

# **Income Diversification in Zimbabwe: Welfare Implications from Urban and Rural Areas\***

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# Income Diversification in Zimbabwe: Welfare Implications from Urban and Rural Areas

## ABSTRACT

The paper examines, taking into account the urban-rural divides, the changes and welfare implications of income diversification in Zimbabwe following macroeconomic policy changes and droughts of the early 1990s. Data from two comparable national income, consumption and expenditure surveys show that the percentage of households earning income from private and informal sources grew considerably while that from government and formal sources declined from 1990/1 to 1995/6. We find that, in general, rural households tend to have a more diversified portfolio of income compared to their urban counterparts and the degree of diversification decreases with the level of urbanization. However, there are important differences in the level of diversification within the rural and urban areas depending on wealth: While the relatively better-off households have a more diversified income base in rural areas, it is the poor that pursue multiple income sources in urban areas. A decomposition of changes in welfare indicates that the total contribution of income diversification is large and increased between 1990/1 and 1995/6 in both urban and rural areas. On the other hand, there were significant declines in returns to human and physical capital assets during the same period. The findings suggest that households with a more diversified income base are better able to withstand the unfavorable impacts of the policy changes and weather shocks. The fact that relatively better-off households have a more diversified income base following the shocks implies that the poor are more vulnerable to economic changes unaccompanied by well-designed safety nets.

*Key Words:* Zimbabwe, Income Diversification, Weather, Adjustment.

*JEL Classification:* D1, H5, O5, R2, I3

## 1. Introduction

Over the last several decades, many countries in the developing world implemented economic structural adjustment programs (ESAP) aimed at stimulating economic growth. Zimbabwe began implementing ESAP in 1991. The ESAP in Zimbabwe, like in other countries, involved a series of planned macroeconomic actions, including deregulation of the domestic economy, less restrictive trade policies, and reductions in public spending aimed at promoting sustainable economic growth. In most adjusting countries, including Zimbabwe, Marquette (1997) citing several sources (e.g., Mosley et al., 1996; Lensik, 1996) points out that the effectiveness of ESAP as a catalyst for economic growth has been a subject of lengthy debate among the development community. Concerns have been raised over the social costs of ESAP particularly for vulnerable groups, such as the poor (Renfew, 1992; Gibbon, 1995). The poor could be disproportionately hurt by short-run financial volatility and economic downturns that arise due to fiscal austerity and openness to global market forces, particularly in countries whose social and market institutions are weak to begin with.<sup>1</sup>

For Zimbabwe, the implementation of the ESAP was complicated by the droughts of the early 1990s. The 1991/2 drought was one of the most severe in recent memories, and affected all of southern Africa (Scoones et al., 1996). The country was again hit with a subsequent drought in 1994/5. The latter drought was less severe and more localized in the eastern part of the country.<sup>2</sup> In Zimbabwe, like in most sub-Saharan African countries, the livelihood of the majority its

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<sup>1</sup> While the implementation of some of structural policy prescriptions such as removal of governmental inefficiencies could be beneficial in the medium to long run, policy reversals and failure to implement policy changes may have been harmful and actually worsened the conditions for the poor. This is particularly true in present Zimbabwe. For instance, the high level inflation and devaluation in 1997 stemmed from failure to control the deficit and to sell off parastatals. The poor may be hurt by the downturn and volatility but it is debatable that ESAP is to blame for such government policy failures.

<sup>2</sup> But, coming on the heels of the earlier drought, it may have increased hardship, especially among the vulnerable groups in drought-prone areas.

population depends on rain-fed agriculture.<sup>3</sup> The drought of 1991/2 affected the entire economy, and real GDP per capita shrank by almost 12 percent in that year (CSO, 1998a). The observed decline in per capita income was associated with the dramatic decrease in agricultural production. For instance, maize yield on all farms fell to about 1/3 of its normal levels, and agriculture's share of total production fell from about 14 percent to below 7 percent (CSO, 1998a). The impact of the weather shocks, along with that associated with ESAP, was felt throughout the country. As a result, indicators of well-being fell drastically for both rural and urban households (Alwang et al., 1999, 2001).

But attributing these outcomes solely to economic policy reform and the droughts could be misleading. Individual, household and community own risk management strategies or lack thereof may have aggravated or lessened their adverse impacts. The literature on intertemporal consumption behavior illustrates that agents, anticipating or facing conditions of adversity, engage in various risk management strategies—some mainly risk-reducing and others simply coping devices to protect consumption once a shock has taken place (see, for instance, Paxson (1992) on weather shocks in Thailand; Udry (1990, 1994 and 1995) on credit markets in West Africa; Zimmerman and Carter (1996) on asset-based risk management). One of the several risk management strategies is to maintain a diversified livelihood base to shelter oneself from shocks. Evidence abound which suggest that income diversification is a key way of reducing vulnerability to shocks (Bryceson, 1996 & 1999; Delgado and Siamwalla, 1999; Toulmin et al., 2000; Barrett et al., 2001a).

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<sup>3</sup> Although the contribution of agriculture to Zimbabwe's GNP is relatively lower compared to other sub-Saharan countries, this sector provides employment and livelihood for approximately 70 percent of the population and provides raw materials for the majority of the country's manufactured goods and exports. Even in urban areas, many households rely on food from nearby gardens and goods remitted from rural households; these informal contributions of agriculture go largely unaccounted in national accounts. (See CSO (Central Statistical Office), 1997, 1998a, 1998b; Alwang et al., 1999, 2000)

The objective of this paper is to examine the role of household's own risk management strategies for coping with the adverse effects of the economic policy reform and the droughts. We analyze the determinants of income diversification and its effectiveness in mitigating the impacts of the financial and weather shocks that hit Zimbabwe in the early 1990s. We look at the degree of diversification and factors influencing income and activity diversification ex ante and ex post the shocks. We then investigate its role in the face of adverse changes. We hypothesize that households with more diversified income base were better able to withstand the shocks originating from the droughts and macroeconomic policy reforms. Finally, the paper looks at income diversification in urban areas as compared to that of rural. We use, along with time-series rainfall data from 1951-1996, two nationally representative household level data straddling the period of financial and weather shocks. The household data come from national income, expenditure and consumption surveys in 1990/1 and 1995/6, which were conducted using similar methodologies and near-identical questionnaires.<sup>4</sup>

The paper is organized as follows. Section 2 provides a brief review of the nature and impact of Zimbabwe's economic policy reform program and the droughts on its urban and rural households. Section 3 overviews the key literature on income diversification and its role in mitigating shocks. Section 4 describes the data and section 5 presents the empirical model. Section 6 discusses the results of multivariate analysis of the determinants of income diversification and its impact on welfare before and after economic shocks. Finally section 7 concludes the paper.

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<sup>4</sup> The 1990/1 ICES was conducted during the period July 1990 through June 1991. The 1995/6 ICES was conducted during the period July 1995 through June 1996.

## **2. The Economic Reform Program and the Drought**

Following independence, Zimbabwe accorded a high proportion of its public expenditures to social sectors, perhaps in an attempt to redress the social and economic inequality of the colonial era among different population groups. Spending on public sectors (such as health, education, transport) as a share of total government expenditures rose from 25.7 percent in 1980/1 to 34.9 percent in 1990/1 (CSO, 1997). The expenditures on public service delivery have resulted in substantial improvement in health and education coverage. However, the increased spending program has led to a growing imbalance between central government expenditures and revenues, which compromised the sustainability of the program. Gaps between expenditures and revenues grew throughout the 1980s, and interest payments on the national debt began to consume a greater share of the government budget. Budget deficits also crowded out private investment and created inflationary pressures.

In order to stave off the impending inflationary and overcrowding effects of the fiscal deficits, Zimbabwe embarked on an Economic Structural Adjustment Program (ESAP) in 1991. The objectives of the ESAP were to liberalize the domestic economy through privatisation, deregulate prices and wages, reduce public spending and reduce the central government's budget deficit. A principal ESAP target was to reduce the fiscal budget deficit from near 10 percent of GDP at the end of the 1980s to 5 percent by 1994/5. The program included cost recovery measures in education and health, as these sectors formed the core of the government's increased spending program. ESAP also involved removal of subsidies on food items and reform of trade and exchange rate policies. The liberalization of agricultural marketing was expected to improve conditions in rural areas by removing implicit taxation on agricultural products, increasing

consumption of less-expensive maize substitutes, and allowing rural decision makers to allocate resources more freely in line with their comparative advantage.

Unfortunately, the onset of ESAP coincided with one of the country's worst droughts in 1992. All provinces of Zimbabwe experienced below-average rainfall during the 1991/2 agricultural year, especially during the critical months of October and November when soil moisture is needed for seed germination, and during February, when maize begins to form tassels. The vast majority of communal and resettlement farms depend entirely on rainfall for crop production. High dependency on rainfall made the agricultural sector and the entire economy highly vulnerable to the drought. The 1992 drought reduced domestic food production and lowered real incomes throughout the country due to general economic decline. The subsequent drought in 1994/5 agricultural season had a major impact on agricultural yields, particularly for rainfall-dependent crops such as maize. The droughts lowered the asset base as many households sold their asset holdings in order to survive. The deterioration of the asset position has affected the longer-term prospects for households to move out of poverty.

Many of the ESAP reforms were not implemented as planned due to the 1992 drought, which necessitated increased public spending. The economy failed to exhibit growth in the early 1990s, and the separate effects of droughts and ESAP are difficult to disentangle. The ESAP had negative effects on the poor in that prices rose due to removal of subsidies, and unemployment rose as public-sector employment fell due to retrenchments (Marquette, 1997). It had a direct and immediate impact on the urban poor households, as their livelihood mainly depends on wage income and market purchase of consumption goods. Countrywide studies by Alwang et al. (2001) and others show that poverty has increased in Zimbabwe between 1990 and 1996. The prevalence, depth and severity of poverty have increased substantially (Alwang et al., 2001).

The data indicate that between the 1990 and 1995 survey periods mean real per adult equivalent consumption expenditures declined by about 29 percent and the median fell by 24 percent (table 2). Households in urban areas were hardest hit by these declines. The impact of these changes on the livelihood strategies of the poor is largely unknown. Studies are scant that show how income generating activities changed in response to the unfavorable effects of economic policy reform and the droughts.

### **3. Income Diversification and Economic Shocks**

It is important to note that income diversification is not synonymous with livelihood diversification. The latter is a process by which households construct a diverse portfolio of activities and social support capabilities in order to improve their living standards and manage risk. Income generation is one of components of livelihood strategies (Ellis, 1998). Livelihood diversification also encompasses the social institutions, gender relations, property rights and other no-income support systems that sustain a living. The paper abstracts from these and focuses on income diversification aspect of livelihood strategies.<sup>5</sup>

Natural and policy-induced risks are common facts of life for many people all over the developing world. A number of studies have explored the strategies employed for risk management in developing countries where insurance and credit arrangements are weak or nonexistent. Such studies show that most households generally have smoother consumption than income (Deaton, 1991; Paxson, 1992; Udry, 1994 & 1995; Lund, 1996; Zimmerman and Carter, 1996). People insulate their consumption from income fluctuations in different ways. These range from informal community risk sharing to participating in insurance and credit markets when such opportunities exist (e.g. Binswanger and McIntire, 1987; Bromley and Chavas, 1989;

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<sup>5</sup> For detailed description of livelihood strategies, see Bryceson, 1996 and Ellis, 1998.

Reardon, et al., 1992; Coate and Ravallion, 1993; Udry, 1990 & 1994; Townsend, 1995; Carter, 1995; Fafchamps et al., 1998). They also use saving and dissaving arrangements, where available (Paxson, 1992; Alderman, 1996; 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). Rosenzweig and Wolpin (1993) provide evidence that livestock sales and purchases are used as part of farm households' consumption smoothing strategies.

Households also use income diversification for ex ante risk management or to cope ex post with shocks (Rosenzweig and Binswanger, 1993; Reardon et al., 1992; Reardon et al., 1998). Few households in developing countries derive the bulk of their income from a single source. The literature on livelihood sustainability under conditions of economic uncertainty concludes that most households avoid an extended period of dependence on only one or two sources of income (Reardon, 1997; Bryceson, 1999; Ellis, 2000; Toulmin et al., 2000). There are, in fact, several factors responsible for observed income diversification at the household level. These include: (a) self-insurance against risk in the context of missing insurance and credit markets (e.g. Kinsey et al., 1998), (b) an ex-post coping strategy (e.g. Reardon et al., 1992), with extra individuals and extra jobs taken on to stem the decline in income, (c) an inability to specialize due to incomplete input markets, (d) a way of diversifying consumption in areas with incomplete output markets, (e) to exploit strategic complementarities and positive interactions between activities, and (f) simple aggregation effects where the returns to assets vary by individual or across time and space (Barrett et al., 2001b).

In rural areas of developing countries, diversification into non-farm income sources is growing over time and now accounts for a considerable share of household income. In an extensive analysis of household surveys from 1970s through the 1990s, Reardon et al. (1998) find

an average non-farm income share of 42% in Africa, followed by 40% in Latin America and 32% in Asia. Many studies in rural Africa find positive association between non-farm diversification and household welfare. On the basis of these findings, recommendations such as the promotion of off-farm employment in rural areas as a policy tool have gained widespread support by development agencies including the World Bank and non-governmental organizations (NGOs) (Delgado and Siamwalla, 1999).

On income diversification, the most relevant studies for Zimbabwe are those by Piesse et al. (1998) and by Kinsey et al. (1998). Piesse et al. (1998) find that in remote areas, non-farm income sources increase income inequality but in areas better connected to the large urban market of Harare, that it decreases income inequality. They suggest that in rural areas less well connected to urban centers, the agrarian power structures allow those with higher farm incomes to better exploit non-farm income sources. With better access to urban markets, they suggest that opportunities for non-farm employment are less dependent on these power structures and are therefore more equalizing of income. Kinsey et al. (1998) examine 400 resettled households in rural Zimbabwe over a 13 year period and find that income diversification is a coping strategy used during times of drought, but that the income sources that can be tapped are likely to be low-return activities such as day jobs or agricultural piecework.

The existing empirical studies on income diversification in Zimbabwe, like elsewhere, have several limitations. First, there is little focus on the role of income diversification under urban settings. Urban poor households share some of the same risks as their rural counterparts such as varying returns to labor, market failures and the risks of structural adjustment and macroeconomic policy changes. But conditions and opportunities for income diversification tend to be different in urban and rural areas, as are the economic activities and access to land and

natural resources. We hypothesize that the nature, the degree, and the motives for diversification in urban areas are not similar to those in rural areas. Secondly, most current empirical work on income diversification uses the share of non-farm income as a measure of diversification. The non-farm income share is difficult to measure, requiring an accurate accounting of the level of income from farm and non-farm sources. Moreover, it does not facilitate urban-rural comparison because of its relative irrelevance in urban areas where most income sources tend to be non-farm. Thirdly, there is little or no work comparing income diversification behavior before and after economic shocks.

This study attempts to extend the empirical literature on income diversification by addressing the above issues. It uses a measure of income diversification that lends itself to urban-rural comparison (see section 4). While examining the changes in income diversification before and after economic shocks, it tests its effectiveness as a risk management and coping strategy. In rural areas the paper compares two measures of income diversification: the percentage of non-farm income versus the newly proposed measure in section 4.

#### **4. Data and Descriptive Statistics**

We use two comparable household level data from the national Income, Consumption, and Expenditure Surveys (ICES) in 1990/1 and 1995/6<sup>6</sup>, and a time series rainfall data (1951-1996) from 113 representative weather stations located throughout Zimbabwe. The Central Statistical Office of Zimbabwe administered the surveys. The ICES were based on representative samples comprising both urban and rural sectors of the country (table 1). They contain data on socio-

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<sup>6</sup> The 1995/6 ICES has a slightly expanded set of questions on a few items and a slightly less disaggregated questions on a few others. For our purposes, these differences create very little complication. We have accounted for those differences by establishing a similar set of variables in order to maintain the comparability between the results of 1990/91 and 1995/6. Although the sampling designs of both surveys were quite similar and representative of the different segments of the population, it was not possible to construct a panel structure.

demographic characteristics, incomes from various sources, consumption and other expenditures on a weekly basis, and for some durable and semi-durable items, on a monthly or yearly basis. Each selected household was monitored for a complete month, during which household consumption expenditures were recorded in a daily record book. From the 1990/1 round, about 14,168 observations were obtained following data cleaning. For 1995/6, we have 17,527 observations from a total of 395 enumeration areas. Table 1 presents the composition and geographic distribution of sampled households for both years.

The consumption portions of the questionnaires for the two surveys are virtually identical and permit construction of a consistent measure of consumption expenditures. Our welfare measure, the consumption expenditures, includes the value of all goods and services that are consumed in the previous month. We use a poverty-specific price deflator to adjust the per capita consumption expenditures. Raw prices from regional markets, used to create the national CPI, were obtained from CSO. The prices of the 23 items used to create the Zimbabwean food poverty line (see CSO, 1998b) were weighted using the food poverty line weights. The resulting index was used as an implicit deflator, with June 1990 Zimbabwean dollars in Harare as the base. This index reflects changes in costs of obtaining goods and services faced by the poorest consumers, and varies by survey month and province.

The second source of data comes from time-series rainfall information from 113 representative weather stations throughout Zimbabwe from 1951 through 1996. The data were obtained from the Meteorological Office of Zimbabwe. Season- and region-specific rainfall variables were created using the data. Three basic rainfall variables representing different cropping seasons, allowing accounting for seasonal variations in observed rainfall, were used. Planting season rainfall variable ( $R_P$ ) measures the total rain during September-October;  $R_W$

measures rainfall during November-January and runs through weeding and growing season; and  $R_H$  measures rainfall during February-April and covers the harvest.<sup>7</sup> Transitory rainfall variables are measured as standard deviations of actual rainfall in region  $j$  at time  $t$  from its regional mean.<sup>8</sup>

### **Measuring Income Diversification**

Attempts to quantify income diversification, so far mostly available for rural areas, have focused on estimating the share of non-farm income in the total household income (e.g. Block and Webb, 2001; Barrett and Webb, 2001; Lanjouw et al., 2001). The assumption in these studies is that higher share of non-farm income amounts to higher income diversification and less vulnerability to weather related shocks, the main risk factor in rural areas where agriculture is the mainstay of livelihood. However, some important difficulties are associated with using the share of non-farm income as a measure of diversification. For instance, the share of non-farm income as a proxy indicator for income diversification gives equal risk-mitigation weight to households deriving a given percent of non-farm income from 1 versus 3 sources. It is also a difficult indicator to measure, requiring an accurate accounting of the level of income from all farm and non-farm sources. Moreover, the share of non-farm income as a measure of diversification also has less relevance in urban areas where most income sources tend to be non-farm anyway.

In order to make urban-rural comparisons possible, this paper uses a relatively easy to measure diversification index, the number of income sources ( $S$ ), and compares it against a more data intensive non-farm income share. The desire to pursue more than one source of

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<sup>7</sup> The cropping seasons are approximate; planting can take place as late as November and harvesting can come late in May. The information on seasons was obtained from crop calendars of Food and Agriculture Organization (FAO).

<sup>8</sup> The regional mean is computed over all years except the current year, to eliminate biases in the measure of the deviation from the mean for those regions with shorter time-series.

income may arise from concerns to reduce risk emanating, for instance, from macroeconomic policies that may result in job losses due shrinkage of the public sector employment, which has been the case in the 1990s Zimbabwe. A diversification measure based on S has several advantages over the share of non-farm income. Since S can be readily available, it is relatively easy to measure while calculating the non-farm income share involves accounting for the actual household incomes from various sources. It also allows studying of income diversification behavior in urban areas, thus facilitating urban-rural comparison.

We consider fourteen income sources obtainable from the Zimbabwe ICES data, which form three mutually exclusive categories: wage employment income, self-employment income, and non-labour income ( table 2).<sup>9</sup> Wage employment income has itself six different sources: from employment in private formal, private informal<sup>10</sup>, government, parastatal, agriculture, and other sectors. Household members could be self-employed in agriculture or own business enterprises. For agricultural households, income from farming is subject to variability and can be derived from cultivation of one crop, many different crops, livestock, or from mix of crops and livestock, which may have different implications for instability. Incomes from self-employment in agriculture are thus grouped into five categories based on broad commodity groupings: grain crop, industrial crop, fruits and vegetables, livestock and other agricultural income.<sup>11</sup> Along with

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<sup>9</sup> Please note that the number of income sources could be arbitrary and vary with the level of disaggregation of income sources. Different income sources may have inherently varying degrees of vulnerability to shocks. We anticipate that the larger the number of income sources constructed, the better our results in terms of accounting for such variations. The fact that we disaggregated them into more than two broad categories was an attempt to account for this. This is an improvement over the use of non-farm share of income, which requires dividing total household income into only two sources: farm and non-farm. The non-farm income share gives the same weight, for instance, if the non-farm income came from 3 sources or just 1 source.

<sup>10</sup> It is difficult to make a clear distinction between formal and informal activities in developing countries. For the purpose of this paper, formal refers to economic activities that are registered and licensed by the government while informal ones do not possess one or both of these characteristics.

<sup>11</sup> Other agricultural sources includes incomes fodder crop, fishery, forestry and others.

property and remittance incomes in the non-labour category, these form the fourteen different income sources considered in this paper.

Tables 3 presents the percent distributions of households according to the number of income sources ( $S$ ). The number of income sources as a measure of diversification may be criticized on several grounds. A first criticism against the use of number of income sources may arise from the argument that a household with more economically active adults will, all things being equal, be more likely to have more income sources. This may reflect household labor supply decisions as much as a desire for diversification. We address this concern by including the number of household members in different age, sex and education categories as explanatory variables in the empirical analysis.

Secondly, it may be argued that there is discrepancy when comparing households receiving different shares of their income from similar activities. For instance, a household obtaining 99% of its income from farming and 1% from wage labor has the same number of income sources as a household with 50% of its income from farming and 50% from wage labor, if appropriate corrections are not made. Since our data allows us to estimate actual incomes from the different sources, the paper assigns weights to account for differences in income shares. By doing so we ensure, for example, a household with 50% of its income from farming and 50% from wage labor has a higher diversification index than another household obtaining more than 50% of its income from farming and the rest from wage labor. We utilize another measure of diversification,  $D$ , which accounts for relative income of different sources (equation (2)).  $D$  will be used to check the robustness of  $S$ .

The second measure of income diversification, which takes into account the variations in the income shares, is the inverse of Herfindahl index of concentration:

$$S_k = \frac{Y_k}{Y} \quad (1)$$

$$D = \frac{1}{\sum_k S_k^2} \quad (2)$$

Where  $Y_k$  is total income from source  $n$ ,  $Y = \sum_k Y_k$  is total household income from all sources, and  $S_k$  is the share of income source  $k$ . This index measures the degree of concentration (scattered-ness) of household income into various sources; and it thus measures the level of income diversification. Accordingly, households with most diversified income will have the largest  $D$  and the less diversified incomes are associated with smallest  $D$ . For least diversified households (i.e., those depending on a single income source),  $D$  takes on its minimum value of 1. The upper limit for  $D$  depends on the number of income sources available and their relative shares. The higher the number of income sources ( $S$ ) and/or the more evenly distributed the income shares, the higher the value of  $D$ .

### **Descriptive Analysis and Comparison of the Two Cross-sections**

Not all households derive income from each of the 14 sources listed in table 2, although most households have at least 2 income sources (table 2). A few of the changes in these contributions between 1990/1 and 1995/6 are worth noting. First, there is a greater reliance on informal sources of income in both urban and rural areas. Reliance on government and parastatal incomes declined. In urban areas, private (formal and informal) income sources increased in importance, while public (government and parastatal) income sources declined. This probably reflects the retrenchment component of economic adjustment. Agriculture declines in importance in rural areas, reflecting the drought and the reduced food demand from urban areas. The importance of

non-farm income sources such as informal wage employment increased in rural areas.

Meanwhile, in urban areas, the contribution of incomes from urban agriculture (mainly from fruit and vegetable production) increased.

There are marked differences in livelihood strategy in urban and rural areas. The rural areas have a more diversified income base, with less than 17% depending on a single income source at either time period (table 2) while about 38% of urban households depend on a single income source. Using the income classification on table 2, in 1990/1 (1995/6) 73% (58%) of rural households had 3 or more income sources. In urban areas, 1990/1 (1995/6) saw 31% (27%) of households with at least 3 income sources. While all areas saw less diversified portfolio following the shocks, the rural areas got hit harder in terms of reduction in number of income sources.

The descriptive statistics on table 4 do not indicate significant changes in demographic and educational variables before and after the shocks, although educational attainments are generally higher in urban areas. Household size showed slight downward growth. The percentage of household receiving non-labor income such as remittance and transfers decreased in both urban and rural areas. This is perhaps indicative of the fact that even the traditional sources of remittance were affected by the shocks, suggesting their widespread impact. During the same time period, the fraction of households depending on informal income sources increased. Overall, household monthly consumption expenditures took strong downward hit and the reduction was highest among the urban households.

## 5. Empirical Approach

Income diversification affects consumption stability and the overall welfare of households. The level and the type of income diversification depend on the accessibility and availability of different income sources and the type risk households are responding to, which may in turn depend on household's geographic location, access to factor and labor markets, human and social capital, and recurring policy changes. Empirical studies show that educational attainment and infrastructure access are strong determinants of diversification (Barrett, et al., 2001a, 2001b; Block and Webb, 2001). In this section, we empirically investigate the impact of income diversification on household welfare. At the same time, we also examine the determinants of income diversification taking into account several household characteristics variables.

Let  $INCDV_{jt}$  be a measure of income diversification for a household in region  $j$  (rural, urban) and at time period  $t$  (1990/1, 1995/6). A model that contemporaneously determines income diversification and per capita consumption ( $Y_{jt}$ ) as a function of explanatory variables  $X_{jt}$ , and  $Z_{jt}$  can be given as:

$$Y_{jt} = INCDV_{jt} \mathbf{p}_t + X_{jt} \mathbf{q}_t + v_{jt} \quad (3)$$

$$INCDV_{jt} = X_{jt} \mathbf{a}_t + Z_{jt} \mathbf{b}_t + u_{jt} \quad (4)$$

where  $X_{jt}$  is a vector of explanatory variables common to both (3) and (4);  $Z_{jt}$  contains those variables that affect income diversification but affect per capita consumption only indirectly through their effect on income diversification (e.g. transitory income factors). The vector  $X_{jt}$  includes household demographic variables in age, sex and education classes as well as asset holding. We include regional dummy variables in estimating (3) and (4) in order to account for regional differences in income generation that may affect income diversification as well as the level of consumption expenditures. The explanatory variables are either directly obtained from

the Zimbabwe Income, Consumption, and Expenditure Surveys (ICES) of 1990/1 and 1995/6 or derived from it with the exception of the rainfall variables. In order to facilitate comparison of the estimates obtained, the construction of the dependent variables is identical and similar sets of explanatory variables are used for both 1990/1 and after 1995/6 households.

Since the above system of equation is endogenous, we estimate the parameters by using instrumental variables approach. A two-stage least squares (2SLS) instrumental variables regression can be used to produce consistent estimates if the system is properly identified (Davidson and Mackinnon, 1993). Two seasonal (planting and harvesting) rainfall variables with a lag are used as identifying instruments for income diversification. These variables are standard deviations of seasonal rainfall by a year on the grounds that more variable rainfall would lead to a more variable income for both rural and urban households.<sup>12</sup> We assume that seasonal rainfall variation produces shocks to income through its effect on income diversification and transitory income variability, but has no direct effect on current per capita consumption.<sup>13</sup>

## 6. Results

Before discussing the results, we address the econometric specification issues. Since income diversification could be a choice variable, we test if it suffers from endogeneity problems when estimating household welfare. As suspected, the test result reported in table 10 strongly rejects

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<sup>12</sup> Extension of rainfall variables as instruments to urban areas assumes strong urban-rural linkages in developing countries such as Zimbabwe through food markets and other factors (see, for instance, Ravallion and Datt, 1996 on India). In order to make the rainfall variables better instruments we use national average rainfall information for major urban areas instead of regional rainfall figures. Our empirical results (not reported, but available upon request) indicate that rainfall variability indeed significantly affects welfare in urban Zimbabwe, both before and after economic changes.

<sup>13</sup> This is in line with permanent income hypothesis. See Paxson (1992) who, in studying the savings behavior of Thai farm households, makes a similar assumption and 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. Alderman (1996) applies a similar technique to Pakistani households. We test the validity of our instruments (see table 10).

that hypothesis that S is exogenous in the structural equation (4). A common econometric fix for endogeneity concerns is to use instrumental variables estimation such as a two-stage least squares regression (2SLS). 2SLS presupposes that appropriate instruments exist, i.e., the instruments are relevant in the sense that they are correlated with suspected endogenous variable and uncorrelated with error term in the structural equation.

Table 10 presents several specification tests for the instrumental variables approach. The relevance test (Bound et al., 1995), which tests the hypothesis that the coefficients on these instruments in the first stage regressions are jointly zero are soundly rejected (the F statistic meets the rule of thumb threshold of 10 established in Bound et al. (1995)). The instruments also satisfy the over-identification test proposed by Davidson and MacKinnon (1993) on the joint hypothesis that the instruments are uncorrelated with the error term and that the second stage regression is correctly specified. The standard Durbin-Hausman-Wu test also shows that OLS estimates are inconsistent in all cases, justifying the use of an instrumental variables approach.

Tables 5a & b present instrumental variables (IV) estimates of per capita consumption expenditures for rural areas. We also report the accompanying OLS estimates of income diversification. Tables 8a & b contain the corresponding results for urban areas. Table 6 presents the estimates of obtained by using non-farm income share (NF) as a measure of diversification for rural areas. The results of tables 5a & b and 6 are used to compare the estimates obtained by using our measures of income diversification against those obtained by using NF.

### **Determinants of Income Diversification**

Before exploring the role of income diversification on welfare, this section assesses the determinants of income diversification in urban and rural areas. The level and the type of income diversification strategy may depend on the accessibility to and availability of different income

generating activities, which may in turn depend on a household's geographic location, access to factor markets, human and social capital, and recurring policy changes. The first columns on Tables 5 through 7 present the regression results of the different income diversification indices as functions of (1) household demographic variables such as headship, head education and age, and other household members in age/sex/education groups; (2) household asset ownership variable to capture the wealth effect; (3) regional variables such provincial indicators for the rural sub-sample; (4) a measure of rainfall variability to capture household response to income risk originating from weather shocks.<sup>14</sup> We expect that rainfall variability to have a positive association with income diversification.

Column (1) on tables 5a and 7b indicates the number of income sources is positively associated with household asset ownership in rural areas, while in urban areas it is either negatively associated or insignificant. This finding suggests that it is easier for the asset rich to diversify in rural areas and the poorer pursue multiple income sources in urban areas. The urban rich tend to have a more stable jobs or businesses compared to the poor. On the other hand, the rich in the rural areas have greater access to a diversified portfolio, while the rural poor might face entry barriers or lack the necessary resources or credits to pursue multiple income sources. It is interesting to note that following the structural and weather shocks, the urban rich had a higher rate of diversification than they did before.

The number of income sources are directly associated with household head sex and the number of adult household members in rural areas. On the other hand, income diversification is negatively associated with household head sex. Unlike in rural areas, female-headed households tend to have more income sources in urban areas. Higher rainfall diversification leads to pursuit

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<sup>14</sup> In Africa, where most of the poor reside in rural areas and rely, at least partially, on agricultural activities for their livelihoods, climatic conditions can have a major impact on economic well-being and production decisions.

of multiple income sources as would be expected since diversification may be pursued in response to risk such as income variance. Positive association between rainfall variability and income diversification may imply that the latter may have been used as a risk management strategy. Finally, access to credit appears to improve conditions for diversification in rural areas, but not so in urban areas. The rural finding underscores the possibility that credit constraints prevent households from engaging in lucrative diversification options in rural areas. However, in urban areas following the shocks access to credit had negative effect on diversification, suggesting access to credit market could be a substitute for diversification. Recall that income diversification serves as mainly risk coping strategy in urban areas.

### **Welfare and Income Diversification in Rural Areas**

The results using S (table 5a) and D (table 6b) are quite similar, lending support for use of the number of income sources as a measure of diversification. D is the most appropriate measure of diversification as it incorporates information in the number of income sources as well as the relative shares of each income source. However, it requires complete accounting of all income sources, similar to non-farm income share in rural areas. The advantage of D and S over NF is that they allow urban-rural comparisons. S has added advantage in that it is easier to measure. The number of income sources is based on much smaller set of information. Since the results using S is to those obtained by using D and NF, our discussions are mainly based on S for the remainder of the section.

Table 5a column (2) indicates that income diversification has a significant positive impact on per capita consumption both before and after the shocks. Following the shocks, its role on consumption has increased in magnitude (see table 5a columns (2) and (5) and Chow test in

table 7). The OLS estimate significantly underestimates the role of income diversification on per capita consumption, although the coefficient on S remained significant both before and after the shocks (see table 5 columns (2) and (5)). Other variables have expected signs and significance on per capita consumption. Household head education, asset ownership and the proportion of educated adults in the household are directly correlated with per capita consumption. However, returns on these variables and other assets appear reduced following the shocks.

Table 6 is presented to examine the commonality of the results obtained by using number of income sources versus the commonly used non-farm income share for rural areas. We do this by comparing their impact on per capita consumption and their responsiveness, as measures of risk management and coping strategies, to factors such as income variability. The two results are comparable in terms of explanatory power and their positive effect on consumption. Similar to S, the effect on welfare of NF increases following the shocks. Rainfall variability leads to higher diversification in terms of non-farm income share as was observed for S. Therefore, to the extent that rural households use income diversification to manage income risk or cope with it, it appears S is at least as good a measure of diversification as NF.

### **Welfare and Income Diversification in Urban Areas**

Tables 7a & b present the results obtained using S and D, respectively. Similar to the rural areas, the results based on number of income sources (S) and income diversification index (D) in equation (2) are quite comparable.<sup>15</sup>

The role of income diversification in urban areas is markedly different from that in rural, especially before the economic shocks. Unlike rural areas, consumption expenditures per capita

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<sup>15</sup> Unlike for the rural sample, the coefficients on income diversification when using S and D are somewhat different in urban areas. But the general trends and directions of effect are quite the same.

is negatively associated with the number of income sources in urban areas, implying multiple income sources are primarily practiced among the poor. The urban poor commonly engage in temporary, seasonal and informal sector jobs. Their income sources are unstable, making them more vulnerable to risky factors such as rainfall variability and policy changes. Thus it is not surprising to find that the poor and female-headed households in urban areas depend more on multiple income sources.

In sum, our findings are comparable to those by Piesse et al. (1998) in that it is easier for better off households to diversify in rural areas and that the poorer households diversify more in urban areas. However, our results for 1995/6 show that even the urban rich are not immune to shocks. While the poor commonly pursue multiple income sources in urban areas, it is interesting to note that the urban rich also engage in the pursuit of multiple income sources when faced with shocks. Note that the policy changes have led to significant shrinkage in formal wage employment, which was and remains to be the single most important source of livelihood in urban Zimbabwe.

### **Parameter Stability Tests**

This section investigates if changes in parameter space following the shocks that we observed on tables 6 through 8 are indeed statistically significant and their implications for policy. The Chow test is the most common one used for testing structural changes. But the assumption of equal variance for error terms in both periods is crucial for its validity. Such an assumption fails for the Zimbabwe ICES and thus variance correction steps are needed before implementing the Chow test.<sup>16</sup>

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<sup>16</sup> A simple variance adjustment procedure was used before implementing the Chow test. The procedure is not reported to save space and is available upon request.

Table 9 presents the results of parameter stability test using the Chow test. Structural parameter stability test indicates significant shift in coefficients following the economic shocks. Specifically we observe significant declines in returns to human capital and physical assets in rural areas. On the other hand, returns to income diversification were significantly higher following the shocks. The role of boys and girls in welfare generation increased following the shocks, particularly in rural areas. This may suggest that more children are involved in income generating activities during economic crisis. In addition to highlighting the importance of income diversification as a risk coping strategy, this finding also has implications, among other things, on the empirical validity of poverty targeting and mappings techniques that combine survey and census data collected at different points in time (see, for instance, Hentschel, et al., 2000).

### **Decomposition of Household Welfare Changes**

The rural and urban results discussed above show that income diversification had significant impact in weathering away some of the negative effects of the economic shocks that hit Zimbabwe in the early 1990s. Given that there were changes in other structural variables and the Chow test on Table 9 also showed significant changes in the parameter estimates, it would be useful to decompose the impacts of explanatory variables on the changes in household welfare.

Denote the means of the dependent variable (log of real per capita consumption) and the explanatory variables for time  $t$  as  $\bar{y}_t$  and  $\bar{x}_t$ , respectively. Denoting  $b_t$  as a corresponding vector of parameter estimates, one can obtain:

$$\bar{y}_{1990} = b_{1990} \cdot \bar{x}_{1990} \quad (5)$$

$$\bar{y}_{1995} = b_{1995} \cdot \bar{x}_{1995} \quad (6)$$

$$\bar{y}_{1995} - \bar{y}_{1990} = b_{1995} \bar{x}_{1995} - b_{1990} \bar{x}_{1990} \Leftrightarrow$$

$$\bar{y}_{1995} - \bar{y}_{1990} = (\bar{x}_{1995} - \bar{x}_{1990}) \cdot b_{1995} + (b_{1995} - b_{1990}) \cdot \bar{x}_{1990} \quad (7)$$

[Total change]      [Due changes in level]      [Due changes in return]

Equation (7) shows that the mean changes in per capita consumption from 1990/1 to 1995/6 equals the changes in the level of explanatory variables multiplied by their return in 1995/6 plus changes in returns to these variables multiplied by their level in 1990/1.

Table 9 reports the results of this decomposition. In both urban and rural areas, the decomposition exercise clearly shows that changes in welfare due both the changes in level of and return to income diversification are positive. However, the total contribution of income diversification to changes in household welfare is larger for urban areas (0.92) than for rural areas (0.44). The effects of S on consumption levels are larger from the change in returns to 1990/1 levels than from changes in levels from 1990/1 to 1995/6. On the other hand, total contributions to changes in welfare of changes in return to other variables (such as head sex and education, household size, and physical asset holding) are negative.

## 7. Summary and Conclusion

In the early 1990s, Zimbabwe suffered two sets of shocks. The first was a policy shock associated with economic structural adjustment program (ESAP). The second involved the droughts of the early 1990s. Indicators of well-being for both rural and urban households dramatically fell as a result. This study looked at the role of income diversification in weathering away some of the adverse effects of these shocks. It analysed changes in income diversification behavior before and after the droughts and economic adjustment policies of the early 1990s. We

used two national surveys, the Income Consumption and Expenditure Surveys of 1990/1 and 1995/6 that straddle the shocks.

Pre the shocks, per capita consumption expenditures varied positively (negatively) with the degree of income diversification for rural (urban) households, implying that multiple income sources are mainly pursued by the poor in urban areas and by the rich in rural areas. This suggests the rich have better access to pursue multiple income sources in rural areas. The urban poor commonly engage in temporary, seasonal and informal sector jobs, and they are thus subject to more vulnerability due to risk factors such as rainfall and policy changes. In general, the results suggest different motives for diversification in urban and rural areas. While in urban areas diversification is driven more by survival than wealth accumulation motives, in rural areas diversification serves as a means of both wealth accumulation as well as shock protection.

Following the shocks, there were marked differences with regard to the role income diversification on welfare as well as the factors affecting diversification, especially in the urban setting. Income diversification is positively and significantly associated with per capita consumption expenditures in both urban and rural areas. In fact, the role of income diversification on consumption has significantly increased in both urban and rural areas. While in general the poor are more associated with multiple income sources than the rich in urban areas, the urban rich also engage in income diversification as a coping strategy when faced with shocks.

These results have important policy implications. The decomposition of changes in welfare shows that the total contributions of income diversification are large and positive in both urban and rural areas. The structural stability tests indicate significant shift in parameters after the economic shocks: significant increase in returns to income diversification and decrease in returns to most other asset variables. The findings suggest that households with a more

diversified income base are better equipped to withstand the unfavorable welfare impacts of financial and weather shocks. The fact that better-off households in both urban and rural areas have a more diversified income base following the shocks implies that the poor are more vulnerable to economic shocks. These findings thus strengthen the need for the public provision of well-designed safety nets before implementing significant policy changes.

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**Table 1:** Zimbabwe population and sampling distribution for ICES 1990/1 and ICES 1995/6

<i>Province</i>	<i>Total Population ('000)</i>				<i>Sampled Households</i>			
	<i>1990/1</i>	<i>%</i>	<i>1995/6</i>	<i>%</i>	<i>1990/1</i>	<i>%</i>	<i>1995/6</i>	<i>%</i>
Manicaland	1315	14.7	1706	16.0	2118	14.9	2078	11.8
Mash. Central	587	6.6	936	8.8	1221	8.6	1577	9.0
Mash. East	1096	12.3	1027	9.6	1702	12.0	1753	10.0
Mash. West	1090	12.2	1073	10.1	1651	11.7	1847	10.5
Mat. North	377	4.2	596	5.6	622	4.4	1441	8.2
Mat. South	545	6.1	592	5.5	1052	7.4	1471	8.4
Midlands	1430	16.0	1320	12.4	1957	13.8	1975	11.3
Masvingo	1135	12.7	1043	9.8	1979	14.0	1670	9.5
Harare	630	7.1	632	5.9	671	4.7	1803	10.3
Bulawayo	711	8.0	1740	16.3	1190	8.4	1670	9.5
<b><i>Total</i></b>	<b><i>8917</i></b>	<b><i>100</i></b>	<b><i>10664</i></b>	<b><i>100</i></b>	<b><i>14168</i></b>	<b><i>100</i></b>	<b><i>17527</i></b>	<b><i>100</i></b>

**Table 2:** Percent contribution of different income sources to overall income of the sample

Income Sources	Rural		Urban	
	1990/1 (N=9432)	1995/6 (N=10136)	1990/1 (N=4744)	1995/6 (N=7391)
<b>Wage Employment</b>				
1. Private formal	21.4	21.7	39.4	37.9
2. Private informal	1.6	3.8	11.8	12.0
3. Government	5.1	4.0	17.9	15.7
4. Parastatal	0.7	0.8	8.8	4.3
5. Farming	1.6	1.6	0.4	0.4
6. Other wage employment	1.1	2.0	1.0	4.4
<b>Self-employment in Business</b>				
7. Own business enterprise	3.6	2.5	5.9	7.6
<b>Self-employment in Agriculture</b>				
8. Grain crop	12.2	9.1	0.2	0.2
9. Industrial crop	2.4	1.9	0.0	0.0
10. Fruit & vegetables	13.0	18.7	1.4	2.4
11. Livestock	11.5	9.7	0.3	0.1
12. Agriculture, other	2.8	4.4	0.3	0.5
<b>Non-labor Income</b>				
13. Remittances & transfers	22.7	19.6	11.0	11.1
14. Property income	0.2	0.1	1.8	3.3
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

Source:  
Zimbabwe ICES 1990/1 and 1995/6.

**Table 3:** Percent distribution of households by number of income sources (S)

Number of income sources	Rural		Urban	
	1990/1	1995/6	1990/1	1995/6
1	9.8	16.7	34.9	38.1
2	17.1	25.8	34.1	35.1
3	20.4	25.4	20.4	18.2
4	21.6	18.9	7.2	6.1
5	17.8	9.1	2.5	2.0
6	9.4	3.3	0.7	0.5
>6	4.1	0.8	0.2	0.1
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

Source:

Zimbabwe ICES 1990/1 and 1995/6

**Table 4: Descriptive Statistics**

Variables	Rural				Urban			
	199/01		1995/6		1990/1		1995/6	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Head Sex (male)	0.62	0.48	0.64	0.48	0.82	0.38	0.80	0.40
Head Education, none (yes)	0.25	0.43	0.21	0.41	0.05	0.22	0.04	0.20
Head Education, primary (yes)	0.62	0.48	0.60	0.49	0.48	0.50	0.42	0.49
Head Education, secondary or higher (yes)	0.13	0.34	0.19	0.40	0.47	0.50	0.54	0.50
Head age (years)	45.31	15.30	44.91	15.78	39.81	12.10	39.54	12.65
Household size (#)	5.28	3.07	4.88	2.83	4.23	2.73	4.09	2.54
# Children <sup>a</sup>	0.99	1.07	0.89	0.99	0.67	0.87	0.61	0.79
# Boys	0.88	1.07	0.79	1.01	0.50	0.84	0.48	0.82
# Girls	0.87	1.07	0.79	1.01	0.53	0.86	0.52	0.85
# Male adult with no education	0.11	0.32	0.08	0.27	0.03	0.19	0.02	0.13
# Male adults with primary education	0.51	0.67	0.49	0.65	0.43	0.58	0.34	0.54
# Male adult with secondary or higher education	0.38	0.68	0.38	0.65	0.82	0.91	0.86	0.87
# Female adults with no education	0.25	0.49	0.19	0.42	0.06	0.26	0.04	0.19
# Female adult with primary education	0.69	0.72	0.66	0.70	0.45	0.60	0.39	0.57
# Female adult with secondary or higher education	0.29	0.61	0.32	0.60	0.64	0.82	0.72	0.84
# Elderly	0.30	0.57	0.29	0.56	0.09	0.33	0.10	0.35
Access to credit (yes) <sup>b</sup>	0.20	0.22	0.30	0.19	0.48	0.15	0.37	0.16
Non-farm income share	0.56	0.38	0.55	0.41	0.97	0.12	0.96	0.16
# of income sources	3.88	1.67	2.96	1.41	2.32	1.15	2.20	1.12
# of income sources per capita	0.96	0.73	0.87	0.72	0.77	0.66	0.72	0.62
# of income earners	2.11	1.21	2.18	1.29	1.78	0.92	1.69	1.02
# of income earners per capita	0.50	0.28	0.54	0.29	0.55	0.31	0.50	0.31
% with formal wage income	0.31	0.46	0.30	0.46	0.72	0.45	0.64	0.48
% with informal wage income	0.11	0.31	0.16	0.37	0.19	0.40	0.28	0.45
% with farming income	0.86	0.35	0.84	0.37	0.40	0.49	0.42	0.49
% with non-labor income	0.69	0.46	0.46	0.50	0.47	0.50	0.36	0.48
Formal wage income share	0.27	0.42	0.26	0.41	0.66	0.43	0.58	0.46
Informal wage income share	0.04	0.16	0.07	0.21	0.13	0.31	0.17	0.33
Agricultural income share	0.42	0.38	0.44	0.40	0.02	0.11	0.03	0.14
Non-labor income share	0.23	0.30	0.20	0.31	0.13	0.28	0.14	0.30
Per capita real consumption <sup>c</sup>	78.5	111.8	59.64	97.18	243.5	438.2	146.9	278.4
Per capita asset holding	0.66	0.70	0.56	0.61	0.82	1.29	0.80	0.99
Home ownership (yes)	0.71	0.45	0.67	0.47	0.34	0.47	0.35	0.48

Source:

Zimbabwe ICES 1990/1 and 1995/6

<sup>a</sup> Children are those with age  $\leq 5$  years; boys and girls are those between 6 and 15 years; adults are those between 16 and 59 years of age, and are further sub-divided by education level; and finally elderly are those over 59 years of age. <sup>b</sup> Credit access, an indicator of whether a household had access to a bank or other credit source, is measured at the community level. <sup>c</sup> Normalized to real terms by July 1990 Zimbabwe dollar using consumer price index that takes into account variations in survey month and regions.

**Table 5a:** Estimation of income diversification (S) and household welfare, rural area.

Dependent Variables: Income Diversification (S) and log of per capita consumption (Cons)	1990/1			1995/6		
	1 <sup>st</sup> stage (1) S	IV (2) Cons	OLS (3) Cons	1 <sup>st</sup> stage (4) S	IV (5) Cons	OLS (6) Cons
S		0.98 (13.4)***	0.49 (9.8)***		1.42 (14.9)***	0.55 (8.9)***
Head sex (Male)	0.07 (12.1)***	-0.02 (0.9)	0.09 (6.0)***	0.06 (11.6)***	0.01 -0.6	0.14 (9.7)***
Head age	-0.02 (2.2)**	0.08 (2.6)***	0.05 (1.8)*	-0.02 (1.9)*	0.10 (3.5)***	0.06 (2.6)**
Age Squared	0.00	-0.01	-0.01	0.00	-0.01	-0.01
Head education primary	-0.5 (2.9)***	(2.4)**	(2.6)***	(0.3)	(3.1)***	(3.3)***
Head education secondary or higher	-0.02 (8.0)***	0.12 (5.7)***	0.09 (4.8)***	0.00 (0.3)	0.04 (1.9)*	0.03 (2.0)**
Household size	0.08 (8.0)***	0.31 (9.2)***	0.45 (15.8)***	0.06 (6.1)***	0.11 (3.7)***	0.22 (8.8)***
# Boys	-0.03 (13.1)***	-0.10 (14.2)***	-0.14 (25.3)***	-0.03 (12.7)***	-0.13 (18.6)***	-0.18 (33.9)***
# Girls	0.01 (1.6)	0.02 (2.1)**	0.03 (3.3)***	0.00 (1.1)	0.05 (4.9)***	0.06 (7.0)***
# Male adult with primary education	0.01 (2.4)**	0.01 (0.7)	0.02 (2.2)**	0.01 (2.3)**	0.06 (5.7)***	0.08 (9.0)***
# Male adult with sec./ higher education	0.02 (3.6)***	0.03 (2.1)**	0.06 (4.7)***	0.01 (2.8)***	0.05 (3.1)***	0.07 (5.9)***
# Female adult with primary education	0.01 (1.7)*	0.12 (8.7)***	0.13 (11.0)***	0.00 (0.6)	0.13 (9.2)***	0.13 (12.0)***
# Female adult with sec./ higher education	0.00 (0.6)	0.07 (4.7)***	0.07 (5.9)***	-0.01 (1.2)	0.07 (4.9)***	0.06 (5.2)***
Per capita asset holding	0.02 (3.3)***	0.18 (11.8)***	0.20 (15.6)***	0.01 (2.2)**	0.15 (9.7)***	0.17 (13.7)***
Access to credit (yes)	-0.05 (12.9)***	0.41 (30.5)***	0.33 (29.9)***	-0.06 (15.8)***	0.32 (26.8)***	0.22 (24.0)***
Manicaland (yes)	0.25 (20.9)***	0.10 (2.2)**	0.48 (14.7)***	0.01 (0.4)	0.35 (7.8)***	0.39 (10.8)***
Masonaland East (yes)	0.03 (2.7)***	0.47 (21.2)***	0.40 (21.6)***	-0.19 (6.4)***	0.10 (4.4)***	0.11 (6.0)***
Masonaland West (yes)	0.14 (12.6)***	-0.03 (1.1)	0.07 (3.4)***	-0.04 (2.6)***	0.09 (3.9)***	0.20 (11.2)***
Matabeleland North (yes)	0.05 (5.1)***	0.21 (8.0)***	0.31 (13.8)***	0.04 (4.3)***	-0.19 (7.3)***	-0.07 (3.5)***
Midlands (yes)	0.17 (14.9)***	-0.17 (5.5)***	0.06 (2.5)**	0.17 (8.8)***	-0.15 (5.6)***	0.02 (1.2)
Rainfall standard Deviations (planting)	-0.08 (8.2)***	0.24 (10.2)***	0.21 (10.6)***	0.18 (15.5)***	-0.48 (15.5)***	-0.21 (9.3)***
Rainfall standard deviations (harvesting)	0.68 (10.3)***			-0.13 (1.4)		
Constant	0.07 (4.9)***			0.22 (4.4)***		
Observations (N)	0.51 (15.3)***	2.46 (24.7)***	3.62 (53.7)***	0.81 (17.2)***	2.13 (21.3)***	3.66 (59.2)***
R Squared (adjusted)	0.25	--	0.47	0.18	--	0.44

Absolute value of t statistics in parentheses. \* significant at 10%; \*\*significant at 5%; \*\*\* significant at 1%

**Table 5b:** Estimation of income diversification (D) and household welfare, rural area.

Dependent Variables: Income Diversification (D) and log of per capita consumption (Cons)	1990/1			1995/6		
	1 <sup>st</sup> stage (1) D	IV (2) Cons	OLS (3) Cons	1 <sup>st</sup> stage (4) D	IV (5) Cons	OLS (6) Cons
D		1.23 (12.9)***	0.58 (20.8)***		1.71 (15.3)***	0.71 (28.4)***
Head sex (Male)	0.07 (7.2)***	-0.04 (1.7)*	0.07 (4.4)***	0.09 (9.5)***	-0.03 (1.1)	0.12 (8.6)***
Head age	-0.06 (3.3)***	0.14 (3.8)***	0.05 (2.0)**	-0.01 (0.4)	0.05 (1.5)	0.05 (2.4)**
Age Squared	0.005 (3.0)***	-0.015 (4.1)***	-0.007 (2.8)***	0.001 (0.7)	-0.008 (2.3)**	-0.007 (3.3)***
Head education primary	-0.08 (6.5)***	0.26 (9.6)***	0.14 (7.8)***	-0.04 (3.1)***	0.10 (3.9)***	0.05 (3.0)***
Head education secondary or higher	-0.05 (2.8)***	0.61 (15.1)***	0.53 (18.7)***	-0.04 (2.1)**	0.29 (7.7)***	0.25 (10.2)***
Household size	-0.12 (33.9)***	0.06 (4.2)***	-0.12 (20.3)***	-0.15 (38.4)***	0.11 (6.5)***	-0.14 (24.6)***
# Boys	0.02 (2.7)***	0.01 (1.0)	0.04 (4.1)***	0.02 (3.5)***	0.02 (1.3)	0.06 (6.6)***
# Girls	0.02 (3.1)***	-0.01 (0.5)	0.02 (2.3)**	0.03 (4.6)***	0.02 (1.7)*	0.07 (8.2)***
# Male adult with primary education	0.05 (5.6)***	-0.03 (1.4)	0.04 (3.5)***	0.06 (6.6)***	-0.04 (2.0)*	0.05 (4.5)***
# Male adult with sec./ higher education	0.03 (3.9)***	0.07 (4.4)***	0.12 (10.1)***	0.04 (5.6)***	0.05 (2.7)***	0.12 (10.8)***
# Female adult with primary education	-0.01 (0.6)	0.09 (5.2)***	0.08 (6.6)***	0.00 (0.4)	0.06 (3.7)***	0.06 (5.3)***
# Female adult with sec./ higher education	0.03 (3.9)***	0.16 (8.4)***	0.21 (15.9)***	0.02 (1.9)*	0.14 (7.1)***	0.17 (13.7)***
Per capita asset holding	0.11 (15.2)***	0.12 (6.4)***	0.29 (26.0)***	0.06 (8.9)***	0.08 (5.8)***	0.18 (20.5)***
Access to credit (yes)	0.47 (21.6)***	-0.16 (2.4)**	0.54 (17.3)***	0.27 (10.5)***	-0.07 (1.2)	0.26 (7.6)***
Manicaland (yes)	-0.02 (1.4)	0.40 (12.5)***	0.29 (13.4)***	0.03 (2.4)**	0.24 (8.8)***	0.20 (11.6)***
Masonaland East (yes)	0.03 (1.2)	0.32 (10.4)***	0.25 (11.7)***	0.14 (5.7)***	0.08 (2.5)**	-0.05 (2.3)**
Masonaland West (yes)	0.08 (1.9)*	-0.10 (2.7)***	-0.10 (3.6)***	-0.72 (10.9)***	-0.05 (1.5)	-0.19 (8.7)***
Matabeleland North (yes)	0.07 (3.2)***	0.02 (0.7)	0.00 (0.1)	-1.30 (10.5)***	0.10 (3.2)***	0.03 (1.5)
Midlands (yes)	0.06 (1.6)	0.15 (5.5)***	0.12 (6.3)***	-0.53 (9.7)***	0.06 (2.0)**	0.05 (2.4)**
Rainfall standard Deviations (planting)	-0.21 (1.0)			2.18 (7.3)***		
Rainfall standard deviations (harvesting)	0.13 (4.2)***			0.76 (10.1)***		
Constant	1.18 (17.6)***	1.76 (11.2)***	3.55 (53.1)***	-0.71 (4.1)***	1.67 (12.2)***	3.49 (60.1)***
R Squared (adjusted)	0.51	--	0.48	0.49	--	0.47
Observations (N)	9342	9342	9342	9910	9910	9910

Absolute value of t statistics in parentheses; \* significant at 10%; \*\*significant at 5%; \*\*\* significant at 1%

**Table 6:** Estimation of non-farm income share (NF) and household welfare, rural areas

Dependent Variables: Non-farm income share (NF) and log of per capita consumption (Cons)	1990/1			1995/6		
	1st stage (1) NF	IV (2) Cons	OLS (3) Cons	1st stage (4) NF	IV (5) Cons	OLS (6) Cons
NF		0.96 (22.5)***	0.21 (10.8)***		0.91 (29.7)***	0.37 (23.8)***
Head sex (Male)	0.02 (2.6)***	0.09 (5.4)***	0.11 (6.9)***	0.11 (12.2)***	0.05 (3.4)***	0.11 (7.8)***
Head age	-0.05 (3.8)***	0.09 (3.2)***	0.06 (2.1)**	-0.02 (1.7)*	0.08 (3.5)***	0.07 (3.1)***
Age Squared	0.00 (1.7)*	-0.01 (3.1)***	-0.01 (2.8)***	0.00 (0.0)	-0.01 (3.3)***	-0.01 (3.5)***
Head education primary	-0.03 (3.3)***	0.11 (5.7)***	0.09 (4.9)***	0.01 (0.9)	0.03 (1.8)*	0.04 (2.3)**
Head education secondary or higher	0.13 (8.7)***	0.34 (10.8)***	0.45 (15.7)***	0.12 (7.7)***	0.13 (5.1)***	0.20 (8.2)***
Household size	-0.03 (10.4)***	-0.12 (19.4)***	-0.14 (25.5)***	-0.06 (17.7)***	-0.14 (23.2)***	-0.17 (31.4)***
# Boys	0.00 (0.1)	0.03 (3.3)***	0.03 (3.5)***	0.02 (3.5)***	0.05 (5.0)***	0.06 (6.5)***
# Girls	0.00 (0.2)	0.02 (2.4)**	0.02 (2.4)**	0.02 (4.1)***	0.06 (6.8)***	0.07 (8.6)***
# Male adult with primary education	0.02 (2.6)***	0.05 (3.4)***	0.06 (4.8)***	0.05 (6.3)***	0.03 (2.2)**	0.05 (4.4)***
# Male adult with sec./ higher education	-0.01 (0.9)	0.13 (10.8)***	0.13 (11.2)***	0.03 (4.3)***	0.11 (9.3)***	0.12 (11.3)***
# Female adult with primary education	0.00 (0.6)	0.07 (5.1)***	0.07 (5.9)***	0.01 (1.9)*	0.05 (3.9)***	0.05 (4.8)***
# Female adult with sec./ higher education	0.03 (3.7)***	0.18 (12.9)***	0.20 (15.5)***	0.05 (6.9)***	0.13 (9.8)***	0.16 (12.8)***
Per capita asset holding	-0.09 (15.0)***	0.40 (32.3)***	0.33 (30.3)***	-0.09 (15.5)***	0.29 (29.9)***	0.24 (27.3)***
Access to credit (yes)	0.46 (26.6)***	0.11 (2.7)***	0.45 (13.5)***	0.28 (12.2)***	0.18 (5.0)***	0.33 (9.9)***
Manicaland (yes)	6.68 (14.3)***	0.44 (22.0)***	0.38 (20.8)***	-1.51 (2.6)**	0.12 (6.4)***	0.12 (6.9)***
Masonaland East (yes)	7.32 (14.4)***	0.05 (2.0)**	0.06 (2.8)***	-0.58 (2.0)**	0.13 (6.6)***	0.19 (10.3)***
Masonaland West (yes)	-5.48 (14.2)***	0.21 (8.6)***	0.28 (12.5)***	-0.04 (0.8)	-0.03 (1.2)	-0.04 (1.9)*
Matabeleland North (yes)	-15.75 (14.4)***	0.01 (0.5)	-0.02 (0.7)	-0.31 (2.1)**	0.05 (2.5)**	0.05 (2.6)***
Midlands (yes)	-12.94 (14.4)***	0.24 (10.9)***	0.19 (9.7)***	0.14 (2.9)***	-0.02 (1.2)	-0.05 (2.9)***
Rainfall standard Deviations (planting)	98.90 (14.3)***			1.81 (3.6)***		
Rainfall standard deviations (harvesting)	10.22 (14.2)***			2.18 (2.8)***		
Constant	-26.84 (13.9)***	3.03 (38.8)***	3.66 (55.2)***	-0.33 (1.1)	3.14 (49.0)***	3.52 (60.7)***
R Squared (adjusted)	0.26	--	0.47	0.21	--	0.46
Observations (N)	9342	9342	9342	9910	9910	9910

Absolute value of t statistics in parentheses. \* significant at 10%; \*\*significant at 5%; \*\*\* significant at 1%

**Table 7a:** Estimation of number of income sources and household welfare, urban areas

Dependent Variables: Income Diversification (S) and log of per capita consumption (Cons)	1990/1			1995/6		
	1 <sup>st</sup> stage (1) S	IV (2) Cons	OLS (3) Cons	1 <sup>st</sup> stage (4) S	IV (5) Cons	OLS (6) Cons
S		-0.79 (2.3)**	-0.37 (3.9)***		0.53 (2.0)**	0.03 -1.3
Head sex (Male)	0.05 (6.2)***	0.20 (4.8)***	0.14 (4.9)***	0.07 (8.9)***	0.15 (4.3)***	0.09 (4.6)***
Head age	-0.02 (1.1)	0.25 (5.0)***	0.26 (5.6)***	0.02 (1.7)*	0.18 (5.6)***	0.16 (5.5)***
Age Squared	0.00 (0.0)	-0.03 (5.2)***	-0.03 (5.5)***	0.00 (3.1)***	-0.02 (5.3)***	-0.02 (5.1)***
Head education primary	0.02 (1.1)	0.28 (5.5)***	0.27 (5.5)***	0.04 (2.9)***	0.12 (2.8)***	0.08 (2.3)**
Head education secondary or higher	0.05 (3.3)***	0.56 (9.5)***	0.50 (10.1)***	0.09 (6.2)***	0.27 (4.7)***	0.19 (4.8)***
Household size	0.00 (1.4)	-0.18 (15.3)***	-0.17 (16.1)***	-0.01 (2.2)**	-0.21 (22.8)***	-0.20 (24.4)***
# Boys	0.00 (0.2)	0.07 (4.0)***	0.07 (4.1)***	-0.01 (1.4)	0.08 (6.2)***	0.09 (7.2)***
# Girls	0.00 (0.1)	0.08 (4.4)***	0.08 (4.5)***	0.00 -0.9	0.10 (7.5)***	0.10 (8.2)***
# Male adult with primary education	0.00 (0.4)	-0.02 (0.5)	-0.02 (0.7)	0.01 (1.1)	0.03 (1.6)	0.03 (1.3)
# Male adult with sec./ higher education	-0.02 (3.8)***	0.05 (2.5)**	0.06 (4.2)***	-0.03 (6.2)***	0.10 (5.9)***	0.12 (10.3)***
# Female adult with primary education	-0.02 (3.4)***	0.02 (0.7)	0.04 (1.9)*	-0.03 (5.3)***	0.04 (1.5)	0.07 (3.8)***
# Female adult with sec./ higher education	-0.02 (4.1)***	0.17 (8.0)***	0.20 (11.0)***	-0.02 (4.1)***	0.18 (10.8)***	0.20 (14.5)***
Per capita asset holding	0.00 (1.3)	0.29 (32.6)***	0.28 (34.7)***	0.00 (0.2)	0.33 (41.6)***	0.33 (43.6)***
Access to credit (yes)	0.07 (2.7)***	-0.01 (0.1)	-0.03 (0.4)	-0.04 (2.4)**	0.38 (7.6)***	0.42 (9.5)***
Secondary city (yes)	-0.04 (3.7)***	-0.32 (10.6)***	-0.31 (11.0)***	0.01 (1.8)*	-0.34 (19.7)***	-0.35 (21.6)***
Bulawayo city (yes)	0.01 (0.6)	-0.24 (7.0)***	-0.24 (7.3)***	-0.02 (1.9)*	-0.14 (6.9)***	-0.14 (7.6)***
Rainfall standard Deviations (planting)	-0.20 (2.9)***			0.29 (6.2)***		
Rainfall standard deviations (harvesting)	0.02 (1.4)			0.06 (2.8)***		
Constant	0.93 (24.7)***	5.56 (11.2)***	4.58 (37.1)***	0.69 (19.8)***	4.97 (14.4)***	4.29 (53.7)***
R Squared (adjusted)	0.36	--	0.52	0.32	--	0.49
Observations (N)	4561	4561	4561	7177	7177	7177

Absolute value of t statistics in parentheses

\* significant at 10%; \*\*significant at 5%; \*\*\* significant at 1%

**Table 7b:** Estimation of income diversification (D) and household welfare, urban areas

Dependent Variables: Income Diversification (D) and log of per capita consumption (Cons)	1990/1			1995/6		
	1 <sup>st</sup> stage (1) D	IV (2) Cons	OLS (3) Cons	1 <sup>st</sup> stage (4) D	IV (5) Cons	OLS (6) Cons
D		-0.63 (1.2)	-0.46 (7.8)***		0.76 (3.5)***	0.27 (13.5)***
Head sex (Male)	-0.04 (2.0)**	0.08 (1.3)	0.14 (4.9)***	-0.08 (5.2)***	0.23 (4.7)***	0.11 (5.3)***
Head age	-0.02 (0.5)	0.24 (3.3)***	0.27 (5.7)***	0.02 (0.7)	0.14 (3.1)***	0.16 (5.4)***
Age Squared	0.00 (0.8)	-0.02 (2.9)***	-0.03 (5.6)***	0.00 (0.1)	-0.02 (3.5)***	-0.02 (5.2)***
Head education primary	-0.02 (0.6)	0.24 (3.2)***	0.27 (5.6)***	-0.10 (3.5)***	0.26 (3.5)***	0.10 (2.8)***
Head education secondary or higher	-0.12 (3.2)***	0.34 (2.5)**	0.52 (10.4)***	-0.20 (6.7)***	0.54 (4.8)***	0.22 (5.8)***
Household size	-0.17 (21.7)***	-0.40 (2.5)**	-0.14 (13.0)***	-0.17 (26.5)***	0.09 (1.1)	-0.17 (19.8)***
# Boys	0.06 (4.6)***	0.15 (2.5)**	0.06 (3.6)***	0.05 (5.3)***	0.00 (0.1)	0.08 (6.5)***
# Girls	0.05 (4.0)***	0.14 (2.7)***	0.07 (4.1)***	0.05 (5.3)***	0.02 (0.5)	0.09 (7.5)***
# Male adult with primary education	0.01 (0.7)	0.00 (0.0)	-0.02 (0.8)	0.03 (1.9)*	-0.02 (0.6)	0.02 (1.0)
# Male adult with sec./ higher education	0.03 (3.0)***	0.11 (2.8)***	0.06 (4.0)***	0.06 (6.4)***	0.02 (-0.7)	0.11 (9.6)***
# Female adult with primary education	-0.01 (0.5)	0.04 (1.0)	0.05 (2.1)**	0.01 (0.6)	0.05 (1.9)*	0.07 (3.8)***
# Female adult with sec./ higher education	0.00 (0.1)	0.20 (7.6)***	0.20 (11.2)***	0.01 (1.2)	0.18 (8.2)***	0.20 (14.6)***
Per capita asset holding	0.01 (2.0)**	0.30 (17.9)***	0.28 (34.6)***	0.04 (7.0)***	0.26 (11.8)***	0.32 (42.9)***
Access to credit (yes)	0.01 (0.1)	0.03 (0.3)	-0.04 (0.6)	0.14 (4.1)***	0.19 (2.1)**	0.39 (9.1)***
Secondary city (yes)	0.08 (3.0)***	-0.12 (0.9)	-0.32 (11.7)***	0.12 (9.6)***	-0.55 (9.2)***	-0.37 (23.1)***
Bulawayo city (yes)	-0.02 (0.6)	-0.13 (1.5)	-0.25 (7.7)***	0.09 (5.8)***	-0.25 (6.1)***	-0.15 (8.3)***
Rainfall standard Deviations (planting)	0.47 (2.9)***			-0.21 (1.4)		
Rainfall standard deviations (harvesting)	0.14 (3.6)***			0.17 (2.2)**		
Constant	1.23 (13.5)***	6.26 (5.0)***	4.27 (36.2)***	1.26 (17.0)***	2.12 (3.6)***	4.04 (52.3)***
R Squared (adjusted)	0.46	--	0.50	0.42	--	0.51
Observations (N)	4561	4561	4561	7177	7177	7177

Absolute value of t statistics in parentheses

\* significant at 10%; \*\*significant at 5%; \*\*\* significant at 1%

**Table 8:** Chow test of structural changes in parameter space, from 1990/1 to 1995/6

Explanatory Variables	Rural	Urban
	Change in coefficient (t-value)	Change in coefficient (t-value)
Year (1995)	-0.57 (4.6)***	-0.78 (2.0)*
Income diversification (S)	0.44 (3.6)***	0.92 (4.9)***
Head sex (male)	0.03 (1.50)	-0.05 (1.7)*
Head education, secondary or higher	-0.20 (5.0)***	-0.29 (4.7)***
Household size	-0.03 (4.9)***	-0.03 (2.2)**
# Boys	0.03 (2.8)***	0.01 (0.8)
# Girls	0.06 (5.1)***	0.02 (1.1)
# Male adult with sec./ higher education	0.01 (1.0)	-0.04 (3.1)***
# Female adult with sec./ higher education	-0.03 (1.3)	0.01 (0.7)
Per capita asset holding	-0.09 (5.8)***	-0.10 (3.7)***
Access to credit	0.23 (9.0)***	0.38 (4.4)***
Observations	19252	11738

Absolute value of t statistics in parentheses

\* significant at 10%; \*\*significant at 5%; \*\*\* significant at 1%

**Table 9:** Decomposition of changes in log real per capita consumption, from 1990/1 to 1995/6

Explanatory Variables	Rural			Urban		
	Due changes in level	Due changes in return	Total	Due changes in level	Due changes in return	Total
S	-1.08	1.71	0.63	-0.06	2.14	2.08
Head sex (male)	0.00	0.02	0.02	0.00	-0.04	-0.04
Head education, secondary or higher	0.01	-0.03	-0.02	0.02	-0.14	-0.12
Household size	0.05	-0.18	-0.13	0.03	-0.14	-0.11
# Boys	0.00	0.03	0.02	0.00	0.01	0.00
# Girls	-0.01	0.05	0.04	0.00	0.01	0.01
# Male adult with secondary or higher	0.00	0.00	0.00	0.00	-0.04	-0.03
# Female adult with secondary or higher	0.00	-0.01	0.00	0.01	0.01	0.02
Per capita asset holding	-0.03	-0.06	-0.09	-0.01	-0.08	-0.09
Access to credit	0.04	0.05	0.09	-0.04	0.18	0.14

**Table 10:** Econometric tests for instrumental variables approach

Test/Equation	Rural				Urban	
	S		NF		S	
	1990/1	1995/6	1990/1	1995/6	1990/1	1995/6
Relevance test: F (2, N-23) statistic (p-value)	12.0 (0.00)	66.70 (0.00)	153.0 (0.00)	219.0 (0.00)	17.3 (0.00)	23.2 (0.00)
Overidentification test: Chi2 (1) statistic (p-value)	1.7 (0.19)	0.04 (0.85)	1.9 (0.20)	2.01 (0.19)	1.48 (0.22)	1.2 (0.28)
Durban-Hausman-Wu test: Chi2 (21) statistic (p-value)	192.6 (0.00)	307.4 (0.00)	246.8 (0.00)	393.5 (0.00)	47.6 (0.00)	53.8 (0.00)
Observations (N)	9342	9910	9342	9910	4561	7177