and Pritchett (2001) report Spearman rank correlation coefficients between asset indices and consumption expenditures of 0.43 for Pakistan, 0.56 for Indonesia, and 0.64 for Nepal. Rank correlations between the two measures are as low as 0.31 for Jamaica and as high as 0.71 for Peru and South Africa in Sahn and Stifel (2003a). Booysen *et al.* (2008) find that their asset index, constructed using the Ghanaian Living Standards survey, has a correlation coefficient and Spearman rank correlation coefficient with household per capita expenditures of 0.421 and 0.493, respectively.

The imperfect correlation between consumption expenditures and asset index values does not imply that the asset index is an inappropriate measure, but rather that the two measures capture slightly different concepts of well-being. Borrowing terminology

from Carter and Barrett (2006), consumption expenditures reflect stochastic poverty while the asset index reflects structural poverty. The asset poverty line indicates whether households' current asset base is predictive of future living standards below or above the poverty line. Due to the static nature of the asset poverty line it is impossible to validate whether households' structural poverty status will remain unchanged over time (Carter and Barrett, 2006). Despite this limitation, we argue that asset poverty (structural poverty in Carter and Barrett's terminology) bears a closer correspondence to household long-term socio-economic status than current consumption expenditures (Filmer and Pritchett, 2001; Sahn and Stifel, 2003b).

Consumption expenditures best capture transient poverty, which reflects short-term consumption variability and the longer-term position of the household relative to the poverty line. Chronic poverty is the component that remains after inter-temporal variability in consumption has been removed (Bourguignon and Chakravarty, 2003). Two of the three asset index components-- ownership of durable goods and housing characteristics-- are accumulated over time, reflecting the evolution of previous socio-economic conditions rather than its *current* economic status. In addition, asset sales and deterioration are more likely to be the result of long lasting shocks rather than transitory ones (Filmer and Scott, 2008). Thus, the asset index is an attractive means of distinguishing between more-permanently poor and non-poor households.

In the absence of panel data to test this hypothesis, this study examines differences in poverty profiles across the two welfare measures. We mainly focus on the determinants of transient and chronic poverty identified in Bourguignon and Chakravarty

(2003) to show the ability of the asset index to distinguish between households with different long-term socio-economic positions.

A comparison of poverty status using the per capita expenditures (with the 2001 official poverty lines) with the asset index (calibrated by asset index cutoffs) reveals that over 75 percent of households in the 2001 ICES (83 percent of rural and 44 percent of urban) are consistently ranked as poor, suggesting good congruence between the two measures. We find fairly consistent patterns in poverty profiles across the two welfare measures as well as differences supportive of the asset index being a good predictor of household long-term economic status (tables 3 and 4).

[Table 3]

The asset index yields a higher prevalence of poverty among female-headed households compared to consumption expenditures (table 4)[12]. The 2001 ICES provides evidence that differences in gender-related poverty by welfare measure could reflect women's spending preferences towards food and schooling versus durable goods. Female-headed households devoted a statistically significant greater fraction of their expenditures to food (56.1 percent versus 50.9 percent) and schooling (1.1 percent versus 1.0 percent) compared to male-headed households, meaning that a smaller share of income remains to be spent on durable goods. This helps explain why female-headed households appear worse off using the asset index measure.

[Table 4]

Household head educational attainment is highly correlated with household poverty status regardless of the method (table 4). Households with uneducated heads are

[12] The same trend is found in urban areas but the differences are not statistically significant.

most likely to be poor and those headed by better-educated members are least likely to suffer from poverty. For households headed by an uneducated member, predicted asset poverty is significantly higher than predicted consumption expenditure poverty in rural areas. This indicates that the asset index has better ability to identify the more-permanently poor households. Similarly, a smaller fraction of households headed by a member who completed post-secondary education appear poor using the asset index compared to consumption expenditures. This is consistent with Bourguignon and Chakravarty (2003) findings that labor force educational achievement is a strong determinant of chronic poverty but insignificant in explaining transient poverty. It also supports the notion that long-term wealth is best captured by an asset-based measure while consumption expenditures do a better job at identifying transient poverty.

Households headed by an *uneducated* member own fewer durable goods, have housing of lower quality, and have access to fewer public services compared to households headed by a member who completed *primary* school. Similarly, durable goods ownership is considerably higher for households headed by a member who completed *post-secondary* compared to those headed by a member with *secondary* education. These results suggest that education is an important determinant of asset accumulation. Bird and Shepherd (2003) also find that educated households own more assets and suggest that the asset index approach may best capture the well-being contribution of these assets.

Regardless of the method, rural households headed by a permanent paid employee are least likely while households of communal and resettlement workers are most likely to be poor (table 4). However, predicted asset poverty among rural households headed by

a permanent paid employee is about 10 percentage points lower than predicted poverty measured using consumption expenditures. This finding is in line with Bourguignon and Chakravarty (2003) who find that having a household member working in the state sector greatly reduces chronic poverty while not being a significant determinant of transient poverty. Again, this suggests that the asset methodology might best reflect long-term economic status.

General conclusions about the asset index

Poverty characterizations differ slightly depending on the methodology, but the analysis shows that the asset index has good ability to distinguish between households of different long-term socio-economic status. In accordance with Filmer and Scott (2008), findings suggest that an asset-based measure might better reflect higher levels of well-being enjoyed by households with higher levels of education and labor force attachment, which are also important determinants of chronic poverty. Assets are accumulated over time and are durable. Asset approaches reflect this continuous flow of well being-enhancing services while expenditure measures provide a snapshot of standard of living.

5. Inter-temporal and rural-urban poverty changes in Zimbabwe, 2001 and 2007/2008

Urban/rural inequalities widened substantially in Zimbabwe between 2001 and 2008. The predicted incidence of rural poverty and extreme asset poverty increased significantly from 72.7 percent to 77.9 percent and from 41.3 percent to 46.8 percent, respectively (table 6). In particular, rural poor and extremely poor households have significantly lower scores for durable goods and housing characteristics in the latter

years. The index scores associated with access to sanitation dropped for rural poor households and remained very low for extremely asset poor households. Urban household asset poverty decreased from 31.9 percent to 27.0 percent and extreme poverty increased from 9.6 percent to 12.7 percent. Differences are statistically significant at the 5 percent level. In 2008, asset index scores of poor and severely poor urban households are significantly greater for durable goods but lower for housing characteristics and access to sanitation, suggesting changes in the asset-base of the urban poor (table 6).

[Table 6]

Geographical spread of poverty

Predicted poverty and extreme poverty decreased significantly from 2001-8 in the highly urbanized provinces of Bulawayo and Midlands (table 7) suggesting a positive relationship between urbanization and poverty reduction. Decomposing the well-being index into its three sub-components indicates stable ownership of durable goods, better access to sanitation, and higher quality housing for the average poor household living in Bulawayo in 2008 compared to 2001.

[Table 7]

In contrast to other urban areas, extreme asset poverty increased significantly in Harare, from 9.6 percent to 20.6 percent, while overall poverty remained nearly constant. Exacerbation of extreme asset poverty in Harare can be explained by the influx of rural poor households moving in search of new opportunities (Dekker and Kinsey, 2011). To cope with the economic challenges of living in the capital, poor households reported moving into cheaper accommodations (Brown and Funk, 2010). Consistent with these

observations, in 2008 extremely poor urban households in Harare lived in lower-quality housing with less access to sanitation compared to their cohort in 2001.

Poverty and household head characteristics

In rural areas, the poverty prevalence increased by about 7 percent for male-headed households while increasing by only 2 percent for their female counterparts (table 4). In urban areas, poverty decreased significantly for both male- and female-headed households but the magnitude of the change is greater for female-headed households, resulting in lower poverty prevalence amongst female- than male-headed households in 2008. Female-headed households invest more in human capital (as shown above) and those able to do so invest more in productive assets than male-headed households (Bird and Shepherd, 2003), making it possible for them to escape poverty over time.

Asset poverty among rural households whose head has no formal education did not change significantly between the two periods. However, an increase is observed in poverty among households whose head has primary, secondary, and post-secondary education (table 4), while the greatest increase is among those with post-secondary education, going from 12.9 percent in 2001 to 27.1 percent in 2007/8. Worsening of living conditions of professionals in Zimbabwe can be explained in part by the deterioration in employment opportunities and poor wages associated with the economic crisis. Between January and April 2007 approximately 4500 teachers resigned due to inadequate compensation. While some left the country to teach in South Africa, others have taken work during the Zimbabwean schooling holidays in South Africa in sectors such as construction and agriculture in order to supplement their poor wages. The health care sector in Zimbabwe is believed to have lost up to 80 percent of its health

professionals such as doctors, nurses, pharmacists, and therapists, many of whom have migrated to other countries (Moyo and Besada, October 18, 2008). Chikanda (2007) reported that 68 percent of public sector health professionals in Zimbabwe have difficulty living on their salaries and more than three-quarters agree that additional employment is needed for public health sector professionals to make ends meet.

Poverty and employment sector of the household head

Poverty decreased between 2001 and 2008 for households headed by permanent paid employees (table 4) in rural and urban areas. This result is likely attributable to the steadier earnings and greater economic stability associated with this type of employment, allowing these households to accumulate assets more easily. In rural areas, only households headed by a permanent paid employee accumulated durable goods between 2001-8, but this form of employment is declining over time. In 2001, 89 percent of household heads with post-secondary education worked as permanent paid employees; this proportion dropped to 79 percent in 2008. In urban areas, the proportion of household heads with post-secondary education who work as a permanent paid employee plunged from 73 percent to 62 percent between 2001 and 2008.

Measured asset poverty among communal and resettlement area workers (the largest share of the rural population) increased modestly but significantly from 84.8 to 87.5 percent between 2001 and 2008 (table 4). Poor households in communal and resettlement areas own fewer durables in 2008, an indication that asset selling took place in response to the economic crisis.

Poverty and household characteristics

A significant increase is observed in household size and dependency ratio of poor urban households (table 5). These changes in household composition are consistent with migration of rural households to urban areas in search of better economic opportunities. The increased size of urban poor households could reflect desperate rural households crowding in with relatives. Household members who are not immediate family members made up 10.7 percent of poor urban households in 2001 compared to 13.3 percent in 2007/8, a statistically significant increase.

[Table 5]

Changes in livestock, productive assets, and land ownership in rural Zimbabwe

In order to gain additional insights on how well-being changed during the period of crisis in rural areas we briefly explore changes in livestock, agricultural productive assets, and land ownership. In rural areas of Zimbabwe, wealth is mainly stored in livestock (Dekker and Kinsey, 2011). In 2001, non-poor households owned significantly more cattle and poultry but significantly fewer goats than poor households. When expressed in terms of livestock equivalent[13], livestock assets in 2001is significantly greater among non-poor than poor households. Non-poor households own fewer cattle in 2008 and, as a result, the difference in livestock equivalent between asset poor and non-poor rural households is no longer significant in 2008 (table 8). Poultry ownership is slightly but significantly lower for poor households in 2008 compared to 2001. During periods of stress, Zimbabwean households maintain current consumption by selling

[13] The livestock equivalent conversion factors employed are based on Tropical Livestock Units and correspond to the following ratios: Cattle=1, Poultry=0.05, Pigs=0.75, Sheep=Goat=0.1, and Donkey=0.5.

assets, which is consistent with the disinvestment in livestock observed among poor and non-poor households (Mutenje et al., 2008).

[Table 8]

A strong relationship is observed between asset poverty and productive asset ownership. A greater fraction of non-poor households own a grinding, tractor, scotchcart, and wheelbarrow while plough ownership is more common among poor households irrespective of the survey year (table 8). Deterioration in productive asset ownership is minimal between the two surveys, reflecting the durability of these assets and their necessity to generate a livelihood.

Arguably, the most important asset for rural Zimbabweans is their land, and changes in access to land have emerged over time. Non-poor households held significantly more land in 2001 (6.1 ha on average) compared to poor households (2.3 ha). In 2008, non-poor and poor households held, respectively, 3.9 and 3.4 ha, a non-significant difference (table 8). To investigate further, we break down holding sizes by land use areas (table 9). As it has been widely reported, the commercial agriculture sector underwent violent upheaval during 2001-2003 as fast-track resettlement dramatically reshaped the commercial sector.

[Table 9]

In communal areas, non-poor and poor households hold little land and holding patterns between the two groups differ only slightly in 2001; non-poor households held about 2 ha compared to 2.17 ha for the poor (most communal land is held in common) (table 9). While small, this difference is statistically significant. However, the larger

amount of land held by asset poor households reflects the negative correlation between land ownership and land quality in communal areas. Non-poor (2.61 ha) and poor (2.51 ha) households held significantly more land in 2008 compared to 2001. Reduced land pressure in communal areas is explained by the land redistribution in commercial farming areas. It is also explained by migration of the rural poor to urban areas.

The data indicate a strong effect of land resettlement on holding sizes in commercial farming areas. In 2001, non-poor households in small-scale commercial farming areas reported owning 29.55 ha of land compared to only 2.41 ha for poor households. In 2008, differences in land holdings between poor and non-poor households living in small-scale commercial farms are no longer significant. Land holdings decreased about 10-fold for non-poor households, while holding sizes reached 3.59 ha for asset poor households in 2008; the difference for poor households is significant at the 10 percent level. This result suggests that as a result of land resettlement, non-poor households living on small-scale commercial farms have lost a significant amount of farmland while holding sizes of poor households remained relatively stable.

In 2001, land holding on large-scale commercial farms among non-poor households (8.04 ha) was significantly greater than for poor households (0.40 ha). In 2008, poor households owned significantly more land (4.81 ha) and as a result, differences in land holding between non-poor and poor households are no longer statistically significant. This finding reflects the process of land redistribution; extremely poor households invaded commercial farms and occupied them with meager assets. There is evidence, however, that their asset position has improved since 2008 (Scoones et al., 2010)

In resettlement areas, differences in land holdings between non-poor and asset poor households are not statistically different for both survey periods. In 2001, non-poor households owned 7.45 ha compared to 8.19 ha for the asset poor. In 2008, land ownership for non-poor and poor resettlement households decreased significantly to 3.64 ha and 4.14 ha, respectively.

In summary, in 2001 non-poor households living on small- and large-scale commercial farms had more land than poor households; in resettlement areas the difference in holding sizes by household asset poverty status is not statistically significant, and in communal areas (where land area and land quality are negatively correlated), non-poor households hold slightly less land than poor households. In 2008, land ownership did not significantly differ by poverty status in any of the four major land use areas in Zimbabwe.

6. Robustness checks

The results paint a rich picture of changes in patterns of asset poverty over time. Due to measurement problems linked to hyperinflation in Zimbabwe, poverty estimates for the 2001-8 period are inexistent. Falling short of statistics on poverty, asset poverty incidences are compared with other indicators to build confidence in the findings. As robustness tests, we first compare our poverty estimates with the evolution of household asset base, and monetary and non-monetary indicators. Second, rural poverty trends from the asset index are compared with those obtained from a regression-derived economic asset index (Christiaensen et al., 2012). The economic asset index method starts by regressing per capita expenditures (from 2001) on assets. Estimated coefficients are used

as asset weights to predict per capita expenditures for the 2008 survey, and poverty indicators are computed.

Household asset base

The evolution of household asset bases from 2001-08 provides additional insights into patterns of welfare changes. In urban areas, consumer durable goods ownership increases, mainly for televisions, refrigerators, and stoves (table 1). As expenses toward durable goods do not compete directly with subsistence expenditures such as food, the higher rates of durable goods ownership may indicate a modest increase in income among urban households[14]. The flow of services derived from owning these goods might also have improved returns to other assets, such as labor. Possession of a stove and refrigerator reduces time in meal preparation, making it possible to dedicate more resources toward income generation while television ownership facilitates access to information (Christiaensen et al., 2012).

In rural areas, households have less access to adequate sanitation (table 1) and live in lower-quality housing in 2008 compared to 2001. These changes are reflected in the asset index as a higher prevalence of asset poverty and extreme poverty. If the lack of access to proper sanitation increases illnesses, the asset poverty estimates might in fact understate the reduction in well-being in rural areas. Health problems, in addition to being a financial burden, may reduce labor availability and lower income generation.

In 2001, 12.4 percent of the rural population reported being ill in the prior month. This compares to 15.2 percent in 2008, a highly significant difference. In contrast, the

[14] It might also reflect increased storage of wealth in the form of physical assets. As financial asset values plummeted in the economic crisis, households quickly converted whatever money they had to durable assets.

prevalence of reported illness in urban areas did not change between 2001 and 2008, staying at 11.2 percent. Roughly equal percentages of rural people (about 36 percent), did not seek any care in both 2001 and 2008. However, inability to afford treatment rose substantially as the main reason for not seeking treatment for illness (from 18 to 29 percent in 2007/8). Reporting that treatment was unnecessary as the main reason for not seeking medical treatment decreased from 21.5 to 19.6 percent between 2001 and 2008; in addition to being ill more frequently, rural households were more severely ill in 2008. These findings build confidence in the asset-based story told above; conditions deteriorated for rural households, and improved slightly for those in urban areas.

Monetary and non-monetary indicators of well-being

The asset poverty predictions are consistent with the evolution of various Zimbabwe GDP measures. In 2001, per capita GDP annual growth was 0.9 percent, which dropped to -3.3 percent in 2007, and -17.5 percent in 2008[15]. A breakdown by sector of the economy reveals that the agriculture sector was the most severely affected. Its annual growth rate plunged from 14.0 percent in 2001 to -7.0 percent in 2007, and to -39.3 percent in 2008. The annual growth rate of the industry sector was -6.6, -3.8, and -19.7 percent in 2001, 2007, and 2008, respectively while the services sector had an annual growth of -0.5, -2.1, and -5.2 percent for the same time period. Since the industry sector performed better in 2007 than 2001 and about 85 percent of the 2008 data was collected in 2007, these figures support asset-based estimates of a reduction in urban poverty between 2001 and 2008.

[15] World Bank, http://databank.worldbank.org/data/home.aspx

As an additional robustness check, the asset poverty estimates are compared with estimates of prevalence of child malnutrition, derived from the 1999, 2005, and 2010 DHS. The percentage of children under age 5 whose weight for age is more than two standard deviations below the international standards was 11.5, 14.0, and 10.1 in 1999, 2005, and 2010, respectively[16]. The prevalence of stunting among children under age 5 follows a similar trend. Stunting affected 33.7 percent of the children under age five in 1999, increasing to 35.8 percent in 2005, and declines in 2010 to 32.3 percent. This suggests a worsening of the socio-economic conditions towards the middle of the 2000s, consistent with our findings that rural poverty and extreme poverty as well as overall extreme poverty increased between 2001-8 in Zimbabwe.

Economic asset index

To further verify the findings, the small area estimation (SAE)-based poverty prediction method is applied and compared to the asset results. SAE, also referred as poverty mapping, was introduced by Elbers et al. (2003) to project consumption expenditures from surveyed areas to non-surveyed ones. The method was adapted to predict consumption expenditures from a household budget survey based on similar data sets lacking consumption data, such as Demographic and Health Surveys (Christiaensen et al., 2012; Stifel and Christiaensen, 2007). This method is also called economic asset index since assets are directly linked to consumption expenditures, providing a link to utility theory (Stifel and Christiaensen, 2007). The first step of the adapted SAE methodology consists of estimating an empirical model of per capita consumption (c_t) as a function of observed household assets (x_t). In the first step the relationship between

[16] Source: World Development Indicators, http://data.worldbank.org/data-catalog/world-development-indicators

individual consumption (c_t) and assets (x_t) is estimated in a log-linear fashion (household subscripts omitted) and a correction for heteroskedasticity is applied:

$$ln\ c_t = \beta_t x_t + u_t \quad (4)$$

Then, in the second step estimates of $ln\ c_{t+k}$. are calculated based on x_{t+k} and estimates of u_{t+k} and β_{t+k}, which are drawn from the empirical distribution of u_t and β_t obtained by estimating equation 4. In the last step, poverty estimates are derived from c_{t+k}. This methodology requires the assumption that the distribution of β remains constant over time, which is conceptually similar to the assumption employed in the asset index approach that the asset/well-being relationship did not change over time.

More precisely, the simulations involve drawing the beta coefficients from a multivariate normal distribution based on coefficient values and their variance-covariance matrix. These simulated betas, $\tilde{\beta}_t^s$, are multiplied by assets x_{t+k} to predict per capita consumption expenditures. In addition, it is assumed that the error term μ_t ($\mu_{cht} = \eta_{ct} + \varepsilon_{cht}$) is made up of two components-- a location-specific term (η_{ct}) and household-specific term (ε_{cht}), both independent and uncorrelated with the explanatory variables. This specification allows capturing spatial autocorrelation (with η_{ct}) and household-level heteroskedasticity (with ε_{cht}). The location-specific term is a within-cluster mean of the overall error term and is estimated as:

$$\hat{\eta}_{ct} = \frac{1}{N_c} \sum_{h=1}^{N_c} \hat{\mu}_{cht} \quad (5)$$

$N_c$is the number of households within cluster c, where the clusters in this study correspond to survey enumeration areas. The household-specific term is obtained by subtracting the location-specific term from the overall error term:

$$\hat{\varepsilon}_{cht} = \hat{\mu}_{cht} - \hat{\eta}_{cht} \quad (6)$$

Then, both error components are simulated. The location-specific term is drawn from a gamma distribution with mean zero and variance $\hat{V}(\hat{\eta}_{ct})$ while the household-specific component is drawn from a normal distribution with mean zero and variance $\hat{V}(\hat{\varepsilon}_{cht})$. The three simulated components are combined together to obtain simulated per capita household expenditures: $\hat{c}^{s}_{cht+k} = \exp(\widetilde{\beta}^{s}_{t} x_{cht+k} + \widetilde{\eta}^{s}_{ct} + \widetilde{\varepsilon}^{s}_{cht+k})$, which is then used to calculate poverty incidence. A distribution of poverty estimates is obtained by repeating the above process for 100 simulations[17].

Equation 4 is estimated for rural Zimbabwe, with x_t being the same asset variables as in the statistical asset index. Despite not including time-varying factors, 30 percent of the variation in per capita consumption in rural Zimbabwe is explained by these assets, compared to 21 percent for rural Kenya in Stifel and Christiaensen (2007), who did include time-varying factors (table 10). Before simulating poverty rates for 2007/8, poverty estimates are simulated for 2001 and compared with the observed poverty rates. The estimates are not statistically different from the rates obtained from the asset approach, suggesting that the model works well.

[Table 10]

The simulated poverty and extremely poor poverty rates for rural Zimbabwe in 2008 are consistent with those obtained from the statistical asset index, but the magnitude of changes is smaller. The economic asset index suggests that poverty prevalence increased from 72.4 percent to 75.5 percent in rural Zimbabwe between 2001 and 2008

[17] The mean of the distribution is reported as a poverty point estimate while the standard deviations can be perceived as the standard errors.

while extreme poverty rises from 41.3 percent to 44.7 percent. Using the statistical asset index, poverty reached 77.9 percent and extreme poverty, 46.8 percent in the later years.

7. Conclusion

It is possible to evaluate inter-temporal changes in household well-being without consumption expenditure or income data. An asset-based estimation method was used to explore how poverty profiles differ between expenditure-based and asset index methods in Zimbabwe. The asset index does a good job reflecting differences in economic status of different population sub-groups; differences in outcomes are easily explained by the relative importance of assets in each measure. We conducted several robustness checks and find that the asset measure holds its own when compared to standard consumption expenditure-based methods, and regression-based small area-based techniques. Findings are easily explained and confirmed by the logic of changes observed in Zimbabwe.

The asset index methodology shows potential for expanded poverty analysis. Issues associated with money-metric measurements are minimized, facilitating comparison over time and space. Measurement error and recall biases are minimized using the approach, and survey fatigue accompanying standard efforts to measure expenditures does not result. Data requirements are much lower than for consumption expenditures, reducing data collection costs. In cases where consumption expenditures cannot be measured, or when they have low validity, such as in the case of hyperinflationary periods, the asset approach is a viable alternative.

Asset-based approaches provide a different window into understanding of depravation and allow focus on longer-term evolution of well-being. In cases where

consumption expenditures can be measured, asset approaches can complement money-metric approaches. They allow nuanced insight into the co-evolution of short- and longer-term depravation, and provide information on the potential for use of asset accumulation as an instrument for poverty reduction. Past patterns of accumulation and their relationship to well-being generation might not hold in the future, but the same may be said about any association. Without other knowledge, however, the past is likely to be the best predictor of the future.

While a consumption-based measure would be clearly preferred to measure short-term changes in well-being and targeting--for example, drought relief efforts--the asset approach seems perfectly suitable for long-term monitoring.

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Table 1: Private asset ownership, housing characteristics, and access to sanitation by region and year, Zimbabwe

	Rural		Urban	
	2001 (%)	2008 (%)	2001 (%)	2008 (%)
Private Assets				
Radio	46.01	31.62*	71.38	66.74*
Television	8.93	8.82	51.76	64.10*
Refrigerator	2.68	2.23*	31.47	37.93*
Stove	3.42	4.03*	75.95	81.21*
Heater	1.14	1	18.93	19.03
Bicycle	22.01	20.14	19.7	19.39
Automobile	1.78	1.13*	9.34	9.25
Sewing machine	12.55	8.74*	22.74	20.31*
Dwelling				
(1)[1] Traditional	40.98	41.75	0.29	0.17
(2) Mixed	41.93	45.73*	0.26	1.30*
(3) Detached	9.03	7.04*	56.3	54.55
(4) Semi-detached	7.25	4.79*	30.92	30.8
(5) Flat/Townhouse/Other	0.82	0.68	12.23	13.2
Cooking fuel				
(3) Electric or gas	3.21	2.68*	76.77	76.88
(1) Wood or coal	95.74	97.12*	16.42	22.91*
(2) Paraffin or other	1.05*	0.20*	6.82	0.21*
Electricity				
Yes	11.22*	13.76*	88.62	84.84*
Access to sanitation				
(4) Flush	4.37	3.18*	95.89	93.01*
(3) Blair toilet	44.13	33.59*	2.7	4.94*
(2) Pit latrine	9.79	20.77*	1.31	1.1
(1) None/Other toilet	41.71	42.45	0.1	0.93*
Water source				
(6) Piped inside house	2.67	1.52*	28.57	38.45*
(5) Piped outside house	3.38	4.45*	66.01	53.25*
(4) Communal tap	14.6	8.22*	4.28	2.16*
(3) Protected well/borehole	53.3	54.64*	1.03	5.23*
(2) Unprotected well	18.05*	21.89*	0.02	0.90*
(1) River/Stream/Dam/Other	8.00*	9.28*	0.09	0.01

Source: 2001 and 2007/8 ICES surveys.

*Signifies that means are statistically different at the 5 percent significance level between 2001 and 2007/8.

[1] The numbers in parentheses represent the ordering of categorical type variables. Lower values indicate assets of inferior wealth and the higher values, assets of superior wealth.

Table 2: Asset weights derived through p-PCA estimation using pooled data

		Coefficients[1]	
Assets	**Ownership categories**	**Urban**	**Rural**
Sewing machine	0. Does not own	-0.078328	-0.03971
	1. Owns	0.285177	0.320467
Radio	0. Does not own	-0.295358	-0.147357
	1. Owns	0.133651	0.229713
Television	0. Does not own	-0.307109	-0.056625
	1. Owns	0.213646	0.554842
Refrigerator	0. Does not own	-0.188319	-0.023236
	1. Owns	0.343283	0.78784
Electricity	0. Does not own	-0.569269	-0.073051
	1. Owns	0.089263	0.495121
Stove	0. Does not own	-0.487174	-0.032008
	1. Owns	0.129464	0.742912
Heater	0. Does not own	-0.100988	-0.013005
	1. Owns	0.425946	0.862685
Bicycle	0. Does not own	-0.029768	-0.047631
	1. Owns	0.120523	0.169832
Automobile	0. Does not own	-0.045505	-0.012627
	1. Owns	0.430408	0.663343
Cooking fuel	1. Wood or coal	-0.469248	-0.028816
	2. Paraffin or other	-0.263919	0.578536
	3. Electric or gas	0.133148	0.718361
Toilet	1. None/Other toilet	-0.783595	-0.242694
	2. Pit latrine	-0.6281	-0.003248
	3. Blair toilet	-0.495156	0.203908
	4. Flush	0.033607	0.556009
Water source	1. River, Stream, Dam, and Other	-0.968848	-0.379645
	2. Unprotected well	-0.754618	-0.190811
	3. Protected well/borehole	-0.551663	0.030648
	4. Communal tap	-0.433143	0.247015
	5. Piped outside house	-0.108021	0.356381
	6. Piped inside house	0.28984	0.48613
Dwelling	1. Traditional	-0.19007	-0.233903
	2. Mixed	-0.153561	0.089974
	3. Detached	-0.046322	0.309174
	4. Semi-detached	0.055202	0.450422
	5. Flat/Townhouse/Other	0.141738	0.673164

Source: 2001 and 2007/8 ICES surveys.

[1]Positive coefficients reflect a positive relationship with well-being, while negative coefficients reflect a negative relationship.

Table 3: Descriptive statistics of household characteristics by region, and year, Zimbabwe

	Rural		Urban	
	2001	2008	2001	2008
Household characteristics	Mean	Mean	Mean	Mean
Household size	4.63	4.71	4.01	4.06
Dependency ratio	0.47	0.46	0.32	0.33
Household head age	45.78	45.76	39.24	40.04
Household head gender			(%)	
Male	60.34	62.02	76.17	70.56
Female	39.66	37.98	23.83	29.44
Household head education			(%)	
No education	15.61	14.42	2.87	2.09
Primary Education	55.98	48.02	32.50	19.65
Secondary Education	23.05	34.31	49.79	58.67
Post-secondary Education	5.36	3.25	14.83	19.59
Household head employment sector			(%)	
Permanent paid employee	20.80	12.64	52.24	43.11
Casual/temporary employee	5.95	5.35	11.63	9.81
Communal/resettlement worker	66.08	76.38	N/A	N/A
Own-account worker/employer	3.34	2.50	17.42	24.82
Others	3.83	3.13	18.71	22.26

Source: 2001 and 2007/8 ICES surveys.

Table 4: Household poverty prevalence (%) by household headship, welfare measure, region, and year, Zimbabwe

	Rural			Urban		
	CE	*Asset Index*		*CE*	*Asset Index*	
	2001	2001	2008	2001	2001	2008
Household head characteristics	(%)	(%)	(%)	(%)	(%)	(%)
Gender						
Male	71.1	67.3*	74.6**	32.2	31.1	28.0**
Female	75.3	81.0*	83.3**	33	34.4	24.8**
Education						
No education	82.4	90.7*	89.8	62.4	53.9	46.3
Primary Education	78.4	76.1*	81.5**	40.5	39.7	33.5**
Secondary Education	65.0	66.3	72.7**	32.2	33.0	28.6**
Post-secondary Education	19.8	12.9*	27.1**	9.5	6.8*	13.7**
Employment sector						
Permanent paid employee	47.5	37.3*	33.1**	24.7	26.9*	19.9**
Casual/temporary employee	58.4	64.5*	49.4**	37.5	47.6*	45.8
Communal/resettlement worker	82.6	84.8*	87.5**	-	-	-
Own-account worker/employer	65.0	63.8	68.7	42.8	34.3*	34.0
Others	69.8	76.4*	80.8	40.9	34.0*	24.8**

Source: 2001 and 2007/8 ICES surveys.
CE = Consumption expenditures
* Means are statistically different at the 5 percent level between predicted consumption expenditures and asset poverty in 2001.

** Means are statistically different at the 5 percent level between 2001 and 2007/8.

Table 5: Household composition by asset poverty status, region, and year, Zimbabwe

	2001		2008	
	Non-poor	Poor	Non-poor	Poor
Rural				
Household size	4.3	4.76	4.4	4.8
Dependency ratio	0.37	0.51	0.38	0.49**
Head age	42.22	47.11	42.19	46.76
Urban				
Household size	4.35	3.27	4.27	3.50**
Dependency ratio	0.33	0.28	0.34	0.31**
Head age	39.83	38	40.88**	37.79

Source: 2001 and 2007/8 ICES surveys. Welfare measure is the asset index applied to the year-appropriate asset poverty line.

** Means are statistically different at the 5 percent level between 2001 and 2008.

Table 6: Household prevalence (%) of asset poverty by region and year, Zimbabwe

	2001		2008	
	Poverty (%)	Extreme poverty (%)	Poverty (%)	Extreme poverty (%)
Rural	72.7	41.3	77.9*	46.8*
Urban	31.9	9.6	27.0*	12.7*
Total	59.8	31.3	58.4	33.7*

Source: 2001 and 2007/8 ICES surveys. Welfare measure is the asset index applied to the year-appropriate asset poverty line.

* Means are statistically different at the 5 percent level between 2001 and 2008.

Table 7: Household prevalence (%) of asset poverty by province, and year, Zimbabwe

	2001		2008	
Provinces	Poverty (%)	Extreme poverty (%)	Poverty (%)	Extreme poverty (%)
Bulawayo	16.2	1.0	8.0*	0.0*
Manicaland	66.1	30.4	65.9	33.0
Mashonaland Central	67.6	32.9	64.3	30.2
Mashonaland East	69.6	30.7	69.6	32.7
Mashonaland West	57.4	28.4	60.3	29.9
Matabeleland North	76.3	59.3	81.5*	63.2*
Matabeleland South	69.3	38.7	75.2*	50.6*
Midlands	68.4	43.4	61.7*	33.8*
Masvingo	72.8	46.5	80.9*	58.7*
Harare	29.2	9.6	31.3	20.6*

Source: 2001 and 2007/8 ICES surveys. Welfare measure is the asset index applied to the year-appropriate asset poverty line.

* Means are statistically different at the 5 percent level between 2001 and 2008.

Table 8: Livestock, productive assets, and land ownership by asset poverty status and year, rural Zimbabwe

	2001		2007/8	
	Non-poor	Poor	Non-poor	Poor
Livestock (quantity)	**(Quantity)**	**(Quantity)**	**(Quantity)**	**(Quantity)**
Cattle	2.168^	1.463	1.520*	1.362
Poultry	5.376^	4.402	4.720^	4.080*
Pigs	0.012	0.022	0.005^	0.019
Sheep	0.024	0.016	0.044	0.019
Goats	0.409^	0.611	0.378^	0.566
Donkey	0.075	0.083	0.051	0.069
Livestock equivalent	2.527^	1.804	1.823*	1.673
Productive assets (%)	**(%)**	**(%)**	**(%)**	**(%)**
Grinding	1.31^	0.32	1.29^	0.43
Plough	38.05^	45.57	38.52^	45.07
Tractor	1.77^	0.29	2.14^	0.66*
Scotchcart	27.14^	19.02	28.54^	19.87
Wheelbarrow	41.09^	34.49	36.64^*	30.37*
Land (ha)	**(ha)**	**(ha)**	**(ha)**	**(ha)**
Total land available	6.125^	2.252	3.866	3.361*
Land owned (ha)	5.935^	2.188	3.721	3.223*

Source: 2001 and 2007/8 ICES surveys. Welfare measure is the asset index applied to the year-appropriate asset poverty line.
^ Means are statistically different at the 5 percent level between poor and non-poor households.
*Means are statistically different at the 5 percent level between the 2001 and 2007/8 surveys.

Table 9: Land ownership (ha) per land use areas, asset poverty status, and year, rural Zimbabwe

	2001		2007/8	
Land use areas	Non-poor (ha)	Poor (ha)	Non-poor (ha)	Poor (ha)
Communal areas	1.98^	2.17	2.61*	2.51*
Small-scale commercial farms	29.55^	2.41	3.01*	3.59
Large-scale commercial farms	8.04^	0.4	5.27	4.81*
Resettlement areas	7.45	8.19	3.64*	4.14*

Source: 2001 and 2007/8 ICES surveys.
^ Means are statistically different at the 5 percent level between poor and non-poor households.
*Means are statistically different at the 5 percent level between the 2001 and 2007/8 surveys.

Table 10: Coefficient estimates used to construct economic asset index , Rural Zimbabwe, 2001.

	Estimated coefficients	Standard Errors
Radio	0.1291***	0.016
Television	0.1005***	0.030
Refrigerator	0.1729***	0.061
Stove	-0.0005	0.079
Heater	-0.0384	0.089
Bicycle	0.0108	0.018
Automobile	1.1572***	0.064
Sewing machine	-0.0389	0.026
Electricity	0.0961***	0.028
Toilet (Base= None)		
Pit latrine	0.0260	0.027
Blair toilet	0.1451***	0.017
Flush	0.2758***	0.070
Water source (Base = River, Stream, Dam)		
Unprotected well	-0.0217	0.027
Protected well/borehole	0.0597**	0.024
Communal tap	0.1834***	0.030
Piped outside house	0.0420	0.061
Piped inside house	0.1510*	0.085
Dwelling (Base = Traditional)		
Mixed	0.1194***	0.018
Detached	0.5159***	0.040
Semi-detached	0.6973***	0.041
Flat/Townhouse/Other	0.5571***	0.099
Cooking fuel (Base = Wood or coal)		
Paraffin or other	0.7238***	0.076
Electric or gas	0.2906***	0.076
Constant	6.2427***	0.023
Number of observations	12,192	

Source: 2001 ICES surveys. Dependent variable is log per capita consumption expenditures. Independent variables are as defined in text.
note: *** p<0.01, ** p<0.05, * p<0.1