Changes in Consumption and Saving Behavior before and after Economic Shocks: Evidence from Zimbabwe

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Abstract

Households face substantial risk in most developing countries. Highly erratic rain, unexpected changes in price policies, and macroeconomic instability are some of the important sources of risk. Zimbabwe is a good example of adaptation to such risks. The major shocks to the economy in the 1990s included drought and macroeconomic adjustments. Evidence shows that poverty has increased substantially during the 1990s, and vulnerability has also grown. The current paper analyzes the changes in household consumption and savings behavior before and after these shocks. The results show that the pre-drought and structural adjustment households consumed the majority of their permanent income, saved the majority of their transitory income and depended less on remittances. The higher marginal propensity to save out of transitory income by households before the droughts and structural adjustments implies that they use savings to smooth consumption. The post-drought and structural adjustments households, however, consumed the majority of both permanent and transitory incomes, and depended heavily on remittances. Household consumption and savings post-drought and post-structural change did not respond to income variability as well. Households were forced away from risk management and prudence to that of high dependence on transitory income and remittances for consumption. The prolonged period of drought and macroeconomic changes of the early 1990s has limited households' long-term ability to mitigate risk. Household risk management strategies are unable to successfully address covariant risks such as drought and economy wide structural changes.

1. Introduction

People face substantial risk throughout most of the developing countries of the world. Livelihood strategies represent adaptation to uncertainty with respect to income generation and subsistence consumption. Households face numerous natural, market and institutional risks in generating means of survival. Just to name few, highly erratic rain, commodity price fluctuations, poorly functioning or missing markets for inputs and outputs, unexpected changes in price policies, unstable governments and armed conflicts are important sources of risk. With the opening of developing countries' markets to national and international market forces, households face a wide array of risks and uncertainty. Some government policies, international trade imbalances, and macroeconomic instability generate uncertainty and compound risks to households. Zimbabwe is a good example of adaptation to such risks. The major shocks to the economy in the 1990s included drought and macroeconomic adjustments. These changes have substantial impact on household welfare and their behavioral strategy in coping up with risks.

In recent years a number of research initiatives have examined patterns of income and consumption smoothing in the risky environments of developing countries. Such studies show that most households in most situations have smoother consumption than income, and smoother income than what a risk-neutral agent would achieve (see Zimmerman and Carter, 1996; C. Paxson, 1992 and 1993; A. Deaton, 1991; C. Udry, 1994 and 1995; S. Lund, 1996). There are different ways households insulate their consumption from production and income fluctuations. They range from an informal community sharing of risks to participating in insurance and credit markets whenever such opportunities exist (e.g., Fafchamps et al., 1998; Binswanger and McIntite, 1987; Bromley and Chavas, 1989; Townsend, 1995a; Udry, 1990; Udry, 1994; S. Coate and M. Ravallion, 1993; Fafchamps, 1992; Carter, 1995; Reardon, Delgado and Malon, 1992). Under conditions where insurance and credit markets are incomplete or do not exist, households may use savings and dissavings arrangements (Paxson, 1992; Udry, 1995). Keeping cattle as an insurance substitute has longstanding importance in the economic literature on Africa (Binswanger and McIntire, 1987; Fafchamps et. al. 1998). Jodha (1978) and Rosenzweig and Wolpin (1993) provide evidence that livestock sales and purchases are used as part of farm households' consumption smoothing strategies.

It has also been pointed out that rural households use income diversification and remittances to mitigate risk (Rosenzweig and Binswanger, 1993; Reardon et. al., 1992). They participate in a variety of institutions (such as sharecropping and bonded labor), which sacrifice static allocative efficiency in order to manage risk. Households may also resort to transfers and remittance (Reardon et al., 1988) to diversify income. Remittance from migrant household and extended family members can be used to address unexpected changes in income. Transfers and remittance provide implicit insurance networks among families and friends (Rosenszweig, 1988; Lucas and Stark, 1985). Whenever possible rural households may also use credit markets to smooth consumption. Udry (1990, 1994), for example, shows that in Northern Nigeria, local credit markets are actively used to deal with income shocks. Other stocks such grain stocks, cash holdings, valuables (gold, jewelry and cloth) and stocks of human and farm capital can also be buffers for consumption smoothing.

The effectiveness of the menu of risk management strategies by households when the risky situation is common to all, for instance drought and unfavorable government policies, has not been widely investigated empirically. None of the above studies addressed the effectiveness of household risk management mechanisms when they face co-variant risks, which affect several households simultaneously. Even though a variety of coping strategies are available to households, it should be noted that most of these strategies are only effective to address idiosyncratic risks. In areas of developing countries, where insurance and credit markets may not function well or do not exist, it will be of interest to investigate how well households savings and transfers options respond to covariant economic shocks. This will help determine appropriate risk management policy to be implemented when governments and international institutions step in to assist households at risk. The current paper examines the effectiveness of household saving behavior to smooth income fluctuations in Zimbabwe.

Zimbabwe in the early 1990s

Zimbabwe is a low-income country with about 67 percent of its population living in rural areas. The rural economy is dominated by agriculture. However the share of agriculture in GDP is far lower than its share in employment. Incomes and productivity in agriculture are thus lower than other sectors of the economy. Many current and past poverty studies have found that, partly because of low-income

generating capacity of agriculture, poverty is more prevalent in rural areas than it is in urban areas (Alwang et. al., 2000; World Bank, 1996a).

Agricultural land in Zimbabwe is categorized into four use areas: The communal areas (CA), large-scale commercial farming (LSCF), small-scale commercial farming (SSCF), and resettlement areas (RA). The majority of rural areas are engaged in communal farming characterized by low productivity and minimal use of purchased inputs and capital. The resettlement areas represent an attempt by the government to address land distribution problems by resettling the rural poor on under-used commercial farmland. Large scale commercial farms are likely engaged in extensive operations, producing drought resistant crops for sale, and running herds of cattle and goats (Zimbabwe Central Statistical Office (CSO), 1998b).

Zimbabwean agriculture is highly dependent on rainfall. The communal farms and resettlement areas depend almost entirely on rainfall for crop production. Large and small-scale commercial farms may have irrigation facilities but irrigation potential is limited. Such high dependency on rainfall makes the sector and the entire economy highly vulnerable to drought. In 1992, Zimbabwe experienced one of the most severe droughts in decades. Agriculture's contribution to GNP during 1992 fell from about 14% to less than 7 % (CSO, 1998b). Within the rural sector, the impact of the drought was more severe in the communal farming and resettlement areas due to low quality land and lack of irrigation compared to small and large scale commercial farms. The drought had a wider impact on rural poverty through its impact on ownership of livestock. The number of livestock population decreased following the 1992 drought due to death and distress sale (CSO, 1998b). It is well know that livestock is a major form of wealth storage for rural households and the drops in livestock numbers are likely to have an adverse effect on rural household livelihood strategies. The ability to accumulate assets determines the poverty reducing potential of agricultural areas dependent on rainfall.

During early the 1990s, the government began to institute a dramatic reform of the economy through structural adjustment programs (ESAP). ESAP represented swift policy changes in recognition that the controlled economy of post-independent Zimbabwe was essentially unsustainable (CSO, 1998b). Cuts were made in public expenditures; trade and exchange rate policies were reformed; food subsidies were removed; and agricultural market liberalization was introduced in stages. Despite ESAP, poverty has increased (Alwang et al. 2000). The change in poverty may be

associated with the droughts of 1992 and 1994 whose impact may be in part reduced or aggravated by the structural adjustment policies undertaken by the government.

Study Objectives

It is important for policy makers and donor agencies to understand how households and groups respond and the resilience of their response in the face of economic shocks. Households' saving behavior has important implications for their ability to smooth consumption during economic shocks. Saving during a good season can mitigate the hardship and income downturns during a bad one. The 1990s Zimbabwe presents a good example of households facing and adapting to risks and uncertainty due to economic changes associated with ESAP, changes in governance such as decentralization, and recurring droughts (Alwang et. al 2000). The objective of the current study is to examine the effect of asset holding position, agro-climatic and demographic factors on household savings and dissavings behavior and the effectiveness of the latter in addressing economic shocks brought by drought and macroeconomic adjustments in the 1990s Zimbabwe. We examine changes in savings behavior before and after the economic shocks. Specifically, the current paper is intended to:

1. Analyze changes in consumption and savings behavior before and after economic shocks.
2. Examine the role of transfers and remittances in consumption smoothing.
3. Investigate the effectiveness of household savings as means of cushioning the impacts of covariant shocks.

It is of paramount importance for addressing poverty and vulnerability issues to understand how the consumption and saving of households behave ex ante and ex post an unexpected event. For groups that find formal insurance strategies more costly or less accessible, it may be necessary for institutions to step in and provide assistance in consumption smoothing to promote economic growth. The empirical results of the current work show that the pre drought and pre macroeconomic adjustment households consumed the majority of their permanent income but saved the majority of their transitory income, and relied less on remittances. In contrast, the post drought and macroeconomic adjustment households consumed the majority of both permanent and transitory incomes and depended heavily on remittances. This

implies that household saving behavior had been adversely affected by recurring droughts and unfavorable economic changes.

The paper is organized as follows. Section 2 discusses theoretical household saving model. Section 3 develops the empirical model for analyzing the problem. Section 4 describes the data source and the variables used. Results and discussions are in section 5. Finally section 6 concludes the paper.

2. Household Saving and Consumption Behavior

There are several reasons why one may be interested to study the saving and consumption behavior of households in developing countries. Saving is related to growth and economic development. There is a close link between household and national saving rates over time (Deaton, 1997). Households in developing countries face substantial risks and uncertainty in generating income to meet basic needs and social obligations. Their consumption and saving behavior may reflect the mechanisms they use to manage risks. Examining household saving helps us understand how people deal with fluctuations in incomes in order to smooth their consumption. It is essential to look at the determinants of household saving and consumption in order to devise policies to advance economic growth and improve the livelihood of households. The current paper addresses these concerns by examining how economic shocks affect household savings behavior.

Basic Household Choice Model

Define $U_t(C_t)$ as a concave continuously differentiable instantaneous utility for a representative household where C_t is household consumption of all goods and services at time period t. C_t is household consumption expenditures on durables (such as farm implements, dwelling units, etc.) as well as expenditures on other consumption goods and services (such as food, clothing, etc.). Since the choice is concerned with resource allocation over time, let's consider a household who maximizes as of time zero

$$E\left\langle \sum_{t=0}^{T-1}(1+\rho)^{-t}U_t(C_t)\,|\,0\right\rangle \qquad (1)$$

Where T is the life span of the household[1]; $E(.|I_t)$ is the expectation conditional on information at time t (I_t), and θ is the rate of time preference. Thus the household maximizes the present discounted value of expected utility, conditional on information at time zero. The evolution of household's asset governs the budget constraint within which the intertemporal utility is maximized:

$$A_{t+1} = (A_t + Y_t - C_t)(1 + r_t) \qquad (2)$$

Where A_t is household's wealth, Y_t is labor income at time *t*, r_t is the real interest rate from period *t* to *t+1*. The earnings (Y_t) and real interest rate are treated as stochastic. Given consumption C_t, the household has a gross savings of $(A_t + Y_t - C_t)$ at time t. The households use their savings in various investment options[2] with return ɾ. Or if $(A_t + Y_t - C_t)$ is negative, they borrow from credit markets or other households with positive savings.

The above basic model of intertemporal choice ignores a number of important facets in the livelihood strategy of a typical developing country household. First, there may not be a clear-cut separability between capital income from asset accumulation (A_t) and labor income (Y_t), which is contrary to the model assumption. Second, the intertemporal choice specification assumes that households can borrow and lend freely in order to meet their consumption needs. We know in practice that the credit market is not readily available in developing areas. However, for simple cases where household incomes may be determined by weather factors and capital accumulation is not an integral part of their means of livelihood, the basic model can be insightful.

Dynamic optimization program can be used to solve the model in (1). Define $V_t(A_t)$ to be the value function:

$$V_t(A_t) = MAX\ E\left\langle \sum_{k=t}^{T-1} (1+\theta)^{-(k-t)} U_k(C_k) \mid t \right\rangle \text{ subject to (2)} \qquad (3)$$

$V_t(A_t)$ is the present discounted value of expected utility evaluated along the optimal path. It depends on the real asset at the beginning of period (A_t). It also depends on

[1] T can be assumed to be infinity (∞) considering the fact that there are strong ties among generations in most developing countries.

[2] Such as bank deposits, in the form of physical assets such as cattle, jewelry, farm equipment, etc.

the conditional distribution of future earnings, rates of returns on assets and the length of time. This dependence implies that the form of V will likely change over time so that we have time index in the value function. The value function satisfies the following recursive equation:

$$V_t(A_t) = \underset{C_t}{MAX}\left[U_t(C_t) + (1+\theta)^{-1} E_t\langle V_{t+1}(A_{t+1}) \mid t\rangle \right] \qquad (4)$$

The first order condition for this maximization is:

$$(4.1) \quad U_t'(C_t) = E_t\{[(1+\theta)^{-1}(1+r_t)]V_{t+1}'(A_{t+1})\}$$

To make sense of the first order condition, we use the envelope theorem. Consider the effect of a small change in A_t on both sides of equation (4). By the envelope theorem and using the budget constraint (2):

$$(4.2) \quad V_t'(A_t) = E_t\{[(1+\theta)^{-1}(1+r_t)]V_{t+1}'(A_{t+1})\} = U_t'(C_t)\}$$
$$(4.3) \quad U_t'(C_t) = E_t\{[(1+\theta)^{-1}(1+r_t)]U_{t+1}'(C_{t+1})\}$$

The equality in (4.3) follows from the first order conditions given above. Equation (4.3) constitutes the familiar Euler equation. Assume r_t is constant and that the instantaneous utility function, $U_t(C_t) = U(C_t)$ for all t. Define $\Omega(C)$ to be the derivative of U(C), then (4.3) becomes:

$$(4.4) \quad \left[\frac{1+r}{1+\theta}\right] E_t\{\Omega(C_{t+1})\} = \Omega(C_t)$$

It implies that marginal rate of substitution between consumption in two periods should equal the expected marginal rate of transformation. The parameters r and θ control the rate at which expected marginal utility tomorrow is discounted relative to marginal utility today.

Permanent Income and Life Cycle Models

The permanent income model championed by Friedman (1957) and the life cycle model proposed by Modigliani and Brumberg (1954, 1979) can be special cases of the above model. Suppose that the rate of time preference (θ) is the same as the interest rate (r) and that the instantaneous utility functions are quadratic so that the marginal utility functions are linear, then (4.4) becomes:

$$C_t = E_t(C_{t+1}) \qquad (5)$$

Equation (5) says that consumption is a martingale, a stochastic process whose expected value is its current value. The optimal path of consumption is such that consumption is expected to be constant over the remainder of the program. This condition, along with the budget constraint, implies that for a quadratic utility function, consumption is a linear function of expected lifetime wealth. In life cycle models, where the focus is more on age profile than uncertainty, the martingale property of consumption and saving becomes the constant consumption property of the simplest of such models. The permanent income hypothesis essentially has the same interpretation in saying that consumption is equal to permanent income, defined as the annuity value of the sum of current assets and the discounted present value of expected future earnings.

In order to arrive at the implications of the basic model, we made some assumptions that could be quite unrealistic for a typical developing country household. For households in a developing country where family sizes are large, the fraction of old people is quite low and only few old people live alone because of strong family ties, the assumptions and the implication of permanent income hypothesis and life cycle models are very questionable. In other words, where the elderly live with their children who provide them with their needs directly, there is essentially no need for saving and dissaving schemes in the way both models portray (Deaton, 1997). Including household characteristics such as age and composition in equation (4.3) as factors affecting marginal utility of consumption, in addition to consumption itself, may help address the shortcoming of the life cycle models. Let Z_t be a set of household characteristics, then a richer version of (4.4) can be defined:

$$(4.4')\Omega(C_t, Z_t) = \left[\frac{1+\mathrm{r}}{1+\boldsymbol{q}}\right]\Omega(C_{t+1}, Z_{t+1})$$

Thus the age profile of consumption is determined by household characteristics and by the relationship between r and θ (Ghez and Becker, 1975). Even richer version of (4.4) can be obtained by incorporating uncertainty and risks that are pervasive in the most developing countries.

Household Precautionary Saving Motives

The permanent income and life cycle do not address the cases where is uncertainty and the household marginal utility is not linear. Households face substantial uncertainty in most developing countries as briefly discussed in the introduction part. Marginal utility and price are higher when consumption is low than when it is high. For a subsistence level of consumption, which characterizes most households in developing countries, the marginal value of consumption may increase to infinity when consumption falls to very low level. Deaton (1997) argues that marginal utility may well be convex for households in developing countries. This has important behavioral implications. Assume that the interest rate is constant at the subjective discount rate so that equation (4.4') becomes:

$$\Omega(C_t, Z_t) = E_t\{\Omega(C_{t+1}, Z_{t+1})\} \qquad (6)$$

Equation (6) implies that if a household is risk averse (as long as U'' < 0), increased uncertainty, say, in the form of an increase in the variance of consumption, decreases expected utility. But its effect on consumer behavior (i.e., on the Euler equation) depends on whether it affects consumer's marginal utility. Since marginal utility is linear ($U^{'''}$ =0) for quadratic utility, an increase in variance of consumption has no effect on expected marginal utility, and thus no effect on behavior. But a non-linear and convex marginal utility function is plausible for a typical developing country household. Therefore an increase in uncertainty raises the expected marginal utility. Therefore, to maintain the identity in (6), the expected future consumption must increase compared to current consumption. Thus uncertainty leads consumer to defer consumption, to be more cautious. Higher income uncertainty and higher risk aversion lead to a lower consumption, to more prudent behavior (Caballero, 1990;

Kimball and Mankiw, 1989). The analysis in this paper incorporates these special features of households in Zimbabwe and tests for the implications of permanent income and life cycle models.

3. The Empirical Approach

The current paper aims to explore household consumption and saving behaviors using cross-sectional data from National Income Consumption and Expenditure Survey (ICES) data of 1990/91 and 1995/96 from Zimbabwe. Households' saving behavior has important implications for the ability to smooth consumption during economic shocks. Household saving can be difficult to measure, especially in developing country settings and in rural areas (Kozel, 1987; Paxson, 1992; Deaton, 1989). Most studies on household saving behavior take savings as a residual of observed expenditure and observed income. In some cases in developing countries, because of the structure of the survey and the seasonal nature of income generation, household income can be difficult to measure and will be unreliable even if it can be estimated. This was the case with Zimbabwe ICES data where the survey span was just a month and most households exhibit seasonal variation in their income generation from agricultural and other enterprises. Consumption expenditures can be appropriately drawn from the national surveys with minimal discrepancy since consumption may not exhibit seasonal fluctuations common in income generation. Also a direct measure of savings, rather than observed income, can be gleaned from the Zimbabwe data. (Refer to the data section for details about ICES data and variable derivation and definitions.)

Modeling Household Consumption and Saving

On the basis of the theoretical model presented in the previous section, assume that consumption and savings ($\boldsymbol{H_{it}}$) are linear functions of permanent income (Y_{it}^{P}), transitory income (Y_{it}^{T}), remittances and transfers (RT_{it}), income variability (VY_{it}) and a set of variables that measure the life cycle stage of a household (LC_{it}):

$$H_{it} = f_0 + f_1 Y_{it}^{P} + f_2 Y_{it}^{T} + f_3 RT_{it} + f_4 VY_{it} + f_5 LC_{it} + e_{it} \qquad (7)$$

Where $\boldsymbol{H_{it}}$ is a vector of real per-capita consumption and two per capita saving instruments (financial and other physical assets savings) for household *i* and time period *t* ((*t*= 1990/91 or 1995/96). Real per-capita consumption ($CONS_{it}$) constitutes households consumption expenditures on food, health care, and schooling. Savings are divided into two components in order to examine the impact of structural adjustment policies of early 1990s. Structural adjustment policies, which included financial liberalization, may have more impact on financial savings than on other types of savings. Thus financial savings may increase at the expense of other savings, leaving the total savings unchanged or decreased as noted by Warman and Thirlwall (1994). Real financial savings ($FSAV_{it}$) constitutes monetary savings (the net sum of loans taken and loans paid, purchase and sale of financial stocks, bank deposits and withdrawals, and other financial payments such as insurance and other financial assets). The other savings instrument ($PSAV_{it}$) consists of all real physical asset savings and is a measure of net purchases and sales of physical assets such as land, livestock, buildings, household durable items, vehicles and other assets.

From the theory of permanent income, we expect the coefficient ϕ_1 in the $CONS_{it}$ equation (the propensity to consume out of permanent income) to be significantly higher than ϕ_2 (the propensity to consume out of transitory income) while the opposite holds for saving instruments ($FSAV_{it}$, and $PSAV_{it}$). For CARA (constant absolute risk aversion) form of utility function, we expect ϕ_4 (the impact of variability of income on consumption) to be negative for the consumption and positive for savings equations. This will be so because of precautionary savings by households. For a quadratic utility function, ϕ_4 will be zero for all equations.

The explanatory variables in the equations are either directly obtained or derived from Zimbabwe ICES data except for instrumental variables employed to proxy income variability. Estimating a measure of income variability (VY_{jt}) requires a panel data, which are not possible in our case[3]. Therefore VY_{it} is instrumented by a set of variables that measure the variability of regional rainfall on the grounds that more variable rainfall leads to more variable income particularly in an agricultural setting. It is proxied by standard deviations of regional and seasonal rainfall (planting, weeding and harvesting periods) over eight years. The life cycle measures (LC_{it}) are variables that measure the number of household members in different age categories.

[3] Our data come from two separate but comparable cross-sectional national surveys of 1990/91 and 1995/96.

We used five variables representing the number of household members in five different age categories (less than 6 years, 6-11 years, 12-17 years, 18-64 years, greater than 64 years). Households with many young children and old members may save less since their present income is less than the annuity value of their wealth. According to the old age hypothesis, households may opt to spend on children as a substitute to saving with the view that children will take care of the parents at old age (see Paxson, 1992 and Nerlove, 1985). The permanent and transitory incomes are derived from the Zimbabwe ICES data (see next section).

Estimating Permanent and Transitory Incomes

In this study, a methodology formulated by Paxson (1992) and adopted by Alderman (1996) in his study of saving behavior in rural Pakistan, is employed for estimating different income categories: permanent income, transitory shocks, and residual income. Paxson (1992), in her study of the savings behavior of Thai farm households, uses time series information on regional rainfall in conjunction with cross-sectional data on farm household income to obtain estimates of components of household income attributed to rainfall shocks. She assumed that rainfall variation will produce shocks to income but will have no direct effect on consumption so that part of each household's income explained by shocks to regional rainfall serves as an explicit measure of transitory income. On the other hand, the part of household income explained by household's permanent variables (such as household members in different age, sex and education categories) serves as an explicit measure of permanent income. Finally residual income is that part of household income unexplained by either transitory or permanent variables.

Total household income is usually estimated as a sum of household earnings from various sources such as wage, farming, business, interests and rents from physical capital assets. However total income can also be derived from different outlays where it may be spent such as consumption and different savings. In the current study, since the Zimbabwe ICES does not lend itself to the first approach, household income is derived from different consumption and savings types. Let Y_{it} be a derived income for household i at survey period t. Income can be derived using the following identity:

$$Y_{it} = CONS_{it} + PSAV_{it} + FSAV_{it} \qquad = \sum_{k=1}^{3} H_{itk} \tag{8}$$

Where the subscript k denotes the different outlays of income (i.e., consumption and saving types).

Total household income at any given period is also made up of permanent income (denoted by Y_{it}^{P}) and a random transitory income component (denoted by Y_{it}^{T}), which can be positive, negative, or zero. Y_{it}^{T} really represents current income deviations from permanent income. Therefore household derived income Y_{it} can be decomposed into permanent and transitory components:

$$Y_{it} = Y_{it}^{P} + Y_{it}^{T} \qquad (9)$$

Define $\mathbf{X}_{it}$ to be the set of all variables important in determining income, for household *i* at time t. The variables in $\boldsymbol{X_{it}}$ may be divided into two-- those that affect the permanent component of total income (denoted by $\boldsymbol{X}_{it}^{P}$) and those that mainly affect transitory component and income variability (denote by $\boldsymbol{X}_{it}^{T}$). Assume a household's permanent income ($\boldsymbol{Y}_{it}^{P}$) is a linear function of variables in $\boldsymbol{X}_{it}^{P}$:

$$Y_{it}^{P} = \boldsymbol{a}_{t}^{P} + \boldsymbol{a}_{P} X_{it}^{P} + \boldsymbol{e}_{it}^{P} \qquad (10)$$

Where ε_{it}^{P} are error terms with zero mean and unit variance. α_t^{P} represents a year effect, which is common to all households; $\mathbf{a}_P$ is parameter vectors associated with $\boldsymbol{X}_{it}^{P}$ and to be estimated in the model. For the current study, variables in $\boldsymbol{X}_{it}^{P}$ include family composition variables measuring the number of household members in different age/sex/education categories, and an asset index variable. Also a sector-specific dummy variable is used to capture urban-rural differences in income generation.

In similar fashion transitory income is defined as a linear function of $\boldsymbol{X}_{it}^{T}$, a vector of variables that mainly influence the transitory component of the observed income:

$$Y_{it}^{T} = \boldsymbol{a}_{t}^{T} + \boldsymbol{a}_{T} X_{it}^{T} + \boldsymbol{e}_{it}^{T} \qquad (11)$$

Where α_t^{T} represents a year effect, which is common to all households; $\mathbf{a}_T$ is parameter vectors associated with $\boldsymbol{X_{it}^{T}}$. The variables used in $\boldsymbol{X_{it}^{T}}$ to estimate the

transitory component of income are regional rainfall deviations and deviations squared obtained using time series information on rainfall over several catchments in Zimbabwe. Therefore the part of household income explained by shocks to rainfall can be used as a measure of transitory income (Paxson, 1992).

Endogeneity of Remittances

Remittances and transfers (RT_{it}) can play an important role as a mechanism of income redistribution between persons and across sectors. This would allow households to diversify their income sources for risk management purposes, to consume in excess of locally generated incomes, or to grant access to an additional source of capital funds. (See a seminal paper by Lucas and Stark, 1985). The amount and the nature and timing of remittances may depend on the wealth of households receiving and giving out. Remittances and transfers thus may depend on consumption and savings of households. Likewise the expectation, the amount and the nature of remittances can influence household savings and consumption decisions. Here lies a potential endogeneity between RT_{it} and $\boldsymbol{H}_{it}$. To address the endogeneity problem, we employ instrumental variable technique and regress RT_{it} (remittances/ transfers) on variables that have no direct effect on household consumption and savings but affect remittances and transfers. We use average regional family size (*AHSIZE*[4]), average regional percent elderly (*AELDER*), average regional household head education level (*AHEDUC*), average regional unemployment rate (*AJOBLESS*), average regional landholding (A*LAND*), and information network availability such as household ownership of radio (*RADIO*) and television (*TV*) to instrument for remittances:

$$RT_{it} = \boldsymbol{d}_0 + \boldsymbol{d}_1 AHSIZE_{jt} + \boldsymbol{d}_2 AHEDUC_{jt} + \boldsymbol{d}_3 AJOBLESS_{jt} + \boldsymbol{d}_4 ALAND_{jt} + \boldsymbol{d}_5 \text{AELDER}_{jt} + \boldsymbol{d}_6 RADIO_{it} + \boldsymbol{d}_7 TV_{it} + \boldsymbol{h}_{it} \quad (12)$$

Where *j* denotes regions in each province based on enumeration unit[5]. The predicted remittance/transfer variable is used as instrument for RT_{it} in equation (7).

[4] Where regions are based on enumeration units within different sectors.

[5] Enumeration units are based on survey design for ICES and comprise a group of one or more villages where enumeration was undertaken by one enumerator. The instruments used in predicting remittances are averages within these enumeration units.

The System of Equations

Now, equations (10), (11), and (12) can be substituted in to (7) for Y_{it}^{P}, Y_{it}^{T} and RT_{it}, respectively, to estimate the structural consumption and savings equations. Also we can combine equations (10) and (11) and use identity in equation (9) to estimate total income equation:

$$Y_{it} = \alpha_t + \alpha_P X_{it}^{P} + \alpha_T X_{it}^{T} + \varepsilon_{it} \qquad (13)$$

$$H_{it} = \phi_{0t} + \phi_1\{\alpha_P X_{it}^{P}\} + \phi_2\{\alpha_T X_{it}^{T}\} + \phi_3 RT_{it} + \phi_4 VY_{it} + \phi_5 LC_{it} + u_{it} \qquad (14)$$

Where $RT_{it} = \ddot{a}_1 AHSIZE_{jt} + \ddot{a}_2 AHEDUC_{jt} + \ddot{a}_3 AJOBLESS_{jt} + \ddot{a}_4 ALAND_{jt}$

$$+ \ddot{a}_5 AELDER_{jt} + \ddot{a}_6 RADIO_{it} + \ddot{a}_7 TV_{it},$$

$\alpha_t = \alpha_t^{P} + \alpha_t^{T}$, and $\phi_{0t} = \phi_0 + \alpha_t^{P}\phi_1 + \alpha_t^{T}\phi_2 + \delta_0\phi_3$.

Note that the LC_{it} and VY_{it} are collinear with $\boldsymbol{X_{it}^{P}}$ and $\boldsymbol{X_{it}^{T}}$, respectively, thus the reduced $\boldsymbol{H_{it}}$ equations can be defined as functions of just the $\boldsymbol{X}_{it}$s and estimated RT_{it}:

$$H_{it} = \lambda_t + \lambda_P X_{it}^{P} + \lambda_T X_{it}^{T} + \nu_1 AHSIZE_{jt} + \nu_2 AHEDUC_{jt} + \nu_3 AJOBLESS_{jt} + \nu_4 ALAND_{jt} + \nu_5 AELDER_{jt} + \nu_6 RADIO_{it} + \nu_7 TV_{it} + u_{it} \qquad (15)$$

λ_t measures the year effect, $\boldsymbol{\lambda_P}$ reflects the impact of Xit^{P} on consumption/ savings through its effect on the permanent income, $\boldsymbol{\lambda_T}$ measures the impact of regional rainfall variables ($\boldsymbol{X_{it}^{T}}$) on consumption/savings through its effect on the transitory income and $\varpi_k = \phi_3\delta_k$ for all k=0, 1, 2, …, 7 and measure of marginal impact of transfers and remittances on consumption/savings. Equations (13) and (15) consist four equations (income, consumption, two savings) of which three are independent since equation (8) has to hold. The parameters estimates of these equations along with distributional assumption of the model can be used to test a number of hypotheses.

While equation (15) gives reduced form estimates of the structural parameters in equation (7), we can directly estimate them using two-stage estimation procedure (Paxson, 1992). First, using ordinary least squares, we estimate equations (12) and (13). The resulting parameters from equation (12) cane used to obtained predicted

RT_{it} and parameters from equation (13) can be used to decompose the total income into estimated permanent (Y_{it}^{P}), transitory (Y_{it}^{T}) and residual (Y_{it}^{R}) components:

$$\begin{aligned}
\hat{RT}_{it} &= \hat{\delta}_0 + \hat{\ddot{a}}_1 AHSIZE_{jt} + \hat{\ddot{a}}_2 AHEDUC_{jt} + \hat{\ddot{a}}_3 AJOBLESS_{jt} + \\
&\quad \hat{\ddot{a}}_4 ALAND_{jt} + \hat{\ddot{a}}_5 AELDER_{jt} + \hat{\ddot{a}}_6 RADIO_{it} + \hat{\ddot{a}}_7 TV_{it} \\
\hat{Y}_{it}^{P} &= \hat{\alpha}_t + \hat{\alpha}_P X_{it}^{P} \qquad (16) \\
\hat{Y}_{it}^{T} &= \hat{\alpha}_T X_{it}^{T} \\
\hat{Y}_{it}^{R} &= Y_{it} - \hat{Y}_{it}^{P} - \hat{Y}_{it}^{T}
\end{aligned}$$

Following Paxson and including residual income, we can estimate the structural equation (7) as:

$$H_{it} = \phi_0 + \phi_1 \hat{Y}_{it}^{P} + \phi_2 \hat{Y}_{it}^{T} + \phi_3 \hat{Y}_{it}^{R} + \phi_4 \hat{RT}_{it} + \phi_5 VY_{it} + \phi_6 LC_{it} + \mu_{it} \qquad (17)$$

In this way, we can directly test the permanent income hypothesis using the parameter estimates on permanent and transitory incomes as well as residual income. Also the coefficient on the proxy for income variability (VY_{it}) can be used to see if households are indeed risk averse and employ precautionary behavior to safeguard themselves from income shocks.

Hypothesis Tests and Restrictions

The parameter estimates of equations (13) and (15) together as well as the estimates of equation (17) can be used to test many hypotheses implied by permanent income hypothesis (PIH). First looking at the consumption side, we expect the propensity to consume out of permanent is close to unity. This, in the case of equations (13) and (15) means the impact of variables in X_{it}^{P} on $CONS_{it}$ and Y_{it} should be similar (i.e., $\lambda_P = \alpha_P$). We also test if the joint impact of $\boldsymbol{X_{it}^{T}}$*s* on consumption is not significant. Looking at the savings equations, the propensity to save out of transitory income is expected to be close to unity, which in our model implies their respective λ_T should be close to α_T. Put differently, the impact of rainfall on income should be identical to its

impact on saving. The acceptance of this last test means households do in fact use saving to smooth consumption. We also test the impact of asset index variable on consumption and saving. We expect it to be significantly positive on consumption while its effect should be non significant on saving.

The coefficients in the structural equation (17) can be used to directly test the PIH. We can test the hypotheses: $H_0: \phi_1=1$, $H_0: \phi_2 =0$, $H_0: \phi_1 > \phi_2$, and $H_0: \phi_1 \geq \phi_3 \geq \phi_2$[6] for household per capita real consumption equation. Failing to reject these hypotheses will indicate that household consumption tends to follow the PIH and that households do use savings to reduce fluctuation in consumption. Similarly, on the savings side, the reverse hypotheses are tested on total savings, i.e., $H_0: \Sigma_1=0$, $H_0: \Sigma_2 =1$, $H_0: \Sigma_1 < \Sigma_2$, and $H_0: \Sigma_1 \leq \Sigma_3 \leq \Sigma_2$ (where Σ_1, Σ_2 and Σ_3 are the sum of permanent, transitory and residual income coefficients, respectively, across the two savings equations (*FSAV* and *PSAV*). Failing to reject these tests indicates that the implications of PIH hold. Finally we can test if the coefficients on rainfall variability (a proxy for income variation) ($\mathbf{f}_5$) are negative for consumption and positive for savings. Failing to reject this test indicates that households are indeed risk averse and use precautionary savings to smooth consumption.

On the other hand, we expect changes in household consumption and saving behavior across survey years because of economic shocks that occurred in the time between the two surveys. We anticipate that households' precautionary measures increase and that transitory income plays a bigger role on consumption and saving decisions. It should be noted, however that the return on education and assets may have decreased after the economy was hit with subsequent droughts. Thus the impact of rainfall on income may be confounded with its impact on production, output quality and prices.

4. The Data

The ICES of Zimbabwe in 1990/91 and 1995/96 are the sources of two comparable data sets for current paper[7]. The surveys were undertaken by the Central

[6] Since unexplained income can have both permanent and transitory components, its coefficients are expected to lie between the coefficient of permanent and transitory income.

[7] In between the two periods Zimbabwe was hit by a number of severe shocks and introduced a structural adjustment program. Analysis of the impact of such macroeconomic changes requires comparable data at least for two points in time, situated appropriately relative to the adjustment

Statistical Office (CSO) and contain data on socio-demographic characteristics, incomes, receipts from households including agriculture, consumption and other expenditures on a weekly basis, and for some durable and semi-durable items, on a monthly or yearly basis. The surveys were based on nationally representative sample comprising all sectors of the country, i.e., the urban and the rural sectors with all their sub-sectors. The proportion of households sampled across sectors and provinces are similar in both survey years, thus improving the comparability over time of the survey data. Since one of the goals of this study is to compare similarities and differences in household consumption and saving behavior before and after economic shocks, having comparable sample reduces possible bias due to sample size disproportionality.

Consumption and Savings Measures

The household consumption expenditure variable was created from an extensive list of food and non-food items from both surveys while maintaining comparability across survey years. The consumption expenditure measure includes market and non-market consumption, and consumption flows from ownership of assets. The ICES has detailed information on expenditures (market, own consumption, gifts, transfers, and payments in kind) for some 250 food items. Since expenditures on durable goods tend to be very lumpy, it was necessary to spread the value of expenditures on durable goods over the estimated lifetime of the good in question. Expenditures on non-durable good items such as clothing, household furnishings, etc. were recorded for the month of the interview and were included directly. The total consumption was computed as the sum of the monthly consumption of food, non-food non-durable and durable goods.

In household surveys in developing countries, incomes are more likely to be underreported. Moreover because of the seasonal nature of income generation for agricultural households, surveys with limited time span may not accurately record the actual annual income. The Zimbabwe ICES, though spread over the entire calendar year, had a month span for each household that may not have matched up with the

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phase and economic shocks so that they can reflect the impact. Moreover the concern with household welfare and poverty requires the availability of micro-level data that cover the different dimension of household welfare. The Zimbabwe ICES data meet these requirements and provide an opportunity to undertake the impact of drought and structural adjustment on the household welfare and saving behavior.

main period of income generation. These two serious limitations make the income variable to be a suspect. In order to address these limitations we directly create the savings variables from the survey data instead of defining savings as a residual between observed expenditures and observed income. Two different saving variables were created: financial savings (FSAV) and all other savings (PSAV). FSAV is the net sum of loans taken and loans paid, purchase and sale of financial stocks, bank deposits and withdrawals, and other financial payments such as insurance and other financial assets. FSAV may likely be underestimated in the case of rural households whose under-the-mattress deposits are not recorded. PSAV is a measure of net purchases and sales of physical assets such as land, livestock, buildings, household durable items, vehicles and other assets. Education and medical expenditures were added to PSAV since such expenditures may yield a flow of services over many years. Descriptive statistics on table 4.1 shows that welfare measures (real income, real consumption, and real savings) and their variability had decreased in Zimbabwe between the two surveys.

Accounting for Human and Capital Assets

Access to assets plays a determinant role in risk management and poverty alleviation. For rural households, diverse assets help determine the choice of income generating strategies and the levels of income achieved. They include land, productive capital, human capital, and livestock for direct production as well as agricultural capital. Both surveys recorded several physical capital assets along with respective household access or ownership status. Ownership or access to durable and income generating assets by households may have important role in determining their consumption and savings behavior. An asset index variable (NATYPE) was created using different weights on asset types owned. NATYPE is assumed to capture the role of physical assets ownership on income generation, consumption and savings decision. Another category of household asset is human capital. The number of household members in different age, sex and education categories is important in the household life cycle. Life cycle models suggest that households with many young children and older members save less since the current labor income of these household members is less than the annuity value of their lifetime wealth. This means that households with many children could save even less. Several variables were

created with different age/sex/education categories to address the importance of human capital asset in molding consumption and saving behavior. Descriptive statistics on table 4.1 shows most age/sex/education variables for an average household remained about the same before and after economic shocks.

The Rainfall Data

We have gathered monthly rainfall figures for seven months (October - April) from 1989 to 1996 and normal monthly precipitation was obtained from Central Statistical Office (CSO) of Zimbabwe. October and November constitute the planting season. December and January are weeding months while the rest (February, March and April) are the main harvest months in Zimbabwe. The rainfall data were collected from all ten major catchment areas covering the whole country. The catchment areas are matched up with corresponding provinces to get region-specific weather variables. Three weather variables representing region-specific rainfall in the three periods (planting, weeding, and harvest) of the cropping season were created. The percent deviations in periodic regional rainfall ($RPDEV_t$, $RWDEV_t$, $RHDEV_t$) from normal regional precipitation are used to estimate transitory income component of household income.

Table 1. Variables used ($N_{90/91}$ = 14116, $N_{95/96}$ = 17527)[8].

	1990/91		1995/96	
VARIABLE: DEFINITION	**MEAN**	**STD.DEV**	**MEAN**	**STD.DEV**
RINC: real income	97.377	13658.5	65.480	11998.1
RCONS: real consumption	86.857	4202.2	65.950	3349.1
RFSAV: real financial savings	(1.967)	12656.9	(2.207)	11554.6
ROSAV: real other savings	12.487	1672.9	1.736	1861.1
RREMITR: real remittances received	10.540	738.1	6.733	1233.1
RPENSION: real pension income	1.044	450.4	0.981	447.2
HEAD: household head (male, female)	0.680	11.7	0.681	11.5
AGE0_5:household members age ≤ 5 years	1.280	30.2	1.104	25.8
MAL6_11: males between 6 and 11 years	0.738	22.0	0.611	19.5
MAL12_17: males between 12 and 17 Years	0.611	20.2	0.573	19.2
M18_64PE: males age b/n 18 and 64 with ≤ primary education	0.623	17.5	0.595	17.9
M18_64SE: males age b/n 18 and 64 with secondary education	0.549	20.1	0.527	19.5
M18_64HE:males age b/n 18 and 64 with postsecondary education	0.012	3.0	0.083	7.4
FEM6_11: females between 6 and 11 years	0.738	22.2	0.624	20.0
FEM12_17: females between 12 and 17 Years	0.606	20.1	0.592	19.2
F18_64PE: females age b/n 18 and 64 with ≤ Primary education	1.028	20.1	0.943	19.8
F18_64SE: females age b/n 18 and 64 with secondary education	0.448	18.2	0.078	7.5
F18_64HE: females age b/n 18 and 64 with postsecondary education	0.004	1.7	0.059	6.5
MAL65_: elderly males (age ≥ 65 years)	0.092	7.3	0.089	7.1
FEM65_: elderly females (ages ≥ 65 years)	0.082	7.0	0.085	7.0
NATYPE: index of asset types owned	1.819	53.3	1.854	49.0
CATTLE: number of cattle owned	3.605	206.9	2.961	3495.6
TV: ownership of a television (yes, no)	0.114	8.0	0.194	9.7
RADIO: ownership of radio (yes, no)	0.414	12.4	0.513	12.3
UR: urban-rural dummy (1 urban, 0 rural)	0.308	11.6	0.325	11.6
CA: communal area dummy	0.554	12.5	0.533	12.3
SSCF: small scale commercial farm dummy	0.009	2.4	0.024	3.8
LSCF: large scale commercial farm dummy	0.099	7.5	0.094	7.2
RA: resettlement area dummy	0.029	4.2	0.024	3.8
RPDEV[1]: planting period rainfall deviations	11.237	567.7	(18.217)	241.4
RWDEV: weeding period rainfall deviations	8.872	394.4	(8.528)	406.3
RHDEV: harvesting period rainfall deviations	(33.238)	335.0	(58.008)	323.6
STDRP: planting period standard deviations	23.788	213.3	18.293	237.8
STDRW: weeding period standard deviations	13.501	300.5	14.618	281.8
STDRH: harvest period standard deviations	33.238	335.0	58.008	323.6

Source: Authors calculations from ICES 90/91 and 95/96 data.

[1] Mean and standard deviations are across provinces, after matching each province (except Harare) with closest weather station. Harare is represented by national rainfall average. The time series data on rainfall were reported from ten weather stations.

[8] The monetary variables are adjusted by 1990 Harare CPI (Consumer Price Index) to get real values from the nominal figures derived from the survey.

5. Results and Discussion

Tables 2-5 contain the parameter estimates of income, and both reduced and structural consumption and saving equations for 1990/91 and 1995/96. We first briefly discuss the results of the income and reduced form consumption and saving equations (equations (13) and (15)). Since the main goal of the paper is to examine saving behavior before and after economic shocks, the discussions focuses on the structural consumption and savings equation estimates in tables 4-5.

Income Generation before and after Economic Shocks

The income equations (table 2) for 1990/91 and 1995/96 households show that most explanatory variables have highly significant effects on income. The sign and significance on HEAD (sex of household head) indicates that male-headed households are better off than female headed ones. This is indicative of gender differences in income generation in developing countries and that male-headed households have a greater chance of generating more income than their female-headed counterparts. The relative return of this gender variable is lower for the post drought and structural adjustment households. The urban-rural dummy variable (UR) has strong significance in favor of urban households in both years. The advantage of being urban household has significantly decreased after the economic shocks. An asset index variable (NATYPE) had significance on income in both years. Households with greater asset ownership have higher real income. Like other determinants of income, the return on assets has reduced after the economic changes, which in all likelihood is indicative of a worsened economic environment in post structural adjustment Zimbabwe.

The age/sex/education variables have expected signs and significance. For male household members whose age is between 18 and 64 (the most productive age category as far as income generation is concerned), income is significantly lower for households with members having primary or lower education level. Members having secondary education or higher have positive impact on income. Finally income is lower for households with higher number of younger (ages less than 18 years) and elderly (ages over 65 years) family members. It is important to note that returns from education have reduced considerably for all age/sex groups after the structural changes and drought. This is a testament to the decline in overall productivity due to rainfall shortage and macroeconomic instability evidenced in the 1990s Zimbabwe.

Table 2. Reduced Form Income and Consumption estimates

VARIABLE	1990/91				1995/96			
	RINC		RCONS		RINC		RCONS	
	Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value
INTERCEPT	40.66	0.98	111.32	4.94	103.13	6.39	101.30	7.61
UR	54.66	8.35	50.87	4.08	30.20	8.63	27.84	5.84
NATYPE	34.77	3.99	30.21	5.28	12.62	2.43	10.39	3.84
HEAD	17.53	2.53	13.21	3.53	18.16	5.92	13.84	6.21
AGE0_5	-17.74	-6.63	-17.82	-12.45	-23.41	-18.42	-20.58	-2.38
MAL6_11	-20.51	-5.92	-21.86	-11.82	-17.94	-10.57	-15.64	-2.75
MAL12_17	-21.77	-5.85	-20.02	-10.06	-20.51	-11.8	-17.62	-4.01
M18_64PE	-27.11	-5.61	-28.93	-11.2	-16.92	-7.79	-13.79	-8.78
M18_64SE	19.20	5.01	17.10	8.34	15.59	8.85	16.44	2.9
M18_64HE	101.80	4.71	66.59	5.77	47.63	10.8	31.20	9.78
FEM6_11	-18.98	-5.54	-20.65	-11.28	-16.18	-9.65	-14.44	-5.9
FEM12_17	-15.98	-4.25	-18.60	-9.27	-18.53	-10.71	-16.51	-3.18
F18_64PE	-30.81	-7.26	-26.78	-11.81	-15.90	-8.4	-13.39	-4.78
F18_64SE	31.60	7.26	21.12	9.09	24.91	2.88	16.34	2.61
F18_64HE	145.26	4.14	36.79	1.96	26.85	2.69	28.66	3.97
MAL65_	-31.28	-3.11	-35.07	-6.5	-33.89	-7.34	-28.60	-8.56
FEM65_	-6.91	-0.72	-18.28	-3.54	-22.15	-5.17	-17.69	-5.71
RPDEV	-0.31	-1.85	-0.18	-2.06	-2.60	-2.48	-3.09	-4.06
RWDEV	0.38	1.03	-0.21	-1.05	-1.53	-5.05	-1.55	-7.08
RPDEV	-5.56	-2.64	-3.02	-2.69	4.02	2.97	3.41	3.47
RPDEV2[3]	-0.003	-0.19	-0.04	-5.43	-0.09	-2.81	-0.11	-4.45
RWDEV2	0.01	0.35	0.02	2.7	-0.05	-3.93	-0.05	-5.59
RHDEV2	-0.06	-2.45	-0.04	-2.6	0.03	2.55	0.03	2.94
N	14052		14052		17492		17492	
R^2	0.163		0.367		0.219		0.287	
Hypotheses Tests[1]								
Test1[2]		6.78 [0.0092]		2.13 [0.1910]		10.03 [0.001]		9.48 [0.0016]
Test2		2.98 [0.0854]		--		56.92 [0.0001]		--
Test3		2.30 [0.1190]		--		7.47 [0.006]		--

Note that along with coefficient estimates, t-statistic is reported instead of parameter standard errors. The results are obtained by estimating a system consisting of income, consumption and savings equations using Seemingly Unrelated Regression (SUR) procedure.

[1]Hypotheses tests report Chi-Square test statistic. The P-values are in the square brackets.

[2]Test 1: the joint effect of rainfall is insignificant; test 2: the permanent income variable, the index of asset types owned (NATYPE), has same effect on consumption as on income; test 3: transitory rainfall variables have the same effect on savings as on income.

[3]RPDEV2, RWDEV2, and RHDEV2 are squares of RPDEV, RWDEV, and RHDEV, respectively.

Most transitory rainfall variables are all significant and highly significant jointly (see hypothesis test 1), supporting our claim that regional rainfall variability may explain transitory income and income variability. Deviations from normal rainfall pattern were more important in 1995/96 than they were in 1990/91. Rainfall deviations and squared deviations during planting and weeding periods played a critical negative role in income generation, and the effect was even higher for the post drought and structural adjustment households. This implies that the droughts of early 1990s have had significant adverse effects on the economy.

Reduced Form Consumption and Savings Equations

The main focus of the current study is to examine household saving behavior and its impact on consumption, which is better examined by looking at the structural savings and consumption equations that explicitly contain different income types as regressors. This will be extensively discussed in the next section. However, looking at the reduced form consumption and savings equations can provide additional insight on household consumption and saving behavior and factors that affect such behavior.

Reduced Form Consumption Equation

Table 2 presents the reduced form consumption estimates for both 1990/91 and 1995/96. The reduced form consumption equations for both years exhibit similar patterns as the income equations. Consumption is significantly affected by most of the variables included in the estimation. Rural households had a decided disadvantage compared to the urban ones and male-headed households have higher consumption expenditures. The asset ownership index variable (NATYPE) was significant in both years but its effect on consumption much higher before the economic shocks than after the changes – in fact its impact reduced five-hold from 1990/91 to 1995/96.

Looking at the household member characteristics, we see similar signs but different sizes on coefficient estimates for both years. Households with many young members have lower consumption expenditures per capita[9]. Households with uneducated male and female adult members (ages 18-64) had disadvantages in

meeting their consumption needs in both years. Many elderly members translate into less consumption expenditures. The family composition variables thus seem to follow the notions of life cycle models in both years. Rainfall deviations have significant unfavorable impact on consumption expenditures. Hypothesis test 1 (F-test statistic =2.13 for 1990/91, F-test statistic =9.48 for 1995/96) shows evidence that rainfall deviations played more important role on consumption in 1995/96 than in 1990/91.

Reduced Form Savings Equations

The results of reduced form equations for financial and other savings are reported in table 3. In this section we are essentially interest in looking at the impact of rainfall deviations on household savings behavior. While positive savings accompanied rainfall deviations in 1990/91, such deviations had no significant effect in 1995/96. Since rainfall variability could be roughly translated into income variability, this result implies that household saving behavior in 1990/91 is more prudent than that in 1995/96. Lack of prudent response to rainfall variability post the drought and structural changes may be explained by the urgency of current needs and lack of economic resources to save for future use. Household with higher asset holding had higher propensity to save in both savings types. It is interesting to note that more educated households save more in the form of physical asset than liquid assets. Many elderly and younger household members mean more financial saving but their other savings are significantly negative, rendering some support to life cycle models.

Hypothesis Tests using Reduced form Estimates

The implications of the permanent income hypothesis (PIH) on household consumption and saving behavior can be tested using the results of the reduced form equations (table 2). The PIH implies that the effect of transitory rainfall variables on income should be equivalent to their effect on savings and they should have insignificant impact on consumption. However, hypothesis test 1 on the consumption equation indicates that rainfall variables are both singly and jointly significant. Furthermore hypothesis test 3 showed that the rainfall deviation' effect on income is

[9] However household level (not per-capita) consumption regressions show that such expenditures are

not identical to its combined effect on savings. Thus we can reject polar cases of PIH for both years. Another implication of the PIH is that saving is unrelated to permanent income. This relationship implies in our case, after controlling for life cycle variables, that permanent income variables such as NATYPE should have zero impact on savings (i.e., should have identical effect on consumption and income). The hypothesis test 2 does not show supportive evidence to such assertion for both 1990/91 and 1995/96 households. Similarly looking at hypothesis tests on savings equations in table 3, we find evidence that both saving types are responsive to rainfall variability in 1990/91 but not in 1995/96. Permanent income variables had significant impact on savings in both years, contrary to the PIH implications. The impact is higher for the 1995/96 households, indicating stronger deviations from the PIH for 1995/96.

Two-Stage Consumption Estimations

Two stage estimates provide us with a clear look at household saving and consumption behavior since we explicitly have permanent, transitory and residual incomes and remittances as regressors. The results are summarized as follows.

Consumption out of permanent (YP) and transitory (YT) Incomes

Table 4 reports the consumption (equation 17) estimates for both survey years. The pre-drought and structural adjustment survey results support the implication that households consume the majority of their permanent income (about 86%). The 1990/91 households consume small but significant amount of their transitory income (about 48%). On the other hand, the 1995/96 data reveals that households are consuming nearly all of their transitory income (98%) and about 81% of their permanent income as well. The propensity to consume the residual income (YR) for 1990/91 households is 31%, which is lower than permanent income but higher than the transitory income. Since YR contains elements of both permanent and transitory incomes, the pre-drought household propensity to consume out of YR seems supportive of the permanent income hypothesis. On the contrary, post-drought propensity to consume from YR is much higher (56% of YR is consumed).

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higher for households with more young members, reinforcing the theory of life cycle models.

Table 3. Reduced form Savings – Financial and all other Savings

VARIABLE	1990/91				1995/96			
	RFSAV		ROSAV		RFSAV		ROSAV	
	Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value
INTERCEPT	-78.004	-2.31	7.348	1.29	18.630	0.88	10.329	1.99
UR	-9.652	-1.80	13.444	4.57	-1.620	-0.74	3.969	7.35
NATYPE	2.374	2.62	2.187	4.44	1.485	5.16	0.744	10.52
HEAD	1.696	0.30	2.626	2.77	3.697	1.95	0.628	1.36
AGE0_5	1.157	0.54	-1.085	-3.01	-2.167	-2.78	-0.655	-3.44
MAL6_11	1.276	0.46	0.073	0.16	-1.727	-1.66	-0.566	-2.23
MAL12_17	-1.359	-0.45	-0.390	-0.78	-2.238	-2.1	-0.652	-2.51
M18_64PE	5.420	1.39	-3.605	-5.54	-2.563	-1.92	-0.569	-1.75
M18_64SE	-1.077	-0.35	-1.022	-1.98	1.612	1.49	-0.771	-2.93
M18_64HE	6.030	0.35	29.183	10.04	9.078	3.35	7.347	11.12
FEM6_11	1.778	0.64	-0.107	-0.23	-1.697	-1.65	-0.042	-0.17
FEM12_17	1.652	0.55	0.974	1.93	-1.844	-1.74	-0.177	-0.68
F18_64PE	-1.248	-0.37	-2.785	-4.88	-1.721	-1.48	-0.784	-2.77
F18_64SE	-11.094	-3.17	0.620	1.06	9.228	1.74	-0.653	-0.5
F18_64HE	72.671	2.57	35.796	7.58	-10.179	-1.66	8.370	5.61
MAL65_	11.159	1.37	-7.371	-5.42	-3.325	-1.17	-1.966	-2.84
FEM65_	14.066	1.81	-2.702	-2.08	-3.128	-1.19	-1.327	-2.07
RPDEV	-0.078	-0.58	-0.048	-2.11	0.386	0.6	0.104	0.66
RWDEV	0.586	1.94	0.009	0.17	0.035	0.19	-0.013	-0.28
RPDEV	-2.714	-1.60	0.176	0.62	0.389	0.47	0.224	1.1
RPDEV2[3]	0.041	3.71	-0.004	-2.08	0.011	0.56	0.002	0.46
RWDEV2	-0.022	-1.57	0.003	1.29	0.001	0.11	0.001	0.29
RHDEV2	-0.032	-1.46	0.003	0.88	0.004	0.52	0.001	0.62
N	14052		14052		17492		17492	
R^2	0.10		0.11		0.06		0.067	
Hypotheses Tests[1]								
Tes1[2]		1.67		0.23		1.26		3.16
		[0.1966]		[0.6284]		[0.2617]		[0.0754]
Test2		2.62		14.44		5.16		10.52
		[0.0087]		[0.0001]		[0.0001]		[0.0001]
Tes3		-1.11		-0.85		-2.02		-2.15
		[0.2663]		[0.3928]		[0.0437]		[0.0318]

Note that along with coefficient estimates, t-statistic is reported instead of parameter standard errors. The results are obtained by estimating a system consisting of income, consumption and savings equations using Seemingly Unrelated Regression (SUR) procedure.

[1]Hypotheses tests report Chi-Square test statistic. The P-values are in the square brackets.

[2]Test 1: the joint effect of rainfall is insignificant on savings; test 2: The asset index variable has insignificant effect on savings; test 3: remittances have insignificant effect on savings.

[3]RPDEV2, RWDEV2, and RHDEV2 are squares of RPDEV, RWDEV, and RHDEV, respectively.

These results show that Zimbabwe households' consumption behavior has changed in the 1990s. The post drought trend has become using all sources of incomes for

current consumption while pre-drought households saved the majority of their transitory income.

The Effect of Family Composition on Consumption

The results show that household per capita consumption decreases with additional young and elderly members in both survey years. This finding is not contrary to the old age security hypothesis that claims people depend on their children for provision when they are old. It is interesting to note that although household consumption and saving behavior has changed over the 1990s, the family composition effect and its dependency structure remained intact even in the face of growing economic shocks.

The Effect of Rainfall Variability on Consumption

Rainfall variability is used in this study as a proxy for income variability and we expect, for prudent household behavior, that it will have negative effect on consumption. Since this measure of income variability does not vary across households in the same region, caution should be taken in interpreting the results. Rainfall variability had a significant negative effect on consumption in 1990/91 but its effect was not significant in 1995/96. This result indicates precautionary behavior for 1990/91 while such prudent behavior is lacking in the post drought and structural adjustment consumption behavior.

The Effect on Remittances and Transfers on Consumption

The role of remittances on household strategies in developing countries has been an important area of research Lucas and Starks, 1985; Reardon, 1988). The magnitude of remittances received and the degree of household dependence on them can have important implications for economic policy since such arrangements link households across regions and labor markets, both at home and abroad. Our analysis shows that receipt of remittances had no significant impact on consumption for households before economic shocks while such receipts played a significantly positive role in the post-drought Zimbabwe. Because of worsened economic environment post-drought and structural changes, remittances have become a more important

source of income for consumption. This shows that household participation in migrant markets may have increased as a strategy to overcome the adverse effects of the drought. It could also be a reflection of missing or incomplete credit and insurance markets to smooth household consumption after shocks. People are forced to depend on remittances from family members and benefits from government sources to meet their daily consumption needs after drought and structural adjustment took place.

Two Stage Savings Estimations

Table 5 reports the savings (equation 17) estimates. We expect some variables that had positive impact on consumption to have the opposite effect on savings. But since different saving measures were estimated such relationship with consumption may not be obtained across all saving types. It should be noted further that certain demographic and environmental variables could simultaneously increase (decrease) both consumption and savings. Under the steadily changing economic, social and environmental landscape of Zimbabwe, simultaneous reduction in both consumption and savings is highly likely. Furthermore, we are interested in examining the characteristics of households and groups that dictate the choice of saving types.

Savings out of YP, YT, and YR

The results of savings (equation 17) estimates in table 5 show that households saved a significant amount of their transitory and residual incomes in 1990/91. But savings out of YT is insignificant and the fraction of residual income saved is considerably lower in 1995/96. Households in both years saved small but significant fractions of their permanent, transitory and residual incomes in the form of OSAV. Contrary to FSAV, OSAV responds negatively to rainfall variability. This may be due to low returns in asset savings, particularly after the drought and structural changes. Rainfall variability in 1990/91 had positive effect on financial savings, planting period variability being the most significant. But rainfall variability does not seem to have much effect on financial savings for the 1995/96 households except that harvest period rainfall variability showed some positive effect on saving.

Table 4 Two-Step Estimation – Consumption

VARIABLE	1990/91		1995/96	
	Estimate	**t-value**	**Estimate**	**t-value**
INTERCEPT	102.753	7.83	36.432	4.66
YP	0.861	8.98	0.811	7.45
YT	0.485	4.35	0.978	12.67
YR	0.313	8.28	0.563	6.15
REMITR	-0.004	-0.07	0.624	3.45
AGE0_5	-2.358	-2.05	-1.468	-2.41
AGE6_11	-4.355	-4.03	-0.984	-1.76
AGE12_17	-2.889	-2.53	-1.185	-2.09
AGE18_64	0.319	0.36	1.227	3.00
AGE65_	-2.776	-1.08	0.769	0.61
STDRP	-1.62919	-7.48	-0.004	-0.07
STDRW	0.12703	0.71	0.024	0.4
STDRP	-0.07583	-0.87	-0.123	-1.94
N	14052		17492	
R^2	0.590		0.717	
Hypotheses Tests[1]				
Tes1[2]		18.95 [0.0001]		44.48 [0.0001]
Tes2		10.83 [0.001]		4.38 [0.0364]
Tes3		98.23 [0.0001]		1.82 [0.1774]

Note that along with coefficient estimates, t-statistic is reported instead of parameter standard errors. The results are obtained by two step procedure: first obtaining the measures of income types (YP= permanent income, YT= transitory income, YR= residual income) and finally estimating a system consisting of consumption and savings measure equations using Seemingly Unrelated Regression (SUR) procedure.

[1]Hypotheses tests report Chi-Square test statistic. The P-values are in the square brackets.

[2]Test 1: the propensity to consume out of permanent income is unity (i.e., $\phi_1 = 1$); test 2: the propensity to consume out of permanent income is the same as that out of transitory income (i.e., $\phi_1 = \phi_2$); test 3: the joint effect of transitory rainfall variability is insignificant (i.e., $\mathbf{f}_5 = \mathbf{0}$).

These results, along with the results from consumption equations, show that households in the post-drought and structural adjustment period are not saving as much as they used to before the changes. There is high dependence on transitory income as the source of consumption. This implies that, although we do not have any evidence for a polar case of PIH, the pre drought households used savings to mitigate income fluctuations, while such behavior was limited post the drought and the structural adjustment. Furthermore since rainfall variability is used as a proxy for

income variability, these results show post drought and structural adjustment households do not manifest precautionary saving behavior while the pre drought and structural changes household saved more when their income fluctuation is higher.

Hypothesis Tests using Two-step Estimates

The tests of PIH using two-step estimates are statistically equivalent to the ones we did employing the reduced form estimates in the previous section. Hypothesis test 1 in table 4 shows that propensity to consume out of permanent income is lower than unity for both years. On the same table, hypothesis test 2 indicates that propensity to consume out of permanent and transitory incomes are about the same in 1995/96 while there is evidence that the former is higher in 1990/91. Household precautionary saving behavior test (hypothesis 3) in table 4 supports that the pre-droughts and structural adjustment households consumption responded to transitory rainfall variability (a proxy for income variability). The post drought and structural adjustment households did not respond in statistically significant fashion to income variation (p-value= 0.1778). Similar hypothesis tests for the savings equations are reported on table 4.4. Hypothesis 1 (i.e., the propensity to save out of transitory income, for both savings types combined, is unity) is rejected for both years. Hypothesis 2 (i.e., the propensity to save out of transitory income is the same to that out of permanent income) shows some support for the PIH in 1990/91 and strong evidence against the PIH in 1995/96 households. We do not have strong evidence to reject the hypothesis (Hypothesis 3) that rainfall variability is jointly insignificant on saving in 1995/96 (p-values 0.1031 for RFSAV and 0.2571 for ROSAV) while we have strong evidence of significance in 1990/91 (p-values 0.0001 for RFSAV and 0.0057 for ROSAV).

These tests show evidence that changes occurred in household consumption and saving behavior after the weather shocks. The results show that in 1990/91, households consumed the majority of their permanent income, saved the majority of their transitory income and depended less on remittances. The higher marginal propensity to save out of transitory income by households in this period implies that they used savings and dissavings to smooth consumption. The fact that propensities to consume out of permanent income is statistically less than one, and savings out it are generally greater than zero indicates that a polar version of the permanent income hypothesis cannot be accepted. The post drought and structural adjustment

households, however, consumed the majority of both permanent and transitory incomes, and depended heavily on remittances. Their saving behavior had been adversely affected by recurring droughts and unfavorable economic changes. Higher income variability is associated with reduced consumption indicating prudent behavior on the part of pre-drought and pre-structural adjustment households. Household consumption and savings post-droughts and structural changes did not respond well to income variability.

Table 5. Two-step Estimation – Financial and all other savings

VARIABLE	1990/91				1995/96			
	RFSAV		ROSAV		RFSAV		ROSAV	
	Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value
INTERCEPT	-89.319	-6.48	-13.308	-3.33	-26.501	-3.25	-9.93	-4.08
YP	0.037	3.38	0.104	3.02	0.104	3.78	0.09	8.17
YT	0.364	3.1	0.150	4.4	-0.038	-0.47	0.06	2.49
YR	0.659	7.68	0.029	5.58	0.389	10.96	0.05	5.09
RPENSION	-0.036	-5.18	--	--	-0.624	-3.45	--	--
AGE0_5	1.768	1.46	0.618	1.77	0.234	0.37	1.23	6.51
AGE6_11	2.977	2.62	1.400	4.25	-0.029	-0.05	1.01	5.83
AGE12_17	1.130	0.94	1.779	5.11	0.163	0.28	1.02	5.82
AGE18_64	-0.846	-0.92	1.151	4.3	0.580	1.36	0.65	5.09
AGE65_	6.295	2.32	-3.296	-4.19	-1.048	-0.8	0.28	0.72
STDRP	1.584	6.91	0.044	0.66	0.018	0.31	-0.01	-0.81
STDRW	0.029	0.15	-0.154	-2.81	-0.055	-0.89	0.03	1.7
STDRH	0.100	1.1	-0.024	-0.9	0.166	2.52	-0.04	-2.24
N		14052		14052		17492		17492
R^2		0.670		0.135		0.403		0.162
Hypotheses Tests[1]								
Test1[2]	9.82 [0.0001]	--		--	16.46 [0.0001]	--		--
Test2	--	7.42 [0.0065]		1.71 [0.1913]		2.89 [0.0894]		1.07 [0.3016]
Test3	--	14.55 [0.0001]		7.64 [0.0057]		2.66 [0.1031]		1.28 [0.2571]

Note that along with coefficient estimates, t-statistic is reported instead of parameter standard errors. The results are obtained by two step procedure: first obtaining the measures of income types (YP= permanent income, YT= transitory income, YR= residual income) and finally estimating a system consisting of consumption and savings measure equations using Seemingly Unrelated Regression (SUR) procedure.

[1]Hypotheses tests report Chi-Square test statistic. The P-values are in the square brackets.

[2]Test 1: the propensity to save out of transitory income is unity (both savings coefficients combined, i.e., $\phi_{2rfsav}+\phi_{2rosav}=1$); test 2: the propensity to save out of transitory income is the same as that out of permanent income (i.e., $\phi_1=\phi_2$); test 3: the joint effect on savings of transitory rainfall variability is insignificant (i.e., $\mathbf{f}_5$**=0)**.

6. Conclusions

Households face substantial risks in most developing countries. Livelihood strategies represent adaptation to uncertainty with respect to income generation and subsistence consumption. Highly erratic rain, commodity price fluctuations, poorly functioning or missing markets for inputs and outputs, unexpected changes in price policies, unstable governments and armed conflicts are important sources of risks. Zimbabwe is a good example of adaptation to such risks. The major shocks to the economy in the 1990s included droughts and structural adjustments. Evidence shows that poverty increased substantially during the 1990s. The current paper analyzes changes in consumption and saving behavior before and after the droughts and structural adjustments. We estimated the propensities to consume and save out of permanent and transitory incomes and tested the notions of permanent income hypothesis and precautionary saving motives. In addition, we analyzed how changes in an overall economic situation seem to translate into changes in propensities to save.

The results show that the 1990/91 households consumed the majority of their permanent income, saved the majority of their transitory income and depended less on remittances. The higher marginal propensity to save out of transitory income by households in this period implies that they used savings to smooth consumption. The fact that propensities to consume out of permanent income are statistically less than one, and savings out it are generally greater than zero indicates that a polar version of the permanent income hypothesis cannot be accepted. Post drought and structural adjustment households, however, consumed the majority of both permanent and transitory incomes, and depended heavily on remittances. Their saving behavior had been adversely affected by recurring drought and unfavorable economic changes. Higher income variability is associated with reduced consumption indicating precautionary behavior on the part of pre-drought and pre-structural change households. Household consumption and savings post-drought and structural change did not respond well to income variability.

The findings from this study have important welfare implications. Zimbabwean households were forced away from risk management and prudence (as manifested in the 1990/91 data) to that of heavy dependence on transitory income and remittances for consumption (as the results of 1995/96 showed). The prolonged period of drought and macroeconomic changes in the early 1990s has limited households' long-term ability to mitigate risk. Households were not able to save and

use savings to buffer consumption from income shocks. Furthermore households may be facing credit problems due to large decline in their incomes and the economy wide decline in productivity may also constrain credit institutions. It should be emphasized that weather risk is spatially covariant and would be difficult, especially for rural households, to undertake arrangements that insure against drought that affect everyone in their locality simultaneously. (See, for instance, Rosenzweig and Binswanger, 1993). Our results from both years indicate that households are able to address idiosyncratic risks through saving the majority of their transitory income in 1990/91; however, they are not capable of managing covariant risks such as drought and economy wide changes as evidenced from 1995/96 data. As a result transitory income fluctuations may have serious welfare consequences.

References

Alderman, H.1996. “Saving and economic shocks in rural Pakistan”. Journal of Development economics. 51(1996), 343-365.

_____ and C.H. Paxson. 1992. “Do the poor insure? A synthesis of the literature on risk and consumption in developing countries”, Research Program in development Studies Discussion Paper #164, Princeton University.

Alwang J., L. Ersado, and N. Taruvinga. 2000. “Changes in poverty in Zimbabwe between 1990 and 1996: Worsening outcomes under adverse conditions”, Mimeo, Virginia Polytechnic Institute and State University.

Besley, T. 1993. “Savings, credit and insurance,” Draft chapter for the Handbook of Development Economics, Vol. 3.

Binswanger, H. and J. McIntire. 1987. “Behavioral and material determinants of production relations in land-abundant tropical agriculture,” Economic Development and Culture Change, 36(1), 73-99.

Binswanger, H. and M. Rosenszweig. 1993. “Wealth, weather risk and the composition and profitability of agricultural investment” , Economic Journal. 103(January) 56-78.

Bromley, D.W., J. P. Chavas. 1989. “On risk, transactions and economic development in the semiarid tropics”, Economic Development and Cultural Change, 37(4) 719-736.

Caballero, R. J. 1990. “Consumption puzzles and precautionary savings,” Journal of Monetary Economics, 25(1), 113-36

Case, A. and A. Eaton. 1998. “Large cash transfers to the elderly in South Africa.” The Economic Journal, 108(September), 1330-1361.

Carter, M. 1997. “Environment, technology and the social articulation of risk in West African agriculture,” Economic Development and Cultural Change, 45(3), 557-590.

Central Statistical Office.1997. *National Accounts 1985-1996*. Harare: Government Printing Office.

Central Statistical Office.1998a. *Report on the ICES*. Harare: Government Printing Office.

Central Statistical Office.1998b. *Poverty in Zimbabwe*. Harare: Government Printing Office.

Coate, S. and M. Ravallion. 1993. “Reciprocity without commitment: characterization and performance informal insurance arrangements,” Journal of Development Economics, (40) 1-24.

Deaton, A. 1990.”Saving in developing countries: theory and review”, World Bank Economic Review, Proceedings of the World Bank Annual Conference on Development Economics, pp. 61-69.

_____. 1991. “Saving and liquidity constraints”, Econom terica, 59/5, 1221-1248.

_____. 1992. *Understanding Consumption*. Oxford University Press, Oxford.

_____. 1997. *The Analysis of Household Surveys: A Microeconomic Approach to Development policy*. The Johns Hopkins University Press, Published for The World bank.

Fafchamps, M. 1992. “Solidarity networks in rural Africa: Rational peasants with a moral economy”, *Economic Development and Cultural Change*, 41, 147-175.

_____, C. Udry and K. Czukas. 1998. “Drought and saving in West Africa: are livestock a buffer stock?”, *Journal of Development economics*. 55(1998) 273-305.

Friedman, M. 1957. *A Theory of the Consumption Function*, Princeton University Press.

Ghez, G. R. and G. S. Becker. 1975. “The allocation of time and goods over the life-cycle,” New York, Columbia University Press for NBER.

Hall, R.E. 1978. “Stochastic implications of the life cycle-permanent income hypothesis: theory and evidence”, Journal of Political Economy, 86(6), 461-481.

Handa, S. 1996. “Expenditure behavior and children’s welfare: An analysis of female headed households in Jamaica”, Journal of development Economics, (50)165-187.

Jalan, J. and M. ravallion. 1999. “Are the poor less well insured? Evidence on vulnerability to income risk in rural China” *Journal of Development Economics*, (58) 61-81.

Jacoby, H. and E. Skoufias. 1992. “Risk, seasonality, and school attendance,” draft, University of Rochester.

Jacoby, H., E. Skoufias. 1997. “Rosk, financial markets and human capital in a developing country”, Review of Economic Studies, 64(3) 335-371.

Jodha, N.1978. “Effectiveness of farmers’ adjustment to risk,” Economic Politics Weekly 18.

Kimball, M. S.and N. G. Mankiw. 1989. “Precautionary saving and the timing of taxes,” Journal of Political Economy, 97(4) 863-79.

Kinsey B., B. Kees, and G. J. Willem. 1998. “ Coping with drought in Zimbabwe: Survey evidence on responses of rural households to risk”, World Development, 26(1) 89-110

Kozel, V. 1987. “Income, consumption, and saving behavior in the Cote d’Ivoire”, Ph.D. thesis, MIT.

Lucas, R.E.B. and O. Stark. 1983. “Motivations to remit: Evidence from Botswana”, Journal of Political Economy, 93(5) 901-918.

Lund, S. 1996. “Informed credit and risk-sharing networks: empirical evidence from the Philippines. Manuscript, Stanford University.

Marquette, C. M. 1997. “Current poverty, structural adjustment, and drought in Zimbabwe”, World Development 25(7) 1141-1149

Modigliani, F. and R. Blumberg. 1954. “Utility analysis and the consumption function:an interpretation of cross-sectional data,” in Kenneth K. Kurihara, ed., *Postkeynesian economics*, New Brunswick, N.J., Rutgers University Press, 388-436.

_____. 1979. “Utility analysis and the consumption function: an attempt at integration.” In Andrew Abel, ed., *The collected papers of Franco Modigliani,* Vol. 2, Cambridge, Mass., MIT Press, 128-97.

Morduch, J. 1993. “Risk, production and saving: theory and evidence from Indian households. Mimeo, Harvard University.

Morduch, J. 1995. “Income smoothing and consumption,” Journal of Economic Perspectives, 9(3), 103-114.

Morduch, J.1998. “Poverty, economic growth, and average exit time”, Economics Letters 59(3) 385-390.

Nerlove, M. A. Razin and E. Sadka. 1985. “The old age hypothesis’ reconsidered,” Journal of Development Economics, 18(August), 243-52.

Paxson, C.H. 1992. “Using weather variability to estimate the response of savings to transitory income in Thailand”. The American economic Review. 82(1)15-33.

_____. 1996. “Saving and growth: Evidence from micro data”, European Economic Review 40(2) 255-288.

Reardon, T., P. Matlon, C. Delgado. 1988. “Coping with household-level food insecurity in drought-affected areas of Burkina Faso”, World Development, 16(9) 1065-1074.

Reardon, T., P. Matlon. 1989. “Seasonal food insecurity and vulnerability in drought-affected regions of Burkina Faso”, in: David, S. (Ed.), Seasonal Variability in Third World Agriculture: The Consequences for Food Security, Hohns Hopkins Univ. Press, Baltimore, MD.

Reardon, T., P. Matlon, C. Delgado. 1992. “Determinants and effects of income diversification amongst farm households in Burkina Faso”, Journal of Development Studies, 28(2) 264-296.

Reardon T. and S.A.Vosti. 1995. “Links between rural poverty and the environment in developing countries: Asset categories and investment poverty”, World Development 23(9), 1495-1506.

Rosenszweig, M. 1988. “Risk, private information and the family,” American Economic Review, 78(2), 245-250.

Rosenszweig, M. 1990. “Credit markets, risk pooling and risk taking in low-income countries” (Manuscript, University of Minnesota).

_____ and H. Binswanger. 1993. “Wealth, weather risk and the composition and profitability of agricultural investments,” Economic Journal, (103) 56-80.

_____ and K. Wolpin. 1989. “Specific experience, household structure and intergenerational transfers: Farm family land and labor arrangements in developing countries”, Quarterly Journal of Economics, 100, 961-987.

_____ and R. Shaban. 1993. “Share tenancy, risk and the adoption of new technology,” Mimeo, University of Pennsylvania.

Scoones, I., et. al 1996. *Hazards and Opportunities: Farming Livelihoods in Dryland Africa. Lessons from Zimbabwe*. London, Zed Books.

Stark, O. and D. Levhari. 1982. “On migration and risk in LDCs”, Economic Development and Cultural Change, 31 (October) 191-96.

Townsend R.M. 1993. *The Medieval Village Economy*. Princeton: Princeton University Press.

Townsend R.M. 1994. “Risk and insurance in village India,” Econometrica, 62(3), 539-92.

Townsend R.M. 1995a. “Consumption insurance: an evaluation of risk-bearing systems in low-income economies,” Journal of Economics Perspectives, 9(3), 85-102.

_____. 1994. “Risk and insurance in village India” Econom terica 62(3) 85-102.

_____. 1995. “Consumption insurance: an evaluation of risk-bearing systems in low-income economies”. Journal of Economic Perspectives. 9(3) 83-102.

Udry, C. 1990. “ Credit markets in Northern Nigeria: credit as insurance in a rural economy”, World bank Economic review, 4930 251-269.

_____. 1994. “ Risk and insurance in a rural credit market: An empirical investigation in Northern Nigeria.” Review of Economic Studies, 61(3) 495-526.

_____. 1995. “ Risk and saving in Northern Nigeria”, American Economic Review, 85(5) 1287-1300.

World Bank. 1996a. *Understanding Poverty and Human Resources in Zimbabwe: Changes in the 1990s and directions for the Future*. Washington: Human Resources development Group, Eastern and Southern African Discussion Paper.

Wolpin, K. 1982. “A new trest of the permanent income hypothesis: the impact of weather on the income and consumption of farm households in India. International Economic Review, 23(3) 583-594.

Zimmerman F. and M. R. Carter. 1996. “Dynamic portfolio management under risk and subsistence constraints in developing countries”. Agricultural and Applied Economics, Staff Paper Series, University of Wisconsin-Madison.