FCND DP No. 152

FCND DISCUSSION PAPER NO. 152

INCOME DIVERSIFICATION IN ZIMBABWE: WELFARE IMPLICATIONS FROM URBAN AND RURAL AREAS

Lire Ersado

Food Consumption and Nutrition Division

International Food Policy Research Institute
2033 K Street, N.W.
Washington, D.C. 20006 U.S.A.
(202) 862–5600
Fax: (202) 467–4439

June 2003

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 in 1990/91 and 1995/96 show that the percentage of households earning income from private and informal sources grew considerably while that from government and formal sources declined. In general, rural households tend to have a more diversified portfolio of income compared to urban and the degree of income 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 1990/91 and 1995/96 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.

Contents

Tables

Acknowledgments

I thank Jeffrey Alwang, James Garrett, John Hoddinott, and Lawrence Haddad for helpful comments on an earlier draft of this paper. The usual disclaimer applies.

Lire Ersado
International Food Policy Research Institute

1. Introduction

Over the last several decades, many developing countries have implemented an economic structural adjustment program (ESAP) aimed at stimulating economic growth. Zimbabwe began implementing an ESAP in 1991. The ESAP in Zimbabwe, as 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, Subasat, and Weeks 1996; Lensik 1996), points out that the effectiveness of an ESAP as a catalyst for economic growth has been a subject of lengthy debate among the development community. Concerns have been raised by nongovernmental agencies over the social costs of an ESAP, particularly for vulnerable groups such as the poor (Renfew 1992; Gibbon 1995). The poor are 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.

For Zimbabwe, the implementation of an ESAP was complicated by the droughts of the early 1990s. The 1991–92 drought was one of the most severe in recent memory and affected all of Southern Africa (Scoones et al. 1996). In Zimbabwe, as in many developing countries, the livelihood of the majority of its population depends on rainfed agriculture.[1] The impacts of weather shocks, along with that associated with an ESAP, were felt throughout the country. As a result, indicators of well-being fell drastically for

[1] 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. Although the contribution of agriculture to Zimbabwe's GNP is lower than 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 agricultural contributions go largely unaccounted for in national accounts. (See Zimbabwe-CSO 1997, 1998a, 1998b; Alwang, Mills, and Taruvinga 1999; Alwang 2000.)

both rural and urban households (Alwang, Mills, and Taruvinga 1999; Alwang, Ersado, and Taruvinga 2001).

But attributing these outcomes solely to policy change, droughts, and their interactions can be misleading.[2] Individual, household, and community risk management strategies (or lack thereof) may have aggravated or lessened their adverse impacts. The main focus of this paper is examining the role of household's own risk management and coping strategies. The literature on intertemporal consumption behavior indicates 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, e.g., 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. Studies on rural income diversification suggest that diversification is a key way to reduce vulnerability to shocks (Bryceson 1996, 1999; Delgado and Siamwalla 1999; Toulmin et al. 2000; Barrett, Reardon, and Webb 2001).

This paper examines income diversification as a livelihood strategy and its role in mitigating the adverse effects of the financial and weather shocks that hit Zimbabwe in the early 1990s. First, it looks at the degree of diversification and factors influencing income and activity diversification before and after the shocks. It then investigates the role of such strategies in the face of adverse changes, i.e., whether households with more diversified income bases were able to better withstand the shocks originating from the droughts and macroeconomic policy changes and their interactions. Finally, it looks at income diversification in urban areas as compared to that of rural areas. The paper uses,

[2] While the implementation of some of the 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 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 whether the ESAP is to blame for such government policy failures.

along with time-series rainfall data from 1951–1996, nationally representative household-level data at two points in time between which the financial and weather shocks took place. The household data come from two national consumption surveys in 1990–91 and 1995–96, which were conducted using similar methodologies and near-identical questionnaires.[3]

The paper is organized as follows. Section 2 presents a brief review of the key literature on the role of income diversification as a means of reducing vulnerability to shocks. Section 3 describes the data, while Section 4 presents the empirical model. Section 5 discusses the results of multivariate analysis of income diversification and its impact on welfare. Section 6 concludes the paper.

2. Income Diversification as a Livelihood Strategy

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 the components of livelihood strategies (Ellis 1998). Livelihood diversification also encompasses the social institutions, gender relations, property rights, and other non-income support systems that sustain a living. The paper abstracts from these and focuses on the income diversification aspect of livelihood.[4]

Natural and policy-induced risks are 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 as well as smoother income than what a risk-neutral agent

[3] The 1990–91 ICES was conducted during the period July 1990 through June 1991. The 1995–96 ICES was conducted during the period July 1995 through June 1996.

[4] For a detailed description of livelihood strategies, see Bryceson 1996 and Ellis 1998.

would achieve (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; Reardon, Delgado, and Malton 1992; Coate and Ravallion 1993; Udry 1990 and 1994; Townsend 1995; Fafchamps, Udry, and Czukas 1998). They also use saving and dissaving arrangements, where available (Paxson 1992; Alderman 1996; Udry 1995; Ersado, Alderman, and Alwang 2003). Keeping cattle as an insurance substitute has longstanding importance in the economic literature on Africa (Binswanger and McIntire 1987; Fafchamps, Udry, and Czukas 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 pre-risk management or to cope with shocks that have occurred (Rosenzweig and Binswanger 1993; Reardon, Delgado, and Malton 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. According to Barrett, Bezunh, and Aboud (2001), these include

- self-insurance against risk in the context of missing insurance markets (e.g., Kinsey, Burger, and Gunning 1998);
- an ex post coping strategy (e.g., Reardon, Delgado, and Malton 1992), with extra individuals and extra jobs taken on to stem the decline in income;
- an inability to specialize due to incomplete input markets;
- a way of diversifying consumption in areas with incomplete output markets;

- exploiting strategic complementarities and positive interactions between activities; and
- simple aggregation effects where the returns to assets vary by individual or across time and space.

In rural areas of developing countries, diversification into nonfarm 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 nonfarm income share of 42 percent in Africa, 40 percent in Latin America, and 32 percent in Asia. Many studies in rural Africa find positive association between nonfarm 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 nongovernmental organizations (Delgado and Siamwalla 1999).

On income diversification, the most relevant studies for Zimbabwe are those by Piesse, Simister, and Thirtle (1998) and by Kinsey, Burger, and Gunning (1998). Piesse, Simister, and Thirtle (1998) find that in remote areas, nonfarm 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 nonfarm incomes. With better access to urban markets, they suggest that opportunities for nonfarm employment are less dependent on these power structures and are therefore more equalizing of income. Kinsey, Burger, and Gunning (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 those elsewhere, have some limitations. First, there is little focus on the role of income diversification in 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. Second, the studies use the share of nonfarm income as a proxy indicator for income diversification. This indicator is difficult to measure, requiring an accurate accounting of the level of income from farm and nonfarm sources. Moreover, it does not facilitate urban-rural comparison because of the lower relevance of nonfarm income share as an income diversification measure in urban areas. Furthermore, there is little or no research comparing income diversification behavior before and after economic shocks, and between urban and rural areas.

This study attempts to extend the empirical literature on livelihood base diversification by addressing the above issues. It introduces a measure of income diversification that lends itself to urban-rural comparison. The paper examines changes in income diversification before and after economic shocks. It tests the effectiveness of income diversification as a risk mitigation strategy. In rural areas it compares two measures of income diversification—the commonly used indicator, the percentage of nonfarm income versus the newly proposed measure discussed below.

3. Data and Descriptive Statistics

The paper uses comparable cross-sectional data from national Income, Consumption, and Expenditure Surveys (ICES) in 1990–91 and 1995–96, and time-series rainfall data (1951–1996) from 113 representative weather stations located throughout Zimbabwe. Zimbabwe ICES were based on representative samples comprising both urban and rural sectors of the country. The surveys contain data on sociodemographic 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 full month, during which time household

consumption expenditures were recorded in a daily record book. From the 1990–91 round, about 14,203 observations were obtained following data cleaning. For 1995–96, we have 17,527 observations from a total of 395 enumeration areas.

The second source of data for this study is time-series rainfall information for Zimbabwe from 1951–1996. Season- and region-specific rainfall variables were created from 113 representative weather stations collected by the Meteorological Office of Zimbabwe. Three basic rainfall variables representing different cropping seasons were used, allowing accounting for seasonal variations in observed rainfall. The planting season rainfall variable (R_P) measures the total rain during September–October; R_W measures rainfall during November–January and runs through the weeding and growing season; and R_H measures rainfall during February–April and covers the harvest.[5] Transitory rainfall variables are measured as the difference between actual rainfall in region j at time t and mean rainfall in region j.[6]

Measuring Income Diversification

Attempts to quantify income diversification, so far mostly available for rural areas, focus on estimating the share of nonfarm income in total household income (e.g., Block and Webb 2001; Lanjouw, Quizon, and Sparrow 2001). The assumption in those studies is that a higher share of nonfarm income amounts to higher diversification and less vulnerability to weather-related shocks, the main risk factor in rural environment where agriculture is the main livelihood. However, some important difficulties are associated with using the share of nonfarm income as a measure of income diversification. For instance, the share of nonfarm income as the proxy indicator for income diversification gives equal risk-mitigation weight to households deriving a given percentage of nonfarm income from one versus three income sources. It is a difficult

[5] 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 the Food and Agriculture Organization (FAO).

[6] 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.

indicator to measure, requiring an accurate accounting of the level of income from all farm and nonfarm sources. The share of nonfarm income as a measure of income diversification also is less relevant in urban areas, since most income sources there tend to be nonfarm.

To improve the comparability between urban and rural areas, this paper proposes a relatively easy-to-measure diversification index: the number of income sources (NYS). Pursuit of more than one income source may arise from the need to reduce income risk emanating, for instance, from macroeconomic policies that result in job losses due to shrinkage of public-sector employment, which may have been the case in Zimbabwe in the 1990s. The number of income sources (NYS) has several advantages over the share of nonfarm income in rural areas. It is relatively easy to measure, while calculating the nonfarm income share involves accounting for the actual household incomes from various sources. The number of income sources allows studying of income diversification behavior in urban areas, thus facilitating an urban-rural comparison.

There are 14 income sources that can be gleaned from the Zimbabwe ICES data, which form three mutually exclusive categories: wage employment income, self-employment income, and nonlabor income (see Table 1). Wage employment income has itself six different sources: employment in private formal, private informal,[7] 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 a 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.[8] Along with

[7] It is difficult to distinguish clearly between formal and informal activities in developing countries. In this paper, *formal* refers to economic activities that are registered and licensed by the government, while *informal* activities do not possess one or both of these characteristics.

[8] Other agricultural income includes incomes from fodder crops, fishery, forestry, and others.

property and remittance incomes in the nonlabor category, these form the 14 different income sources considered in this paper. Tables 2 and 3 present the percentage distributions of households according to the number of income sources (NYS) and number of income earners (NYE).

Table 1 Percent contribution of different income sources to overall income of the sample

	Rural		Urban	
Income sources	**1990 (N = 9,432)**	**1995 (N = 10,136)**	**1990 (N = 4,744)**	**1995 (N = 7,391)**
	(%)		(%)	
Wage employment				
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
Self-employment in business				
7. Own business enterprise	3.6	2.5	5.9	7.6
Self-employment in agriculture				
8. Grain crop	12.2	9.1	0.2	0.2
9. Industrial crop	2.4	1.9	0.0	0.0
10. Fruit and 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
Nonlabor income				
13. Remittances and transfers	22.7	19.6	11.0	11.1
14. Property income	0.2	0.1	1.8	3.3

Source: Zimbabwe ICES 1990-91 and 1995-96.

The number of income sources as a measure of diversification may be criticized on several grounds. First, a household with more economically active adults, all things being equal, will 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 using the number of per capita income sources (NYSPC) as well as by including the number of household members in different age, sex, and education categories as explanatory variables in the empirical analysis.

Table 2 Percent distribution of households, by number of income sources per capita (NYSPC)

	Rural		Urban	
Number of income sources per capita	**1990**	**1995**	**1990**	**1995**
	(%)		(%)	
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
Total	100.0	100.0	100.0	100.0

Table 3 Percent distribution of households, by number of income earners (NYE)

	Rural		Urban	
Number of income earners	**1990**	**1995**	**1990**	**1995**
	(%)		(%)	
1	1.1	1.6	4.0	9.6
2	33.0	30.7	36.0	33.5
3	39.1	38.8	43.8	42.3
4	15.7	15.8	12.3	10.1
5	6.4	7.4	3.1	2.9
6	2.7	3.3	0.7	1.0
>6	1.1	1.5	0.2	0.3
Total	100.0	100.0	100.0	100.0

Source: Zimbabwe ICES 1990-91 and 1995-96.

Second, 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 percent of its income from farming and 1 percent from wage labor has the same number of income sources as a household with 50 percent of its income from farming and 50 percent from wage labor, if appropriate corrections are not made. Since our data allow us to estimate actual incomes from the different sources, the paper assigns weights to account for differences in income shares. By doing so, for example, a household with 50 percent of its income from farming and 50 percent from wage labor has a more diversified income than another household obtaining more than 50 percent of its income from farming and the rest from wage labor. This leads to a second

measure of diversification used in equation (2). The measure will be used to check the robustness of NYSPC.

The second measure of income diversification, which takes into account the variations in the income shares from different sources, is the inverse of the Herfindahl index of concentration[9]:

$$S_k = \left(\frac{Y_k}{Y}\right); \tag{1}$$

$$D = \sum_{k=1}^{14}\left(\frac{1}{(S_k)^2}\right), \tag{2}$$

where Y_k is total income from source n, $Y = \sum_{k=1}^{14} Y_k$ 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 the 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 (NYS) 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 sources listed in Table 1, although most households have at least two income sources (Table 2). A few of the changes in these contributions between 1990 and 1995 are worth noting. First, there is a greater reliance on informal sources of income in both urban and rural areas. Reliance on

[9] See Block and Webb (2001), who also use the Herfindahl index to measure income diversification.

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 nonfarm 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 percent depending on a single income source at either time period (Table 2), while about 38 percent of urban households depend on a single income source. Using the income classification on Table 1, in 1990 (1995) 73 (58) percent of rural households had three or more income sources. In urban areas, 1990 (1995) saw 31 (27) percent of households with at least three income sources. While all areas had a less diversified portfolio following the shocks, rural areas were hit harder in terms of reduction in number of income sources.

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

Table 4 Descriptive statistics

	Rural				Urban			
	1990		1995		1990		1995	
Variables	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 (number)	5.28	3.07	4.88	2.83	4.23	2.73	4.09	2.54
Number of children[a]	0.99	1.07	0.89	0.99	0.67	0.87	0.61	0.79
Number of boys	0.88	1.07	0.79	1.01	0.50	0.84	0.48	0.82
Number of girls	0.87	1.07	0.79	1.01	0.53	0.86	0.52	0.85
Number of male adults with no education	0.11	0.32	0.08	0.27	0.03	0.19	0.02	0.13
Number of male adults with primary education	0.51	0.67	0.49	0.65	0.43	0.58	0.34	0.54
Number of male adults with secondary or higher education	0.38	0.68	0.38	0.65	0.82	0.91	0.86	0.87
Number of female adults with no education	0.25	0.49	0.19	0.42	0.06	0.26	0.04	0.19
Number of female adults with primary education	0.69	0.72	0.66	0.70	0.45	0.60	0.39	0.57
Number of female adults with secondary or higher education	0.29	0.61	0.32	0.60	0.64	0.82	0.72	0.84
Number of elderly	0.30	0.57	0.29	0.56	0.09	0.33	0.10	0.35
Credit access (yes)[b]	0.20	0.22	0.30	0.19	0.48	0.15	0.37	0.16
Nonfarm income share	0.56	0.38	0.55	0.41	0.97	0.12	0.96	0.16
Number of income sources	3.66	1.63	2.91	1.38	2.11	1.10	2.01	1.04
Number of income sources per capita	0.97	0.79	0.86	0.73	0.76	0.65	0.71	0.60
Number of income earners	2.11	1.21	2.18	1.29	1.78	0.92	1.69	1.02
Number of income earners per capita	0.50	0.28	0.54	0.29	0.55	0.31	0.50	0.31
Percent with formal wage income	0.31	0.46	0.30	0.46	0.72	0.45	0.64	0.48
Percent with informal wage income	0.11	0.31	0.16	0.37	0.19	0.40	0.28	0.45
Percent with farming income	0.86	0.35	0.84	0.37	0.40	0.49	0.42	0.49
Percent with nonlabor 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
Nonlabor income share	0.23	0.30	0.20	0.31	0.13	0.28	0.14	0.30
Per capita real consumption[c]	78.50	111.80	59.64	97.18	243.50	438.20	146.90	278.40
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 1990-91 and 1995-96.

[a] Children are those with age < = 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 subdivided by education level; and finally, elderly are those over 59 years of age.

[b] Credit access, an indicator of whether a household had access to a bank or other credit source, is measured at the community level.

[c] Normalized to real terms by July 1990 Zimbabwe dollar using consumer price index that takes into account variations in survey month and regions.

4. 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 of 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, Reardon, and Webb 2001; Barrett, Bezunh, and Aboud 2001; 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 (1990–91, 1995–96). 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

$$Y_{jt} = INCDV_{jt}\pi_t + X_{jt}\theta_t + v_{jt} , \quad (3)$$

$$INCDV_{jt} = X_{jt}\alpha_t + Z_{jt}\beta_t + u_{jt} , \quad (4)$$

where X_{jt} is a vector of explanatory variables common to both equations (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 equations (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 1990-91 and 1995-96 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 1990-91 and after 1995-96 households.

Since the above system of equations is endogenous, we estimate the parameters by using an 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 are used as identifying instruments for income diversification. These variables are standard deviations of seasonal rainfall on the grounds that more variable rainfall would lead to a more variable income for both rural and urban households.[10] We assume that the seasonal rainfall variation produces shocks to income through its effect on income diversification and transitory income variability, but that it has no direct effect on current per capita consumption.[11]

5. 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 5 strongly rejects that hypothesis that NYSPC 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

[10] The extension of rainfall variability as an instrument of income variation in urban areas is based on the understanding that there are 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). 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.

[11] 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 5).

the sense that they are correlated with the suspected endogenous variable and uncorrelated with the error term in the structural equation.

Table 5 Econometric tests for instrumental variables approach

	Rural					
	NYSPC		D		NFIS	
Test/equation	1990	1995	1990	1995	1990	1995
Relevance test: F (2, N-23) (p-value)	52.31	59.67	11.96	66.70	153.00	219.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Overidentification test: Chi2 (1) (p-value)	1.51	0.04	1.71	2.23	1.90	2.01
	(0.22)	(0.85)	(0.19)	(0.14)	(0.17)	(0.16)
Durban-Hausman-Wu test: Chi2 (21) (p-value)	345.32	546.22	192.63	307.43	246.83	393.47
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
	Urban					
Relevance test: F (2, N-23) (p-value)	17.30	23.21	12.50	9.44		
	(0.00)	(0.00)	(0.00)	(0.00)		
Overidentification test: Chi2 (1) (p-value)	1.48	1.17	2.19	2.49		
	(0.22)	(0.28)	(0.13)	(0.11)		
Durban-Hausman-Wu test: Chi2 (21) (p-value)	47.62	53.85	36.65	28.08		
	(0.00)	(0.00)	(0.00)	(0.00)		

Table 5 presents several specification tests for the instrumental variables approach. The relevance test (Bound, Jaeger, and Baker 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 by Bound, Jaeger, and Baker [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 Durban-Hausman-Wu test also shows that OLS estimates are inconsistent in all cases, justifying the use of an instrumental variables approach.

Tables 6a and 6b present instrumental variables (IV) estimates of per capita consumption expenditures and the accompanying OLS estimates of income diversification for the rural areas, using NYSPC and D, respectively. Tables 7a and 7b contain the corresponding results for the urban areas. Table 8 presents the estimates

Table 6a Estimation of income diversification (NYSPC) and household welfare, rural area

	1990			1995		
Dependent variables[a,b]	**1st stage (1) NYSPC**[a]	**IV (2) Cons**[b]	**OLS (3) Cons**[b]	**1st stage (4) NYSPC**[a]	**IV (5) Cons**[b]	**OLS (6) Cons**[b]
NYSPC		1.866	0.266		2.109	0.218
		(20.6)***	(9.5)***		(24.9)***	(8.6)***
Head sex (male)	0.068	-0.017	0.092	0.063	0.010	0.135
	(12.1)***	(0.9)	(6.0)***	(11.6)***	(0.6)	(9.7)***
Head age	-0.021	0.078	0.047	-0.017	0.101	0.059
	(2.2)**	(2.6)**	(1.8)*	(1.9)*	(3.5)***	(2.6)***
Age squared	0.000	-0.007	-0.007	0.000	-0.009	-0.007
	(0.5)	(2.4)**	(2.6)***	(0.3)	(3.1)***	(3.3)***
Head education primary	-0.019	0.120	0.087	-0.002	0.040	0.034
	(2.9)***	(5.7)***	(4.8)***	(0.3)	(1.9)*	(2.0)**
Head education secondary or higher	0.084	0.313	0.451	0.059	0.114	0.219
	(8.0)***	(9.2)***	(15.8)***	(6.1)***	(3.7)***	(8.8)***
Household size	-0.026	-0.097	-0.139	-0.027	-0.131	-0.182
	(13.1)***	(14.2)***	(25.3)***	(12.7)***	(18.6)***	(33.9)***
Number of boys	0.005	0.022	0.030	0.004	0.053	0.061
	(1.6)	(2.1)**	(3.3)***	(1.1)	(4.9)***	(7.0)***
Number of girls	0.008	0.008	0.020	0.008	0.063	0.079
	(2.4)**	(0.7)	(2.2)**	(2.3)**	(5.7)***	(9.0)***
Number of male adults with primary education	0.016	0.030	0.058	0.013	0.045	0.069
	(3.6)***	(2.1)**	(4.7)***	(2.8)***	(3.1)***	(5.9)***
Number of male adults with secondary/higher education	0.007	0.116	0.125	0.002	0.127	0.132
	(1.7)*	(8.7)***	(11.0)***	(0.6)	(9.2)***	(12.0)***
Number of female adults with primary education	0.003	0.066	0.071	-0.005	0.070	0.059
	(0.6)	(4.7)***	(5.9)***	(1.2)	(4.9)***	(5.2)***
Number of female adults with secondary/higher education	0.016	0.179	0.202	0.011	0.150	0.169
	(3.3)***	(11.8)***	(15.6)***	(2.2)**	(9.7)***	(13.7)***
Per capita asset holding	-0.051	0.411	0.328	-0.055	0.324	0.215
	(12.9)***	(30.5)***	(29.9)***	(15.8)***	(26.8)***	(24.0)***
Credit access (yes)	0.249	0.095	0.482	0.006	0.350	0.386
	(20.9)***	(2.2)**	(14.7)***	(0.4)	(7.8)***	(10.8)***
Manicaland (0, 1)	0.026	0.466	0.404	-0.188	0.097	0.107
	(2.7)***	(21.2)***	(21.6)***	(6.4)***	(4.4)***	(6.0)***
Masonaland East (0, 1)	0.135	-0.028	0.072	-0.037	0.090	0.203
	(12.6)***	(1.1)	(3.4)***	(2.6)***	(3.9)***	(11.2)***
Masonaland West (0, 1)	0.047	0.214	0.309	0.042	-0.192	-0.072
	(5.1)***	(8.0)***	(13.8)***	(4.3)***	(7.3)***	(3.5)***
Matabeleland North (0, 1)	0.169	-0.171	0.061	0.171	-0.153	0.024
	(14.9)***	(5.5)***	(2.5)**	(8.8)***	(5.6)***	(1.2)
Midlands (0, 1)	-0.080	0.239	0.213	0.184	-0.477	-0.213
	(8.2)***	(10.2)***	(10.6)***	(15.5)***	(15.5)***	(9.3)***
Rainfall standard deviations (planting)	0.668			-0.149		
	(10.0)***			(1.5)		
Rainfall standard deviations (harvesting)	0.075			0.207		
	(5.0)***			(4.2)***		
Constant	0.512	2.459	3.620	0.805	2.132	3.661
	(15.3)***	(24.7)***	(53.7)***	(17.2)***	(21.3)***	(59.2)***
R Squared (adjusted)	0.251	-	0.474	0.182	-	0.436
Observations (N)	9,342	9,342	9,342	9,910	9,910	9,910

Notes: Absolute value of t statistics in parentheses. * = significant at 10 percent; ** = significant at 5 percent; *** = significant at 1 percent.

[a] Income diversification (NYSPC).

[b] Log of per capita consumption (Cons).

Table 6b Estimation of income diversification (D) and household welfare, rural area

	1990			1995		
Dependent variables[a,b]	**1st stage (1) D**[a]	**IV (2) Cons**[b]	**OLS (3) Cons**[b]	**1st stage (4) D**[a]	**IV (5) Cons**[b]	**OLS (6) Cons**[b]
D		1.751	0.278		2.008	0.361
		(16.3)***	(17.9)***		(21.2)***	(26.4)***
Head sex (male)	0.073	-0.038	0.067	0.093	-0.026	0.116
	(7.2)***	(1.7)*	(4.4)***	(9.5)***	(1.1)	(8.6)***
Head age	-0.058	0.140	0.053	-0.007	0.052	0.054
	(3.3)**	(3.8)***	(2.0)**	(0.4)	(5.1)	(2.4)**
Age squared	0.005	-0.015	-0.007	0.001	-0.008	-0.007
	(3.0)***	(4.1)***	(2.8)***	(0.7)	(2.3)**	(3.3)***
Head education primary	-0.078	0.257	0.141	-0.038	0.103	0.049
	(6.5)***	(9.6)***	(7.8)***	(3.1)***	(3.9)***	(3.0)***
Head education secondary or higher	-0.054	0.612	0.533	-0.038	0.291	0.245
	(2.8)***	(15.1)***	(18.7)***	(2.1)**	(7.7)***	(10.2)***
Household size	-0.124	0.064	-0.118	-0.146	0.105	-0.137
	(33.9)***	(4.2)***	(20.3)***	(38.4)***	(6.5)***	(24.6)***
Number of boys	0.017	0.013	0.037	0.022	0.018	0.055
	(2.7)***	(1.0)	(4.1)***	(3.5)***	(1.3)	(6.6)***
Number of girls	0.019	-0.006	0.021	0.029	0.023	0.071
	(3.1)***	(0.5)	(2.3)**	(4.6)***	(1.7)*	(8.2)***
Number of male adults with primary education	0.047	-0.025	0.043	0.055	-0.036	0.051
	(5.6)***	(1.4)	(3.5)***	(6.6)***	(2.0)*	(4.5)***
Number of male adults with secondary/higher education	0.030	0.073	0.116	0.044	0.047	0.116
	(3.9)***	(4.4)***	(10.1)***	(5.6)***	(2.7)***	(10.8)***
Number of female adults with primary education	-0.005	0.088	0.080	-0.004	0.064	0.058
	(0.6)	(5.2)***	(6.6)***	(0.4)	(3.7)***	(5.3)***
Number of female adults with secondary/higher education	0.034	0.157	0.206	0.017	0.135	0.165
	(3.9)***	(8.4)***	(15.9)***	(1.9)*	(7.1)***	(13.7)***
Per capita asset holding	0.110	0.123	0.286	0.056	0.084	0.178
	(15.2)***	(6.4)***	(26.0)***	(8.9)***	(5.8)***	(20.5)***
Credit access (yes)	0.468	-0.162	0.544	0.271	-0.069	0.260
	(21.6)***	(2.4)**	(17.3)***	(10.5)***	(1.2)	(7.6)***
Manicaland (0, 1)	-0.023	0.395	0.293	0.034	0.237	0.199
	(1.4)	(12.5)***	(13.4)***	(2.4)**	(8.8)***	(11.6)***
Masonaland East (0, 1)	0.030	0.315	0.251	0.136	0.082	-0.045
	(1.2)	(10.4)***	(11.7)***	(5.7)***	(2.5)**	(2.3)**
Masonaland West (0, 1)	0.083	-0.099	-0.095	-0.724	-0.050	-0.186
	(1.9)*	(2.7)***	(3.6)***	(10.9)***	(1.5)	(8.7)***
Matabeleland North (0, 1)	0.066	0.023	0.001	-1.297	0.099	0.029
	(3.2)***	(0.7)	(0.1)	(10.5)***	(3.2)***	(1.5)
Midlands (0, 1)	0.058	0.148	0.120	-0.534	0.060	0.047
	(1.6)	(5.5)***	(6.3)***	(9.7)***	(2.0)**	(2.4)**
Rainfall standard deviations (planting)	-0.205			5.183		
	(1.0)			(10.6)***		
Rainfall standard deviations (harvesting)	0.081			0.926		
	(2.9)***			(11.3)***		
Constant	1.175	1.763	3.547	-0.709	1.667	3.491
	(17.6)***	(11.2)***	(53.1)***	(4.1)***	(12.2)***	(60.1)***
R Squared (adjusted)	0.498	-	0.472	0.472	-	0.467
Observations (N)	9,342	9,342	9,342	9,910	9,910	9,910

Notes: Absolute value of t statistics in parentheses. * = significant at 10 percent; ** = significant at 5 percent; *** = significant at 1 percent.

[a] Income diversification (D).

[b] Log of per capita consumption (Cons).

obtained by using a nonfarm income share (NFIS) as a measure of diversification instead of the number of income sources per capita for rural areas. The results of Tables 6a, 6b, and 8 are used to compare the estimates obtained by using our measures of income diversification against those obtained by using NFIS for rural areas.

Welfare and Income Diversification in Rural Areas

The results using NYSPC (Table 6a) and D (Table 6b) are quite similar, lending support for use of the number of income sources per capita as a measure of diversification. Note that calculating D (the inverse of the Herfindahl index) involves complete accounting of all income sources, similar to the nonfarm income share in rural areas. The advantage of D over NFIS is that it allows urban-rural comparisons. NYSPC has an added advantage in that it is easier to measure. Similarity of the results using NYSPC to those obtained by using D and NFIS establishes the robustness of our proposed new measure of income diversification. For the remainder of the section, our discussions are thus primarily based on NYSPC.

Table 6a column (1) indicates that the number of income sources per capita are directly associated with household head sex and the number of adult household members in rural areas. Rainfall variability leads to higher diversification, as would be expected, since diversification may be pursued in response to risks such as income variance. 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 6a, columns (2) and (5) and the Chow test in Table 9). The OLS estimate significantly underestimates the role of income diversification on per capita consumption, although the coefficient on NYSPC remained significant both before and after the shocks (see 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

Table 7a Estimation of number of income sources per capita and household welfare, urban areas

	1990			1995		
Dependent variables[a,b]	**1st stage (1) NYSPC[a]**	**IV (2) Cons[b]**	**OLS (3) Cons[b]**	**1st stage (4) NYSPC[a]**	**IV (5) Cons[b]**	**OLS (6) Cons[b]**
NYSPC		-1.216	-0.127		0.885	0.020
		(2.3)**	(2.6)***		(2.1)**	(0.6)
Head sex (male)	0.054	0.198	0.139	0.065	0.148	0.092
	(6.2)***	(4.8)***	(4.9)***	(8.9)***	(4.3)***	(4.6)***
Head age	-0.015	0.249	0.264	0.018	0.178	0.160
	(1.1)	(5.0)***	(5.6)***	(1.7)*	(5.6)***	(5.5)***
Age squared	0.000	-0.028	-0.028	-0.003	-0.019	-0.016
	(0.0)	(5.2)***	(5.5)***	(3.1)***	(5.3)***	(5.1)***
Head education primary	0.016	0.283	0.266	0.039	0.119	0.083
	(1.1)	(5.5)***	(5.5)***	(2.9)***	(2.8)***	(2.3)**
Head education secondary or higher	0.050	0.557	0.504	0.087	0.265	0.187
	(3.3)***	(9.5)***	(10.1)***	(6.2)***	(4.7)***	(4.8)***
Household size	-0.004	-0.175	-0.169	-0.007	-0.209	-0.203
	(1.4)	(15.3)***	(16.1)***	(2.2)**	(22.8)***	(24.4)***
Number of boys	0.001	0.071	0.069	-0.006	0.083	0.089
	(0.2)	(4.0)***	(4.1)***	(1.4)	(6.2)***	(7.2)***
Number of girls	0.000	0.077	0.075	-0.004	0.099	0.102
	(0.1)	(4.4)***	(4.5)***	(0.9)	(7.5)***	(8.2)***
Number of male adults with primary education	0.003	-0.015	-0.018	0.008	0.034	0.026
	(0.4)	(0.5)	(0.7)	(1.1)	(1.6)	(1.3)
Number of male adults with secondary/higher education	-0.017	0.045	0.063	-0.027	0.099	0.123
	(3.8)***	(2.5)**	(4.2)***	(6.2)***	(5.9)***	(10.3)***
Number of female adults with primary education	-0.023	0.019	0.044	-0.034	0.036	0.066
	(3.4)***	(0.7)	(1.9)*	(5.3)***	(1.5)	(3.8)***
Number of female adults with secondary/higher education	-0.022	0.173	0.195	-0.021	0.182	0.200
	(4.1)***	(8.0)***	(11.0)***	(4.1)***	(10.8)***	(14.5)***
Per capita asset holding	0.003	0.286	0.283	0.001	0.329	0.328
	(1.3)	(32.6)***	(34.7)***	(0.2)	(41.6)***	(43.6)***
Credit access (yes)	0.071	-0.005	-0.034	-0.038	0.377	0.415
	(2.7)***	(0.1)	(0.4)	(2.4)**	(7.6)***	(9.5)***
Secondary city (0, 1)	-0.040	-0.324	-0.305	0.010	-0.340	-0.348
	(3.7)***	(10.6)***	(11.0)***	(1.8)*	(19.7)***	(21.6)***
Bulawayo city (0, 1)	0.009	-0.242	-0.240	-0.015	-0.136	-0.141
	(0.6)	(7.0)***	(7.3)***	(1.9)*	(6.9)***	(7.6)***
Rainfall standard deviations (planting)	-0.184			0.284		
	(2.9)***			(5.9)***		
Rainfall standard deviations (harvesting)	0.020			0.049		
	(1.3)			(2.6)***		
Constant	0.927	5.556	4.580	0.686	4.972	4.288
	(24.7)***	(11.2)***	(37.1)***	(19.8)***	(14.4)***	(53.7)***
R Squared (adjusted)	0.365	-	0.491	0.310	-	0.485
Observations (N)	4,561	4,561	4,561	7,177	7,177	7,177

Notes: Absolute value of t statistics in parentheses. * = significant at 10 percent; ** = significant at 5 percent; *** = significant at 1 percent.

[a] Income diversification (NYSPC).

[b] Log of per capita consumption (Cons).

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

	1990			1995		
Dependent variables[a,b]	**1st stage (1) D**[a]	**IV (2) Cons**[b]	**OLS (3) Cons**[b]	**1st stage (4) D**[a]	**IV (5) Cons**[b]	**OLS (6) Cons**[b]
D		-1.354	-0.146		1.715	0.186
		(1.4)	(7.3)***		(3.7)***	(12.3)***
Head sex (male)	-0.042	0.076	0.138	-0.081	0.229	0.106
	(2.0)**	(1.3)	(4.9)***	(5.2)***	(4.7)***	(5.3)***
Head age	-0.019	0.241	0.268	0.015	0.138	0.157
	(0.5)	(3.3)***	(5.7)***	(0.7)	(3.1)***	(5.4)***
Age squared	0.003	-0.024	-0.029	0.000	-0.017	-0.016
	(0.8)	(2.9)***	(5.6)***	(0.1)	(3.5)***	(5.2)***
Head education primary	-0.022	0.236	0.267	-0.099	0.256	0.101
	(0.6)	(3.2)***	(5.6)***	(3.5)***	(3.5)***	(2.8)***
Head education secondary or higher	-0.117	0.338	0.515	-0.201	0.535	0.223
	(3.2)***	(2.5)**	(10.4)***	(6.7)***	(4.8)***	(5.8)***
Household size	-0.169	-0.399	-0.143	-0.170	0.090	-0.171
	(21.7)***	(2.5)**	(13.0)***	(26.5)***	(1.1)	(19.8)***
Number of boys	0.057	0.147	0.060	0.050	0.002	0.080
	(4.6)***	(2.5)**	(3.6)***	(5.3)***	(0.1)	(6.5)***
Number of girls	0.050	0.144	0.068	0.051	0.016	0.093
	(4.0)***	(2.7)***	(4.1)***	(5.3)***	(0.5)	(7.5)***
Number of male adults with primary education	0.013	0.001	-0.021	0.029	-0.020	0.021
	(0.7)	(0.0)	(0.8)	(1.9)*	(0.6)	(1.0)
Number of male adults with secondary/higher education	0.033	0.112	0.060	0.059	0.022	0.112
	(3.0)***	(2.8)***	(4.0)***	(6.4)***	(0.7)	(9.6)***
Number of female adults with primary education	-0.008	0.036	0.048	0.008	0.051	0.065
	(0.5)	(1.0)	(2.1)**	(0.6)	(1.9)*	(3.8)***
Number of female adults with secondary/higher education	0.002	0.202	0.197	0.012	0.179	0.198
	(0.1)	(7.6)***	(11.2)***	(1.2)	(8.2)***	(14.6)***
Per capita asset holding	0.012	0.299	0.281	0.041	0.259	0.320
	(2.0)**	(17.9)***	(34.6)***	(7.0)***	(11.8)***	(42.9)***
Credit access (yes)	0.005	0.033	-0.044	0.141	0.190	0.391
	(0.1)	(0.3)	(0.6)	(4.1)***	(2.1)**	(9.1)***
Regional indocators						
Secondary city	0.081	-0.122	-0.322	0.119	-0.551	-0.370
	(3.0)***	(0.9)	(11.7)***	(9.6)***	(9.2)***	(23.1)**
Bulawayo city	-0.022	-0.134	-0.252	0.094	-0.250	-0.153
	(0.6)	(1.5)	(7.7)***	(5.8)***	(6.1)***	(8.3)***
Rainfall standard deviations (planting)	0.404			-0.116		
	(2.7)***			(1.1)		
Rainfall standard deviations (harvesting)	0.129			0.066		
	(3.4)***			(1.7)*		
Constant	1.233	6.263	4.273	1.260	2.117	4.038
	(13.5)***	(5.0)***	(36.2)***	(17.0)***	(3.6)***	(52.3)***
R Squared (adjusted)	0.455	-	0.497	0.416	-	0.495
Observations (N)	4,561	4,561	4,561	7,177	7,177	7,177

Notes: Absolute value of t statistics in parentheses. * = significant at 10 percent; ** = significant at 5 percent; *** = significant at 1 percent.

[a] Income diversification (D).

[b] Log of per capita consumption (Cons).

consumption. However, returns on these variables and other assets appear reduced following the shocks.

Table 8 shows the commonality of the results obtained by using the number of income sources per capita versus the commonly used nonfarm 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 NYSPC, the effect on welfare of NFIS increases following the shocks. Rainfall variability leads to higher diversification in terms of nonfarm income share as was observed for NYSPC. Therefore, to the extent that rural households use income diversification to manage income risk or cope with it, it appears NYSPC is at least as good a measure of diversification as NFIS.

Welfare and Income Diversification in Urban Areas

Tables 7a and 7b present the results obtained using NYSPC and D, respectively. Similar to the rural areas, the results based on number of income sources per capita (NYSPC) and income diversification index (D) in equation (2) are quite comparable.[12]

In urban areas, income diversification is negatively associated mainly with the number of adult male and female members with secondary or higher education, both before and after the shocks. Unlike in rural areas, female-headed households tend to have more income sources in urban areas. Rainfall deviations have significant positive correlation with income diversification in 1995–96 as opposed to before the drought.

The role of income diversification in urban areas is markedly different from that in rural areas, especially before the economic shocks. Unlike in rural areas, the number of income sources per capita is negatively associated with the level of consumption expenditures per capita in urban areas, implying multiple income sources are more

[12] Unlike in the rural sample, the coefficients on income diversification when using NYSPC and D are somewhat different in urban areas. But the general trends and directions of effect are the same.

Table 8 Estimation of nonfarm income share (NFIS) and household welfare, rural areas

	1990			1995		
Dependent variables[a,b]	**1st stage (1) NFIS**[a]	**IV (2) Cons**[b]	**OLS (3) Cons**[b]	**1st stage (4) NFIS**[a]	**IV (5) Cons**[b]	**OLS (6) Cons**[b]
NFIS		0.955	0.205		0.908	0.372
		(22.5)***	(10.8)***		(29.7)***	(23.8)***
Head sex (male)	0.021	0.090	0.106	0.106	0.050	0.106
	(2.6)***	(5.4)***	(6.9)***	(12.2)***	(3.4)***	(7.8)***
Head age	-0.054	0.090	0.055	-0.024	0.082	0.070
	(3.8)**	(3.2)***	(2.1)**	(1.7)*	(3.5)***	(3.1)***
Age squared	0.002	-0.009	-0.007	0.000	-0.008	-0.008
	(1.7)*	(3.1)***	(2.8)***	(0.0)	(3.3)***	(3.5)***
Head education primary	-0.032	0.110	0.089	0.010	0.032	0.039
	(3.3)***	(5.7)***	(4.9)***	(0.9)	(1.8)*	(2.3)**
Head education secondary or higher	0.134	0.339	0.449	0.120	0.132	0.199
	(8.7)***	(10.8)***	(15.7)***	(7.7)***	(5.1)***	(8.2)***
Household size	-0.031	-0.117	-0.140	-0.059	-0.135	-0.167
	(10.4)***	(19.4)***	(25.5)***	(17.7)***	(23.2)***	(31.4)***
Number of boys	-0.000	0.032	0.031	0.019	0.045	0.055
	(0.1)	(3.3)***	(3.5)***	(3.5)***	(5.0)***	(6.5)***
Number of girls	-0.001	0.024	0.022	0.023	0.062	0.074
	(0.2)	(2.4)**	(2.4)**	(4.1)***	(6.8)***	(8.6)***
Number of male adults with primary education	0.018	0.045	0.060	0.046	0.026	0.050
	(2.6)***	(3.4)**	(4.8)***	(6.3)***	(2.2)**	(4.4)***
Number of male adults with secondary/higher education	-0.005	0.133	0.128	0.030	0.107	0.122
	(0.9)	(10.8)***	(11.2)***	(4.3)***	(9.3)***	(11.3)***
Number of female adults with primary education	0.004	0.066	0.071	0.014	0.046	0.053
	(0.6)	(5.1)***	(5.9)***	(1.9)*	(3.9)***	(4.8)***
Number of female adults with secondary/higher education	0.026	0.180	0.201	0.054	0.126	0.155
	(3.7)***	(12.9)***	(15.5)***	(6.9)**	(9.8)***	(12.8)***
Per capita asset holding	-0.088	0.397	0.332	-0.087	0.286	0.240
	(15.0)***	(32.3)***	(30.3)***	(15.5)***	(29.9)***	(27.3)***
Credit access (yes)	0.462	0.106	0.450	0.279	0.184	0.334
	(26.6)***	(2.7)***	(13.5)***	(12.2)***	(5.0)***	(9.9)***
Manicaland (0, 1)	6.684	0.444	0.384	-1.511	0.120	0.122
	(14.3)***	(22.0)***	(20.8)***	(2.6)**	(6.4)***	(6.9)***
Masonaland East (0, 1)	7.323	0.046	0.059	-0.576	0.130	0.188
	(14.4)***	(2.0)**	(2.8)***	(2.0)**	(6.6)***	(10.3)***
Masonaland West (0, 1)	-5.480	0.210	0.279	-0.038	-0.027	-0.041
	(14.2)***	(8.6)***	(12.5)***	(0.8)	(1.2)	(1.9)*
Matabeleland North (0, 1)	-15.747	0.013	-0.018	-0.311	0.054	0.051
	(14.4)***	(0.5)	(0.7)	(2.1)**	(2.5)**	(2.6)***
Midlands (0, 1)	-12.939	0.236	0.194	0.138	-0.024	-0.054
	(14.4)***	(10.9)***	(9.7)***	(2.9)***	(1.2)	(2.9)***
Rainfall standard deviations (planting)	98.904			1.812		
	(14.3)***			(3.6)***		
Rainfall standard deviations (harvesting)	10.220			2.175		
	(14.2)***			(2.8)***		
Constant	-26.839	3.031	3.658	-0.327	3.137	3.518
	(13.9)***	(38.8)***	(55.2)***	(1.1)	(49.0)***	(60.7)***
R Squared (adjusted)	0.259	-	0.474	0.213	-	0.459
Observations (N)	9,342	9,342	9,342	9,910	9,910	9,910

Notes: Absolute value of t statistics in parentheses. * = significant at 10 percent; ** = significant at 5 percent; *** = significant at 1 percent.

[a] Nonfarm income share (NFIS).

[b] Log of per capita consumption (Cons).

available to the poor than the rich. The urban poor commonly engage in temporary, seasonal, and informal-sector jobs. Their income sources are unstable, making them more vulnerability to risk factors such as rainfall variability and policy changes. The urban rich, on the other hand, are characterized by more stable income sources such as formal business enterprises and salaried jobs. Thus it is not surprising to find that poor and female-headed households in urban areas are significantly more involved in the pursuit of multiple income sources.

In sum, our findings are comparable to those of Piesse, Simister, and Thirtle (1998), i.e., 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 1995–96 show that even the urban rich are not immune to shocks—when faced with shocks, the urban rich engage in the pursuit of multiple income sources. 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 whether changes in parameter space following the shocks that we observed on Tables 6–8 are indeed statistically significant and what are the implications for policy. The Chow test is most commonly 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; thus, variance correction steps are needed before implementing the Chow test.[13]

Table 9 presents the results of parameter stability test using the Chow test. The structural parameter stability test indicates a significant shift in coefficients following the economic shocks. Specifically we observe significant declines in returns to human capital and physical assets in rural areas. Returns on head sex and education exhibited significant declines in urban areas as well. The role of boys and girls in welfare

[13] A simple variance adjustment procedure was used before implementing the Chow test. The procedure is not reported here but is available upon request.

generation increased following the shocks, particularly in rural areas. This may be indicative of household decisions to involve their children in income-generating activities during economic crisis. On the other hand, returns to income diversification were significantly higher following the shocks. 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 mapping techniques that combine survey and census data collected at different times (see, e.g., Hentschel et al. 2000). Our parameter stability test for the two periods casts serious doubt on the assumption of parameter stability, at least during periods of significant economic adjustment and natural disaster.

Table 9 Chow test of structural changes in parameter space, from 1990-91 to 1995-96

	Change in coefficient (t-value)	
Explanatory variables	**Rural**	**Urban**
Year (1995)	-0.596	-0.950
	(5.18)***	(1.88)*
Income diversification (NYSPC)	0.327	0.794
	(3.26)***	(1.44)
Head sex (male)	0.032	-0.080
	(1.50)	(1.72)*
Head education, primary	-0.070	-0.183
	(2.92)***	(2.96)***
Head education, secondary or higher	-0.201	-0.333
	(5.42)***	(4.74)***
Household size	-0.038	-0.031
	(4.89)***	(2.22)**
Number of boys	0.034	0.016
	(2.84)***	(0.76)
Number of girls	0.062	0.024
	(5.09)***	(1.14)
Number of male adults with secondary/higher education	0.016	0.067
	(1.03)	(3.09)***
Number of female adults with secondary/higher education	-0.022	0.019
	(1.26)	(0.74)
Per capita asset holding	-0.085	0.042
	(5.84)***	(3.71)***
Credit access	0.439	0.402
	(9.01)***	(4.39)***
Observations	19,252	11,738

Notes: Absolute value of t statistics in parentheses. * = significant at 10 percent; ** = significant at 5 percent; *** = significant at 1 percent.

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 $\overline{y}_t$ and $\overline{x}_t$, respectively. Denoting b_t as a corresponding vector of parameter estimates, one can obtain

$$\overline{y}_{1990} = b_{1990}' . \overline{x}_{1990} ; \tag{5}$$

$$\overline{y}_{1995} = b_{1995}' . \overline{x}_{1995} ; \tag{6}$$

$$\overline{y}_{1995} - \overline{y}_{1990} = b_{1995}' \overline{x}_{1995} - b_{1990}' \overline{x}_{1990} \Leftrightarrow$$
$$\overline{y}_{1995} - \overline{y}_{1990} = (\overline{x}_{1995} - \overline{x}_{1990})' b_{1995} + (b_{1995} - b_{1990}) \overline{x}_{1990}' \quad . \tag{7}$$

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

Equation (7) shows that the mean changes in per capita consumption from 1990–91 to 1995–96 equals the changes in the level of explanatory variables multiplied by their return in 1995–96 plus changes in returns to these variables multiplied by their level in 1990–91.

Table 10 reports the results of this decomposition. In both urban and rural areas, the decomposition exercise clearly shows that changes in welfare due to 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 (0.672) than for rural areas (0.326). The effects of NYSPC on consumption levels are larger from the change in returns to 1990–91 levels than from changes in levels from

1990–91 to 1995–96. 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.

Table 10 Decomposition of changes in log real per capita consumption

	Rural			Urban		
Explanatory variables	**Due changes in level**	**Due changes in return**	**Total**	**Due changes in level**	**Due changes in return**	**Total**
Constant	0.000	-0.596	-0.596	0.000	-0.930	-0.930
NYSPC	0.126	0.200	0.326	0.009	0.662	0.672
Head sex (male)	0.001	0.050	0.051	0.004	-0.293	-0.289
Head education, primary	0.002	-0.118	-0.116	0.011	-0.221	-0.210
Head education, secondary or higher	0.007	-0.026	-0.019	0.015	-0.157	-0.142
Household size	0.054	-0.202	-0.148	0.027	-0.131	-0.103
Number of boys	-0.005	0.030	0.025	-0.002	0.008	0.006
Number of girls	-0.006	0.054	0.049	-0.002	0.013	0.011
Number of male adults with secondary or higher education	0.000	0.006	0.006	0.005	0.054	0.059
Number of female adults with secondary or higher education	0.004	-0.006	-0.002	0.015	0.012	0.026
Per capita asset holding	0.027	-0.048	-0.021	-0.005	0.034	0.029
Access to credit	0.052	0.089	0.141	-0.040	0.192	0.151

6. Summary and Conclusions

In the early 1990s, Zimbabwe suffered two sets of shocks. The first was a policy shock associated with the economic structural adjustment program (ESAP). The second involved the droughts of the early 1990s. As a result, indicators of well-being fell dramatically for both rural and urban households. This study looks at the role of household income diversification in weathering away some of the adverse effects of the two shocks. It uses two national surveys, the Income Consumption and Expenditure Surveys of 1990–91 and 1995–96, which straddle a period of macroeconomic and weather shocks.

Before 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 pursued mainly by the poor in urban areas and by the rich in rural areas. The urban poor commonly engage in temporary, seasonal, and

informal-sector jobs, and they are thus more vulnerable to risk factors, such as weather 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 both as a means of wealth accumulation and protection from shocks.

Following the shocks, there were marked changes with regard to the role income diversification on welfare as well as the factors affecting diversification, especially in urban areas. Unlike before the shocks, income diversification is positively and significantly associated with per capita consumption expenditures in urban areas. The positive impact of income diversification on consumption has significantly increased in both urban and rural areas. The observed changes in urban areas suggest that the urban rich also engage in income diversification as a coping strategy when faced with shocks.

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 a significant shift in parameters after the economic shocks: a significant increase in returns to income diversification and a decrease in returns to most other household human and physical capital assets. The findings suggest that households with a more diversified income base are better equipped to withstand the unfavorable welfare impacts of the financial and weather shocks Zimbabweans experienced in the early 1990s. The fact that better-off households 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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