FOOD SECURITY RESEARCH PROJECT

SMALLHOLDER INCOME DIVERSIFICATION IN ZAMBIA: THE WAY OUT OF POVERTY?

By

Arne Bigsten and Sven Tengstam

WORKING PAPER No. 31
FOOD SECURITY RESEARCH PROJECT
LUSAKA, ZAMBIA
July 2008 ***(Downloadable at:*** **http://www.aec.msu.edu/agecon/fs2/zambia/index.htm** ***)***

Smallholder Income Diversification in Zambia: The Way Out of Poverty?

By

Arne Bigsten and Sven Tengstam*

FSRP Working Paper No. 31

July, 2008

Bigsten is a professor and Tengstam is a researcher in the Department of Economics, University of Gothenburg, Gothenburg, Sweden.

arne.bigsten@economics.gu.se
sven.tengstam@economics.gu.se

ACKNOWLEDGMENTS

The authors are grateful to Jos Verbeek, Eva Lövgren, and Måns Söderbom for useful comments, Abebe Shimeles for help with the poverty analysis, and Rick Wicks for help with the language. We would also like to thank the Food Security Research Project, in particular Michael Weber and Antony Chapoto, for sharing their data on Zambian agriculture with us. We are also grateful for helpful discussions with officials in the Zambian government. We would also like to thank seminar participants at University of Gothenburg and at the Nordic Conference in Development Economics 2008 in Stockholm for helpful comments. Financial support from the Swedish International Development Cooperation Agency (Sida) and The Department for Research Cooperation (SAREC) is gratefully acknowledged**.**

This working paper by Bigsten and Tengstam is being published by the Food Security Research Project in Zambia (FSRP), which is a collaborative program of research, outreach, and local capacity building, between the Agricultural Consultative Forum, the Ministry of Agriculture and Cooperatives, and Michigan State University's Department of Agricultural Economics.

FSRP wishes to acknowledge the financial and substantive support provided by the Swedish International Development Agency, the American people, via the Food Security III Cooperative Agreement (GDG-A-00-02-00021-00) between the United States Agency for International Development (USAID) and the Department of Agricultural Economics at Michigan State University, and from the USAID mission in Zambia. Research support from the Global Bureau, Office of Agriculture and Food Security, and the Africa Bureau, Office of Sustainable Development at USAID/Washington also made it possible for Zambian and MSU researchers to contribute to the collection and utilization of the comprehensive rural household data used by Bigsten and Tengstam.

Comments and questions should be directed to the authors, or to the In-Country Coordinator, Food Security Research Project, 86 Provident Street, Fairview, Lusaka: tel 234539; fax 234559; email: fsrp@coppernet.zm

EXECUTIVE SUMMARY

This paper investigates the relationship between income diversification and income change within Zambian smallholder households, and investigates what the constraints of income diversification are in this group. A panel data set of roughly 7000 smallholder farmer households interviewed in 2001 and 2004 is used. Different combinations of the four main income generating activities – farm income, agricultural wage work, non-agricultural wage-work, and own-business income – are analyzed.

Summary of Findings: This study highlights seven important findings:

First. We showed that poverty as measured by the head-count index declined by about 5.4 percentage points between 1998 and 2004. We decomposed this change into a 6.6 percentage point reduction due to growth, and a 1.2 percentage point increase due to a slight change in inequality. We also looked at growth-incidence across consumption-deciles. According to our estimates, all deciles experienced an increase in consumption during the period. Overall, the increase seems to have been somewhat larger in rural areas, with the exception of the top urban decile, which experienced an even more rapid consumption increase. Still, poverty remains much more severe in rural than in urban areas. (See Diagrams 1 and 2.)

Second. Our descriptive analysis of the pattern of income diversification then showed, among other things, that the lower quintiles had strikingly low incomes per adult-equivalent, but one should keep in mind that this does not mean that consumption levels are that low. (See Tables 6 and 7.) The overall picture is that the higher the quintile, the lower the farm-income share of income. Households engaged in non-agricultural work or had their own business had generally higher incomes than others.

Third. To be able to identify some livelihood strategies, we classified households according to which sources they derived income from, including farm income (F), agricultural wage-work (A), non-agricultural wage-work (N), and own-business income (B). The most common activity-combinations were F, FB, FN, FA, FNB and FAB, in falling order. (See Table 11.) About 30% of the households that were full-time farmers (F) in 2001 had diversified further into wage-work and/or business in 2004. Most of those getting income from a combination of their own farm and work on the farms of others (FA) in 2001 did not do any agricultural wage-work in 2004. Thus, working on others' farms is not generally a permanent feature of smallholder income generation in Zambia.

Fourth. Panel-data analysis showed that greater diversification is associated with higher income per labourer. Combination FA gives 35% higher income than F alone, while FN, FB and FAB give approximately 70% and FNB 109% higher income. The negative effect of having a female household-head is about 17%, while an increase of the land/labour ratio has a strong positive effect on income. We also ran standard OLS regressions to make it possible to include a broader range of control variables in the analysis, but the effect of activity combination remained more or less the same. All our estimates showed that good education and an accessible location, such as Lusaka province, had a strong positive effect on income. In line with this we also found that shifting into more diversified activity-combinations was associated with higher growth of income per labourer.

Fifth. We further studied what determines selection into an activity combination. The most striking result is that location, that is, province, matters a lot. If you are in a more diversified and urbanised environment, you are able to diversify more easily. Luapula and Western stand

out, however, as remote regions but nevertheless having a high probability of diversification into business. Primary and secondary education opens up opportunities for non-agricultural wage-work. It also opens up the route to business, though this is less dependent on education. Diversification into agricultural wage-work depends especially on land shortage, which suggests that this is more of a distress-diversification. Households with more market-oriented agricultural production were more likely to have diversified into business (FB), which also reduces the probability of entering also agricultural wage work (FA). A possible interpretation of this is that the cash income generated by market-oriented agriculture helps lift the cash-constraint on entering business.

Sixth. Female-headed households were less likely to have the combination FN, which may reflect the fact the females are often less geographically mobile (because of traditional household or family duties) than males.

Seventh. Land per labourer, education and gender of the household head, and province did not just influence income indirectly via choice of activity-combination, but also directly. In other words, the endowments and constraints that a household faces not only affect the possibility for diversification, they also affect how successful the household is within the activity-combination chosen. The negative direct effect of being in Luapula or Western more than offset the positive indirect effect via high probability of diversification.

POLICY IMPLICATIONS: Policy-makers should thus keep in mind that rural household incomes are not derived from agriculture alone. A major focus should be on measures that strive to facilitate smallholder income-diversification. Typically, these are policies that develop the overall economic environment and help smallholders get better market access. Agriculture is a major part of the private sector in Zambia, and should receive higher priority. Of course, poverty may also be reduced by households leaving agriculture altogether and migrating to town. This will also be the long-term pattern, but at this stage in the development of Zambia this type of migration will only be relevant for a minority (Bigsten 1988).

It is thus clear that the focus of poverty-oriented policies must largely be on the rural sector. Since Zambia is a very unequal society, with a high Gini coefficient, poverty-levels could also be reduced by lowering inequality. But since average income and consumption are extremely low, growth is crucial for poverty reduction. To make agriculture more efficient, and thus reduce rural poverty, resources should be used to improve infrastructure such as roads and electricity, extension services, and education, rather than for subsidy schemes.

Overall the analysis has shown that smallholders in Zambia are dependent on a range of off-farm income sources, and that it is therefore important not to look at rural policies as only those concerning agriculture. Paving the way for diversification is key in a package of poverty-reducing policies. Infrastructure that facilitates income-generating activities other than agriculture of course includes many things that are also beneficial for agriculture, e.g., good transportation. The diversification route to higher income for rural households requires a well-functioning economic environment and general policies that make it possible for new income-generating activities to emerge.

JEL-codes: O13, O55, Q10, R11
Keywords: Zambia, Agriculture, Income diversification, Structural change, Poverty

CONTENTS

LIST OF TABLES

TABLE **PAGE**

LIST OF DIAGRAMS

DIAGRAM **PAGE**

ACRONYMS

CPI	Consumer Price Index
CSO	Central Statistics Office
FSRP	Food Security Research Project, Zambia
GDP	Gross Domestic Product
ILO/JASPA	International Labour Office, Jobs and Skills Programme for Africa
IMF	International Monetary Fund
LCMS III	Living Condition Monitoring Survey III
MSU	Michigan State University.
PHS	Post-Harvest Survey
SAREC	The Department for Research Cooperation
SIDA	Swedish International Development Cooperation Agency

1. INTRODUCTION

Zambia started out in 1964 as one of the richest of the newly independent developing countries. During the first decade of independence, Gross Domestic Product (GDP) per capita in Zambia changed little, but from the oil crisis in 1973-74 through the mid-1990s, per capita incomes fell by more than 45%. Since the late 1990s, however, there has been a recovery, with increasing per capita income. A very important question is to what extent this reversal of fortune has implied a reduction in poverty. This depends on both the growth in the economic activities in which the poor are engaged and on the extent to which the poor can shift into other and more lucrative activities.

The income changes of poor households are thus the joint outcome of growth and structural change. The latter feature has been a central part in the theorizing about economic development typified by the dual-economy model of Lewis (1954). Empirically, economic growth has been associated with a declining share for the agricultural sector in GDP, and increasing shares for industry and services. This structural change can be seen as a macroeconomic phenomenon, but it also occurs within households. Smallholders in Africa (and elsewhere) were originally almost exclusively farmers, but over time they have shifted into non-agricultural activities as well. In some cases households have shifted completely out of agriculture, but usually the process is gradual with households maintaining a foothold in agriculture for an extended period of time. Hence, the income structure of households changes as the overall economic structure changes. This aspect of structural change or income diversification at the household level in Zambia is the focus of this paper. We contribute to the discussion in *World Development Report 2006*, which argued that the key challenge in poverty reduction efforts relates to inequality of opportunities. The opportunity set we are particularly concerned with here is access to different types of income opportunities for smallholders.

In this paper we first analyse the income incidence of growth during 1998-2004 on both urban and rural households. Then we concentrate on the changes among smallholders, which are the largest group of poor in Zambia. We look specifically at the role of income-diversification of smallholder households in the income changes, and also investigate what the constraints on income-diversification are in this group. The policy question we focus on is what interventions could make it easier for smallholder households to enter new types of income-generating activities, but we also briefly discuss how they could earn more money in existing activities.

2. THEORY REVIEW

Structural change is an integral part of economic development. Typically the agricultural-sector share shrinks, while industry and services expand. As we noted in the introduction, we will investigate structural change or income-diversification at the level of rural households. Income diversification is a result of households' allocation of their assets across different income-generating activities. Households seek to achieve an optimal balance between expected returns and risks in different activities, given the constraints they face (Doss, McPeak, and Barrett 2006.)[1] Since households are different in many respects, income patterns vary according to assets and constraints. After all, not all households have access to the same set of income opportunities, and there is certainly a large variation across households in terms of constraints. There are spatial variations in transaction costs, market prices, etc., and there are variations in households in the quality of factors determining their allocation of resources across activities. Doss, McPeak, and Barrett (2006) analyse how income sources and diversification vary among and within Kenya, Cote d'Ivoire, and Rwanda, but since they only had access to cross-section information, actual changes over time could not be analysed. The challenge in the analysis of diversification is to find adequate disaggregated income-data. With access to panel data there is a better chance of establishing a causality pattern than with a cross-section. We have panel data for Zambia covering two years, 2001 and 2004, which we use to analyse changes over time for individual households.

Constraints differ across households in terms of property rights, land and labour availability, and access to credit or other forms of liquidity. There are also considerable start-up costs in some activities; one has to enter at a reasonably large scale to be able to enter at all.[2] This means that households that do not possess sufficient human and financial resources do not have access to some potentially lucrative activities. As noted by Doss, McPeak, and Barrett (2006), constraints may force households to choose low-return activities.

The endowments are of course a key determinant of smallholders' activity choices.[3] To be a full time farmer you need reasonable access to land. The bigger the labour force of the household, the more land is required. Consequently, the labour/land ratio of the household is one key determinant of its desire to move into off-farm activities. The human-capital endowment (education) of the members of the household is also a key factor determining activity choices. In addition, it is of course easier to diversify out of agriculture if the household has good access to a thriving off-farm sector, which often means being close to an urban market. Access may also vary by region: Some areas have more diversified economies. So, overall, we would say that the main factors behind allocation-choices are differences in endowments, differences in access to markets, and access to finance.

[1] Barrett et al. (2005) write that "households choose an activity allocation vector for asset endowments that yield an uncertain income return from among a feasible set defined by the intersection of a non-tradable inputs availability constraint equal to one's endowment level of the input (e.g., land) and a budget constraint equal to one's current cash income plus access to liquid capital through savings or credit. Because income is a function of activity choice, it is an endogenous function of the prevailing (shadow) price distributions for all factors, goods and services. So observed income patterns can be understood as a function of the constraints – including ex ante asset endowments – faced by the household and its preferences."

[2] (Barrett et al. (2005) write that "entry into lower-return niches (e.g., petty commerce at weekly rural markets) is low cost and widespread, but movement within the sub-sector in the higher-return niches requiring partially irreversible investment in fixed capital is sharply limited by liquidity constraints, social networks necessary to stabilize, monitor, and enforce contracts, etc."

[3] Assets are of course endogenous variables, and to understand the dynamics one also needs to understand the process of factor accumulation.

It has also been observed in the literature that the character and impact of smallholder income diversification varies by the education of the household. The most common pattern seems to be that households gradually develop their economy and improve their lot thorough diversification. Reardon (1997) found in his survey of the income-diversification literature that non-farm income generally is regressively distributed. This means that households with the highest farm income also have the highest level and share of income from non-farm activities. Doss, McPeak, and Barrett (2006) found that the poor are more likely to rely on income from their own farm. This suggests that diversification generally is a way up the income scale. However, there is also the opposite pattern, distress-diversification, where households in a poor situation seek to add to their meagre agricultural incomes (Barrett 1998).[4] Here we are interested in finding to what extent income diversification in Zambia is of one or the other of these two types.

Typically one would assume that cash-crop and livestock incomes are related to higher income levels and to the better-off farm households. The poor tend to rely more on farm wage labour, while the richer households rely more on cash crops, livestock income, and non-farm income. Most households pursue strategies with several income components, but we will try to identify the most common activity-combinations to see whether there is a pattern of mobility among them, and whether some routes of diversification are more successful than others.

[4] Ethiopia, with a very undifferentiated countryside, would be a case of distress diversification. There the households that diversify out of agriculture tend to be poorer than the non-diversified (Bigsten et al. 2003).

3. CHANGES IN POVERTY INCIDENCE, 1998-2004

The Central Statistical Office (CSO) of Zambia has collected household consumption data and measured poverty since 1991 (See Appendix A for a discussion of the estimates). We use the comparable surveys for 1998 and 2004 to evaluate poverty trends over the period, for which we will investigate the role of smallholder income diversification for poverty-reduction.

The CSO-estimated poverty levels are shown in Table 1. According to these, national poverty was virtually the same in 2004 as in 1991: Rural poverty declined from 88% to 78%, while urban poverty increased from 49% to 53%. However, both urban and rural poverty declined from 1998 to 2004.[5]

The poverty levels in 1998 and 2004 are estimated using the standard FGT index, which is given as

$$P_\alpha = 1/n \sum_{i=1}^{q} \left[\frac{(z - y_i)}{z} \right]^\alpha \qquad (1)$$

where n is the total number of households, q is the number of households below the poverty line, z is the poverty line, and y_i is the consumption of household i. For $\alpha=0$, the FGT index reduces to the head-count ratio H; for $\alpha=1$, it is the poverty-gap or depth of poverty; and for $\alpha=2$, the FGT index has been interpreted as indicating the severity of poverty.

Table 1. Development of Moderate Poverty Levels According to CSO, 1991-2004

	1991	1993*	1996	1998	2004
Total	70	74	69	73	68
Rural	88	92	82	83	78
Urban	49	45	46	56	53

* The extra high poverty levels this year when taking the underestimation into account are probably explained to a large extent by drought.
Source: CSO (2005)

Table 2. FGT-indices of Moderate Poverty for Total, Rural, and Urban Households

	Total		Rural		Urban	
	1998	2004	1998	2004	1998	2004
Head count	72.93	67.56	83.45	77.47	55.05	52.12
Depth	40.05	35.22	49.94	44.10	23.74	22.00
Severity	26.71	22.73	34.82	29.86	13.20	11.98

Source: Own calculations

[5] Poverty levels generally change with the seasons. The 1993 survey was conducted April-June, which is a season when the poverty level is approximately three percentage points lower than the yearly average. The other four surveys (except 2002/03) were conducted when poverty levels were in general 3-5 percentage points higher than the yearly average (World Bank 2007a:54).

Poverty declined by about 5 percentage points between 1998 and 2004 according to these estimates, but remained much more widespread and severe in rural areas[6].

Next we take a closer look at how poverty-changes have been brought about, using the decomposition approach of Datt and Ravallion (1992). They devised a simple decomposition algorithm able to decompose the change in poverty between two points in time into one part due to per capita income growth (G), and one part due to inequality change (D), plus a residual (R), since the poverty measures used are not additively separable. If we apply this approach to the change in poverty from 1998 to 2004, the basic formula is

$$P_{04} - P_{98} = G(98,04) + D(98,04) + R(98,04)\,. \qquad (2)$$

The growth component G and the redistribution component D are given by

$$G(98,04) = P(z_{04} / \mu 04_{04}, L_{98}) - P(z_{98} / \mu_{98}, L_{98}) \qquad (3)$$

$$D(98,04) = P(z_{98} / \mu_{98}, L_{04}) - P(z_{98} / \mu_{98}, L_{98})\,, \qquad (4)$$

where $P(z_{04} / \mu_{04}, L_{98})$ is the poverty level that Zambia would have had in 2004 with a 1998 income distribution and a 2004 per capita income-level.

We use this method to decompose the change in moderate poverty from 1998 to 2004. This decomposition is based on the official poverty-lines, even though we have some concerns about them as discussed above. Our consumption-expenditure per-adult-equivalent based Gini coefficients are 0.533 for 1998 and 0.544 for 2004, a slight increase over this period.[7] Tables 3, 4, and 5 report our results.

Table 3. Decomposition of Changes in Total Moderate Poverty

	Growth component	Redistribution Component	Residual	Total change in poverty
Head count (P0)				
1998 to 2004	-6.62	1.24	0.01	-5.37
Depth (P1)				
1998 to 2004	-5.41	0.68	-0.10	-4.83
Severity (P2)				
1998 to 2004	-4.27	0.39	-0.10	-3.98

Source: Own calculations.

[6] Table 2 tells us that 77% of the population in the rural areas was moderately poor in 2004. The rural moderately poor on average consumed 580,000 Kwacha per adult equivalent (43% of the moderate poverty line).

[7] The Gini coefficient for income is estimated by CSO to be 0.57 (Republic of Zambia 2006c, p. 16). Our estimate of the Gini coefficient for the distribution of per-adult-equivalent consumption is slightly lower. Consumption-distribution tend to be more equal than income-distribution.

Table 4. Decomposition of Changes in Rural Moderate Poverty

	Growth component	Redistribution Component	Residual	Total change in poverty
Head count (P0)				
1998 to 2004	-6.53	0.21	0.34	-5.98
Depth (P1)				
1998 to 2004	-7	1	0.16	-5.84
Severity (P2)				
1998 to 2004	-6.06	1.1	0	-4.96

Source: Own calculations.

Table 5. Decomposition of Changes in Urban Moderate Poverty

	Growth component	Redistribution component	Residual	Total change in poverty
Head count (P0)				
1998 to 2004	-5.9	2.85	0.12	-2.93
Depth (P1)				
1998 to 2004	-3.45	1.84	-0.13	-1.74
Severity (P2)				
1998 to 2004	-2.28	1.2	-0.14	-1.22

Source: Own calculations.

The results for changes in moderate poverty show that growth contributed significantly to poverty reduction in 1998-2004, in both urban and rural areas. Although there was a modest poverty increasing effect from the inequality increase, overall poverty still declined substantially. Since Zambia is a very unequal society with a Gini coefficient almost as high as South Africa, there is a poverty-reduction potential from policies aimed at decreasing inequality. The negative effect of income-distribution change on poverty is somewhat more pronounced in urban than in rural areas. We repeated the same calculations for extreme poverty for the period, and found the same pattern.

Poverty is clearly more severe in rural areas, but income growth has been somewhat better there than in urban areas. The incidence as measured by the head-count is of course much higher, but the urban-rural differences are even larger when comparing the depth and severity of poverty. The results are in line with indicators such as life expectancy, under-nutrition, and child mortality, were Zambia has been scoring worse than Africa in general since about 1990 (see Appendix Diagrams in Bigsten and Tengstam 2008). Hence, although poverty is being urbanised in Africa, it is still overwhelmingly rural.

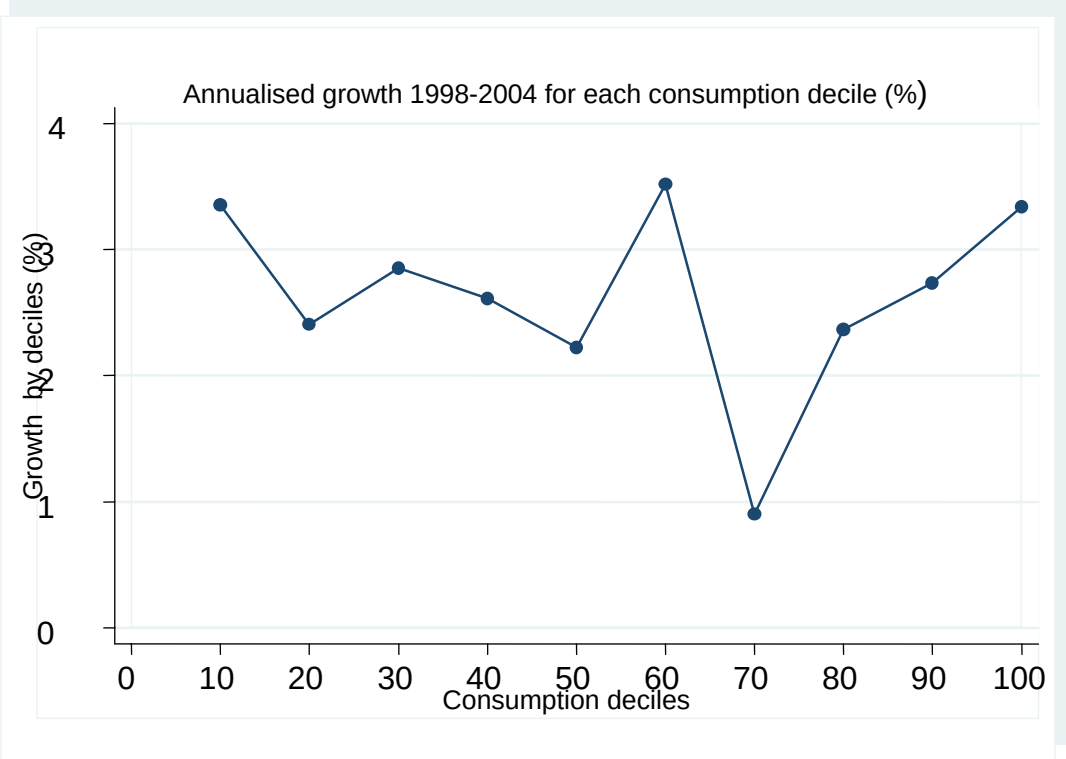
To characterise the growth pattern further, we have constructed growth-incidence curves for total, rural, and urban Zambia. These curves show how consumption-growth varies across deciles of the population, and how average real household-consumption increased from 1998 to 2004. The curves are deflated by the poverty line.

For total Zambia all deciles experienced growth during the period (Diagram 1). There is no clear pattern of differences across income-levels. For rural Zambia (Diagram 2), the bottom decile has done really well, but one needs to be cautious not to read too much into this, since measurements are particularly problematic at the lower end of the income distribution. These are households with very low incomes. Apart from the bottom decile, the curve generally slopes upward, indicating that the better-off farmers on the whole did somewhat better than

their poorer colleagues. But using the official poverty-line, close to 8 deciles of the rural population are still poor. In urban growth incidence (Diagram 3), the bottom of the distribution has done slightly better than the intermediate range, while the richest urban decile in particular was successful.

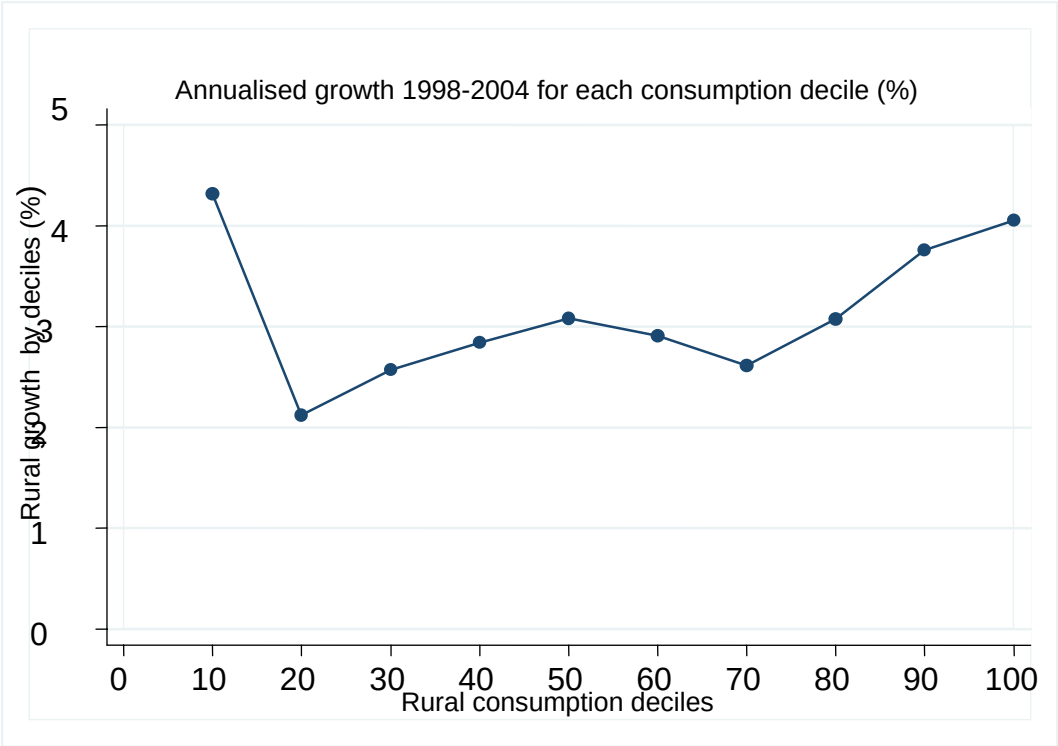
Thus rural households saw consistent but rather modest improvements in consumption during the period 1998-2004. Underlying this development was an expansion of agricultural production. The total gross value of agricultural output rose by over 50% between the mid-90s and 2001-2004 (Jayne et al. 2007). In the rest of this paper we will focus on the contribution of income-diversification to this process.

Diagram 1: Total Growth-incidence Curve



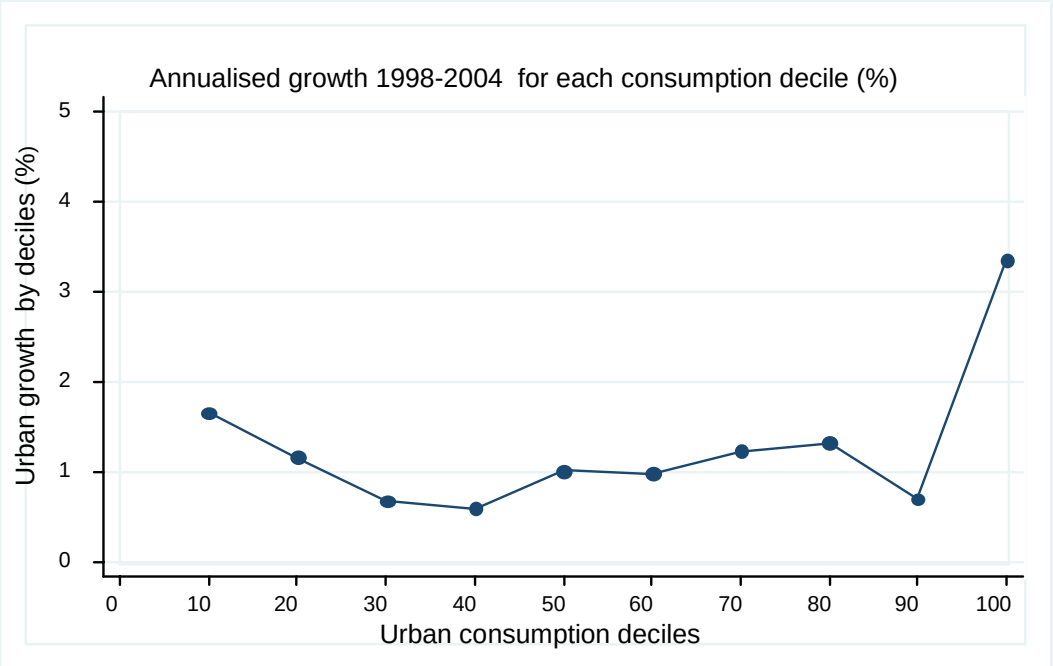
Source: Own calculations

Diagram 2: Rural Growth-incidence Curve



Source: Own calculations

Diagram 3: Urban Growth-incidence Curve



Source: Own calculations

4. DATA AND THE INCOME VARIABLE

4.1. The Data

The data comes from the Food Security Research Project (FSRP) of the Agricultural Consultative Forum, the Ministry of Agriculture and Cooperatives, and from Michigan State University. Policy-makers in Zambia have access to the Crop Forecast and the Post-Harvest Survey (PHS), conducted annually by the Central Statistics Office, when deciding how to promote small-farmer welfare (Zulu, Jayne, and Beaver 2007). These surveys were complemented by the two recent FSRP surveys that provide a more complete assessment of smallholder conditions, since more information is collected.

In April/May 2001 and June/July 2004 these nationally-representative supplemental surveys were carried out, collecting data for the 99/00 and 02/03 cropping seasons and for the 00/01 and 03/04 marketing seasons, and covering the same sample of roughly 7000 households as the 1999/00 PHS. A sampling-frame of smallholder farmers (cultivating less than 20 hectares) was used.

The Food Security Research Project reports that rural poverty has been falling (Jayne et al. 2007). Agricultural growth has been positive, and real staple-food prices for consumers have declined by 20% over the past decade. The total gross value of agricultural output rose by over 50% from the mid-90s to 2001-2004. The worst performers in terms of output-growth were staple grains and beans. As much as 90% of all fertilizer used by smallholders has been used on maize, which has been stagnant, while cassava, sweet potatoes, cotton and groundnuts have performed well. One out of every five small farmers grew cotton in 2002/03, while 45% derived income from the sale of animal products, and 17% from horticultural products (fresh fruits and vegetables, etc.). The value of animal products and horticulture sales was almost as high as for maize, and there has been export-led growth in cotton and tobacco.

Neither 1998 nor 2004 was exceptional in terms of the conditions for agricultural production (Jayne et al. 2007), so we can be reasonably confident that our data-sets are representative for the long-term trend in rural incomes.

4.2. The Income Concept

The data collected on smallholder incomes is not quite complete. Smallholder income is broadly made up of on-farm (agricultural) income and off-farm income. While the latter is well measured, the former lacks some components on the income side, and also lacks some costs.

The ideal income concept includes all current income of the household (revenue minus costs) plus asset-valuation changes. The latter component is difficult to gather, but for a smallholder household one would like to have at least stock-valuation changes (changes in the value of livestock assets). This we do not have, so we are confined to looking at current income during a year. However, this data also has some shortcomings, discussed below. The time-gap between the cropping and marketing seasons is also a problem, though hopefully not a serious one.

4.2.1. Farm Income

a. Own consumption of crops – This is gross output/income from crops produced less crops sold but without deduction of costs. Errors here will therefore be overestimates.

b. Crop sales – This is the value of the part of gross production that is sold. It is overestimated to the extent that input costs related to the production of crops sold.

c. Vegetable sales – This is the value of vegetables sold. This income is overestimated to the extent that there were input costs related to the production of vegetables that were not deducted, but it is underestimated to the extent that the household itself consumes vegetables.

d. Livestock income – This is total income from livestock i.e., the value of sales of animals (live and slaughtered), milk, and eggs. Here we underestimate household income by ignoring own consumption of livestock products or overestimate by ignoring the cost of livestock inputs.

4.2.2. Off-farm Income

a. Own-business income – This is net income, i.e., gross income less costs, so here there are no conceptual problems. The precision in measurements is probably rather low, however, since it is difficult for people to remember all costs and revenue for a whole year. To compute annual income, the questionnaire therefore asks for data for a good month and data for a bad month and then about the number of such months. Although this is an ingenious way of computing this difficult income category, it is still an approximation.

b. Agricultural wage-income – This is the value of agricultural wage-income.

c. Non-agricultural wage-income – This is the value of non-farm labour wage-income.

d. *Remittances* – This is remittances received by the household. Households may of course also remit out, but that is considered a part of household expenditures, and is therefore not deducted here.

All income variables are expressed in 2004 Kwacha. See Appendix B for further details about the variables.

5. DESCRIPTION OF THE PATTERN OF INCOME DIVERSIFICATION

The question discussed here concerns how patterns of diversification relate to incomes. We start by presenting our data in some descriptive tables.

Our tables show how income diversification among smallholders in Zambia changed from 2001 to 2004. We report estimates for the whole aggregate, and by quintile. What is reported in these tables can be compared to some basic figures: In 2004, GDP per capita was 2.29 million Kwacha (1133 PPP-$ in 2005 prices), and the food poverty line was approximately 900,000 Kwacha per adult-equivalent. The average per adult-equivalent income of smallholders was below the food-poverty line (Table 6). Even if incomes may be underestimated, and the poverty- line may be too high (see Appendix A for a discussion), this suggests that severe poverty is quite widespread among Zambian smallholders.[8]

Although incomes were exceedingly low, all income-categories except remittances increased in absolute terms. The percentage coming from farm income increased, while the off-farm percentage decreased. The dependence on subsistence income (not shown) declined slightly. Tables 7-9 show how income diversification varied by quintile.[9] In general, the higher the quintile, the lower the farm-income share (Table 7). Subsistence dependence declines with income. Higher quintiles had higher sales of crops and vegetables, higher wage-incomes (most for non-farm labour) and higher own-business income, but lower remittances.

Table 6. 2001 and 2004 Overall Income Diversification, in Percent and in 2004 Kwacha

	Percent		Per a.e. (000')		Per capita (000')		Total (billions)	
Income Source	2001	2004	2001	2004	2001	2004	2001	2004
Farm income	49.1	56.3	211	296	163.2	245	1077	1829
Farm work	2.6	2.3	11.3	12.0	8.8	10.0	58	74
Non-farm work	19.7	16.4	84.5	86.3	65.3	71.5	431	534
Own business income	26.5	23.8	113.8	125	88.0	104	581	773
Remittances	2.1	1.1	8.8	5.6	6.8	4.6	45.1	34.5
Sum	100	100	429.5	524.8	332.2	435	2190	3240

Note: The discount factor 1.7619 was used (IMF 2007a), based on CPI for April/May 2001 and June/July 2004.
Source: Own calculations

Table 7. 2001 and 2004 Income Diversification Shares by Quintile

Quintile	1		2		3		4		5	
Year	2001	2004	2001	2004	2001	2004	2001	2004	2001	2004
Income Source	---------- percent ----------									
Farm income	85.8	89.1	81	86	79	81	65.9	74.4	34	44.3
Farm work	1.6	2.3	1.4	1.3	2.7	2.3	3.3	3.7	2.6	2.0
Non-farm work	1.1	2.1	2.5	3.1	2.8	4.2	10.4	6.6	28.0	22.6
Own business income	6.5	4.0	10.3	8.1	12.1	11.0	17.7	14.0	34.3	30.4
Remittances	5.0	2.4	4.4	1.8	3.3	1.7	2.8	1.3	1.3	0.8
Sum (percent)	100	100	100	100	100	100	100	100	100	100

Source: Own calculations

[8] Even if incomes might be underestimated to some extent, they are mainly in line with the Living Conditions Monitoring Survey IV. The Central Statistical Office (2005 p. 86 and 91) reports that total smallholder farm-income in 2004 was 2158 billion Kwacha, whereas Table 6 shows that total smallholder farm-income was 1829 billion Kwacha. Both income levels are expressed in June/July Kwacha. The smallholder farm-income reported by CSO (2005) is reasonable in relation to the total smallholder income, smallholder consumption, household consumption, and GDP reported by CSO (2005 p. 86 and 99) and World Bank (2007b).

[9] There are the same number of persons in each quintile, so for 2004 it is the poorest 1,500,000 persons (not adult-equivalents) in quintile 1. "Poor" means belonging to a household with low income per adult-equivalent (not per capita).

Table 8. 2001 and 2004 Income Diversification per Adult-Equivalent by Quintile

Quintile	1		2		3		4		5	
Year	2001	2004	2001	2004	2001	2004	2001	2004	2001	2004
Income Source	----------2004 Kwacha per ae (in 1000s) ----------									
Farm income	48,8	54	107	129	182,9	208	269	334	446	749
Farm work	0.9	1.4	1.9	1.9	6.5	6.0	13.6	16.7	33.7	33.9
Non-farm work	0.6	1.3	3.2	4.6	6.5	10.9	42.2	29.7	369.2	381.7
Own business income	3.7	2.4	13.6	12.2	28.1	28.3	72.0	62.8	450.9	514.5
Remittances	2.9	1.5	5.8	2.7	7.6	4.4	11.2	5.8	16.6	13.5
Sum	56.8	60.5	131.7	150.1	231.7	257.5	407.8	449.1	1316.4	1692.4

Source: Own calculations

Table 9. 2001 and 2004 Income Diversification Per Capita by Quintile

Quintile	1		2		3		4		5	
Year	2001	2004	2001	2004	2001	2004	2001	2004	2001	2004
Income Source	----------2004 Kwacha per capita (in 1000s) ----------									
Farm income	37.7	44.5	82	106	141.6	172	209	277.5	345	625
Farm work	0.7	1.1	1.4	1.6	5.0	4.9	10.6	13.9	26.1	28.3
Non-farm work	0.5	1.1	2.5	3.8	5.1	9.0	32.8	24.6	285.8	318.6
Own business income	2.9	2.0	10.4	10.1	21.7	23.4	56.0	52.2	349.1	429.4
Remittances	2.2	1.2	4.5	2.2	5.9	3.7	8.7	4.8	12.9	11.2
Sum	43.9	49.9	101.3	124.2	179.2	212.6	317.1	372.9	1019.1	1412.5

Source: Own calculations

Tables 8 and 9 show income per adult-equivalent and income per capita by quintile. From a welfare perspective, income per adult-equivalent is the most appropriate measure. The lower quintiles had strikingly low income per adult-equivalent, but this does not necessarily mean that consumption levels were that low. Income per adult equivalent for the lowest quintile grew by only 6.5%. Crops harvested for this quintile developed less favourably, with only a modest increase in own consumption and sales of crops, and own-business income fell. Wage-income almost doubled. This is in line with the notion that the wage-income option is mainly used by the poorest to supplement their income when other sources yield too little. The three middle quintiles saw their income grow by a bit more than 10%. Compared to the overall figures in Table 6, these households had a less favourable development of crops and own business. Finally, quintile five incomes per adult equivalent grew by 29%. This is mostly due to increases from crops sold and own business income.

To be able to identify some livelihood strategies, we classify households according to the sources from which they derive income. To simplify, we do not take remittances into account (this is just 1-2% of total income). This leaves us with 15 potential activity-combinations, if we do not include those for which no income at all was registered. A household that derived farm income, but no other, has the activity-combination F. A household that derive income from farming and from agricultural work, but no other, has the activity-combination FA, and so on.

Tables 10 and 11 present the activity-combinations for 2001 and 2004, respectively.[10]

[10] Based on the panel data set; that is, those observations that exist for both years. Megill (2005:14) writes, "…at the national level the 2001 SS represents 94.2% of the 99/00 PHS frame, while the corresponding % for the 2004 SS is 79.4. That is, it is estimated that slightly more than 20% of the rural households moved or were dissolved between the 99/00 PHS and the 2000 SS." However, we only use those households that are in both SSs, so our dataset represents 79.4% of the 99/00 PHS frame; that is, "the projected total number of rural agricultural households for the reference date of May 1, 2000".

Table 10. Income by Activity-combination, 2001 (in 2004 Kwacha per Adult Equivalent, 1000s)

	Farm income	Farm work	Non-farm work	Own business	Total income	Activity Freq. %
F	235.36	0.00	0.00	0.00	235.36	50.94
FA	216.36	164.19	0.00	0.00	380.55	4.66
A	0.00	50.61	0.00	0.00	50.61	0.02
FN	201.20	0.00	562.28	0.00	765.91	9.11
N	0.00	0.00	505.37	0.00	505.37	0.10
FB	210.77	0.00	0.00	333.19	542.90	26.38
FAB	151.63	77.79	0.00	123.28	353.80	2.27
FNB	221.58	0.00	384.51	328.03	934.11	5.14
B	0.00	0.00	0.00	274.57	274.57	0.54
AB	0.00	333.08	0.00	158.26	491.34	0.04
NB	0.00	0.00	432.59	117.24	550.30	0.06
FAN	128.15	40.95	186.65	0.00	355.65	0.30
FANB	201.81	94.30	238.90	136.42	672.69	0.44
All	220.09	10.17	73.71	109.05	412.99	100.00

NB: F = Farm income, A = Agricultural wage work, N = Non-agricultural work,
B = Own business income. Activity frequency is based on population, and not on households.

Table 11. Income by Activity-combination, 2004 (per Adult Equivalent, 1000s)

	Farm income	Farm work	Non-Farm work	Own business	Total income	Activity Freq.%
F	301.83	0.00	0.00	0.00	301.83	53.49
FA	199.11	155.32	0.00	0.00	353.92	5.09
A	0.00	83.05	0.00	0.00	83.05	0.17
FN	310.54	0.00	554.91	0.00	865.45	10.21
N	0.00	0.00	697.48	0.00	697.48	0.14
FB	345.62	0.00	0.00	368.34	713.97	22.08
FAB	206.21	94.62	0.00	180.94	482.18	2.58
FNB	312.90	0.00	417.55	405.00	1135.45	4.93
B	0.00	0.00	0.00	838.27	838.27	0.29
AB	0.00	14.93	0.00	11.64	26.65	0.02
NB	0.00	0.00	1137.88	436.07	1573.95	0.08
FAN	216.36	84.64	97.86	0.00	399.39	0.49
FANB	197.48	77.43	168.67	150.06	593.03	0.44
sum	302.18	11.32	80.97	108.72	503.17	100.00

Note: F = Farm income, A = Agricultural wage-work, N = Non-agricultural wage-work,
B = Own-business income. Activity-frequency is based on population, not on households.

The overall pattern changes little between Tables 10 and 11. Households that are engaged in non-agricultural work or own business have generally higher incomes than others. Comparing Tables 10 and 11, one can see how the activity-frequencies for the activity-combinations developed. The share of full-time farmers increased. The incomes from activity combinations including own-business generally decreased, while those including wage-work generally increased. The poor development of own-business is somewhat surprising; to explain it further we would need to know more about the kinds of businesses generating the income.

Table 12 shows paths from one type of combination in 2001 to another in 2004. The entries in the table show where those who started in a certain activity combination in 2001 end up in 2004. For example, the first row is about the households that had activity combination F in 2001. Of those, 69.0 % still had F 2004, 4.1 % had activity combination FA, 5.5 % had activity combination FN 2004 and so on. We see that 16.8 % of the households that had the activity combination F in 2001, had diversified into FB 2004.

Table 12. Percentage Moving from One Activity Combination in 2001 to Another in 2004

	F	FA	FN	FB	FAB	FNB	Rest	Sum	Freq. In 2001
F	**69.0**	4.1	5.5	16.8	1.7	2.2	0.8	100	50.9
FA	45.9	**23.8**	8.0	13.3	4.6	2.9	1.3	100	4.7
FN	27.9	4.8	**40.0**	9.0	0.9	13.2	4.1	100	9.1
FB	45.8	3.7	5.4	**36.6**	3.0	3.6	2.0	100	26.4
FAB	48.1	9.0	4.9	21.2	**8.8**	4.3	3.6	100	2.3
FNB	26.2	5.4	23.7	22.5	3.7	**15.3**	3.3	100	5.1
Rest	38.6	0.0	11.1	28.3	2.7	13.2	6.1	100	1.5

Note: F = Farm income, A = Agricultural wage-work, N = Non-agricultural work, B = Own-business income. Rest = A, N, B, AB, NB, FAN and FANB. Percentages are based on population, not on households.

70.1 % (Table 12, row 2, columns 1, 3, 4 and 6) of those getting income from a combination of own-farm income related work and agricultural wage-labour in 2001 did not receive any agricultural wage-income in 2004. Thus, working on others' farms is not generally a permanent feature of smallholder income generation in Zambia. Most of the households that were full-time farmers in 2001 had the same activity combination in 2004, but 31 % (row 1, columns beyond F) had diversified further into wage-work and/or business. Clearly there are considerable fluctuations in incomes and income structures in rural Zambia.

Looking at the values on the diagonal in Table 12, we see that it is not a general pattern that households remain in the same activity combination. Only 40 % of the households that started in FN had the same activity combination in 2004, for example. But at the same time it is clear that you are much more likely to end up in FN if you start in FN, than if you start with another activity combination. We see that 53.2 % of those starting at FN remained with combination FN or had diversified further into FNB in 2004, and 39.0 % of those who were in FNB in 2001 were still in FNB or FN three years later. This means that FNB includes numerous households that often change activity combination. We further may note that of those who start in FB 43.2 % stay as FB or diversify further, while 45.8 % falls back to F.

These descriptive tables show that there is extensive income diversification among Zambian smallholders, and increasing diversification seems generally to be associated with higher incomes. However, to be able to say something more substantive about causality and driving forces behind this change we need econometric analysis.

6. EXPLAINING INCOME DIVERSIFICATION OF SMALLHOLDERS

In the econometric analysis we look at several related aspects of smallholder income-diversification and incomes. Before we do the analysis we present the variables used in the regressions.

6.1. Explanatory Variables

From the theoretical review we concluded that important determinants of household income are endowments, market access, and access to finance. From our data-set we were able to extract variables that reflect the first two dimensions, while we do not have any direct measure of access to finance.

First we have data reflecting the assets of households. We include a variable for the age of the head of household (Age) and its square (Agesq) to pick up potential life-cycle effects. We also include three dummy variables measuring the level of education of the head: primary (Grade 1-7); secondary (Grade 8-12 or Form 1-5); and or tertiary in which we include Form 6, College, or higher. The default category in the regressions is no education. We also include a dummy for female headship, and a measure of land per labourer, that is, hectares of land per household-member aged 15-64. To pick up possible effects of indivisibility, we also include a variable for the absolute size of the household labour force.

We include market access in two ways: First, we include provincial dummies for eight provinces, Lusaka, Central, Copper Belt, Eastern, Luapula, Northern, North Western, Western; Southern is the default. Three provinces, Lusaka, Copper Belt, and Central, stand out as being the most urbanised. Households in Lusaka and Copper Belt have by far the shortest distance to market (Thurlow and Wobst 2004). One would therefore expect it to be much easier for smallholders in these three provinces to diversify. Table A5 and the Map in Appendix D provide additional information about the provinces. We also included a second, more direct measure for market orientation, the fraction of agricultural output that a household sells in the market.

Access to credit may to some extent be picked up by the provincial dummies, which do reflect different levels of economic integration, including development of the financial system. The market-orientation variable also to some extent can be taken to reflect access to cash that can be used, for example, for investment in alternative activities.

There were 6,922 households in the survey in 2001, of which 1,503 were not in the survey in 2004. Thus the attrition rate was 21.7%. Households that left the survey had on average 95% of the income of the total 2001 sample; 26.7% were female-headed compared to 21.7% for the whole sample; and they were on average 1.8 years younger, yet with 0.14 years more schooling.

There were some problems with the variables education and age of head: Individuals sometimes answered differently in the two years. Only 47% reported exactly the same year born in the two waves. For another 15% the differences were not more than one year, while for about 10% the difference was more than ten years. For education, 40% answered the same in 2004 as 2001. For another 25% the difference was no more than one year, while for about 10% the difference was more than four years. These differences are a concern, but they do not seem to be systematic for either of the variables. So we use these two variables in most of our regressions despite this. But we do not include them in the fixed-effects panel-estimates, since these are more sensitive to measurement error.

6.2. Selection into Activity Combinations

The first key issue is to understand the determinants of activity combinations, that is, the factors and constraints that determine how households can enter into various activities. We base our analysis on the structure of activity combinations shown in the previous section. We only discuss the six most common activity combinations, since the other nine were very unusual.

We first run a multinomial legit regression explaining selection into states in 2001. Table 13 shows the marginal effects. The most striking result is that location, that is, province, mattered a lot.

If a household was in the most urbanised province, Lusaka, it was particularly likely to have an activity combination other than food only (F). Households in Southern, the default, had a 44% higher probability than those in Lusaka of farming only, and they were less likely to be in FA and FN combinations. Households in Western and Luapula were particularly likely to be in FB (21% and 17% more likely, respectively, than those in Eastern), FAB or FNB. Households in some of the poorer regions where there is a limited market for agricultural wage work instead seemed to go into business on the side to supplement the farm incomes. Households in the provinces along the Line of Rail are more likely to be in FA. Also, the more market-oriented the agricultural production of the household was, the more likely was the combination FB. Income from the sale of agricultural output probably helped relieve the financial constraint on entering business. Overall, it seems clear that the character of diversification depended strongly on location and market access.

Household with high land/labour ratios were more likely to be in farming only. One extra hectare per labourer increased the probability by 1.6%. This means that households shift into agricultural wage work for others when they are short of own land. The absolute size of the labour force also has some effect, with smaller size associated with some activity in combination with farming. Small households may suffer from indivisibility problems when trying to allocate their labour time across activities because of indivisibility. Households with better educated heads are much more likely than others to diversify into FN or FNB. Secondary education increases the probability of being in the FN category by 11%, while tertiary education increases it by 64%. Thus education can take you out of agriculture, but the combination farmer and own business is less likely if the head has tertiary education. Tertiary education opens up primarily for non-agricultural wage work. The probability of being a full time farmer (55%) is progressively reduced by education; 8% for primary, 19% for secondary, and 57% for tertiary. Clearly, education opens up the market for much better paid non-agricultural wage-work, and this clearly is a way out of poverty, as was suggested by the descriptive tables in the previous section.

Households with more market-oriented agricultural production were more likely to have diversified into business (FB), while the probability of agricultural wage-work (FA) was reduced. A possible interpretation of this result is that the cash generated by market-oriented agriculture helps lift the cash-constraint on entering business. Female-headed households were less likely to have the combination FN, which may reflect the fact the females often are less geographically mobile (because of traditional household or family duties) than are males. Non-farm wage-work may require long-distance movement. If the head of the household is young, the household was a bit more likely to be in FB, but this effect was quite weak.

Table 13. Marginal Effects for Selection into Activity-combination, 2001

Activity combination	F	FA	FN	FB	FAB	FNB
age01	0.002	-0.001	0.00604**	0.00828***	-0.000	0.001
agesq01	0.000	0.000	-0.00007**	0.00006***	-0.000	-0.000
primary01*	-0.084***	-0.002	0.018	0.055***	0.000	0.012*
Secondary01*	-0.191***	-0.011	0.112***	0.048**	0.000	0.040***
tertiary01*	-0.567***	-0.033***	0.637***	-0.140***	-0.003	0.103***
female01*	0.026	-0.002	-0.029***	0.009	0.003	-0.005
landplabor01	0.016***	-0.015***	-0.007**	0.006***	-0.000	0.001
lusaka*	-0.440***	0.121***	0.060*	0.095**	0.070**	0.051**
copperbelt*	-0.207***	0.124***	0.016	-0.001	0.056***	0.014
central*	-0.082***	0.043**	0.009	0.023	0.013*	-0.004
eastern*	-0.008	0.018	0.012	-0.031*	0.013**	-0.003
luapula*	-0.272***	0.035**	0.005	0.142***	0.045***	0.034**
northern*	-0.018	-0.011	0.001	0.026	0.002	-0.001
nwestern*	-0.065*	0.002	0.020	0.039	0.000	-0.001
western*	-0.295***	0.022	-0.007	0.183***	0.054***	0.035**
market orientation01	0.014	-0.024*	-0.031**	0.048**	-0.001	-0.007
laborforce01	-0.012***	0.001	0.002	0.006**	0.000	0.003**
Frequency	52.0%	4.7%	8.0%	27.1%	2.5%	4.5%

Note: F = Farm income, A = Agricultural wage-work, N = Non-agricultural work, B = Own-business income. Marginal effects from a multinomial logit. The marginal effects are for discrete changes of dummy variables (*) from 0 to 1 and for other variables for changes at the mean.
Significance levels are: * at the 10% level, ** at the 5% level, and *** at the 1% level.

So the results that emerge from this stage of our analysis are that location matters a lot. If you are in a more diversified and urbanised environment, you are able to diversify more easily. Primary and secondary education opens up opportunities for non-agricultural wage-work, and to some extent for business. Diversification into agricultural wage work depends especially onland shortage, which suggests that this diversification is more of a distress-diversification.

6.3. Determination of the Level of Income

Next we look at the determinants of the level of real income. We need to normalize for household size in some fashion, and the most appropriate if we want to explain incomes, is to do it per labourer (members of the household in the age bracket 15-64 years). We checked for specification with a Hausman test, which suggested that we should use fixed effects estimation. So we run FE panel regressions with two waves of observations.

We do two different regressions. First we run a regression on the activity-combinations chosen and control variables (but dropping education and age of head): Column 1 in Table 14. The activity-combinations are obviously endogenous, so we go on to estimate a second equation with only the other determinants (col. 2), which in this case includes both the effect on income and activity choice.

Looking at the first panel regression (col. 1) where we control for gender and land per labourer, we see that FA gives 35% higher income than F, while FN, FB and FAB give approximately 70%, and FNB gives 109% higher income. So we see a very clear pattern of incomes going up with diversification, although the regression suffers from some endogeneity problems. When we consider the total effect of the deeper variables (col. 2), we

see that the total negative effect of having a female household-head is about 17%, while the land/labour ratio has a strong positive effect on income: 13% per hectare/labourer. With the FE model, we do not get any estimates of time invariant variables, such as province.[11]

OLS estimates of the pooled sample are shown for comparison, and to try to get some estimates of the impact of education and age as well as location. Columns 3 and 4 repeat the regressions in columns 1 and 2, while columns 5 and 6 show the results for regressions with all variables included. The first set of results (col.3-4) are similar to those in the fixed effect regressions. The second set of regressions (col. 5-6) are also broadly consistent for the variables included in the fixed effect regressions, although we here also pick up the effects of education, age, and province. Even with all these controls included, the estimates for the effect of activity combination (col. 5) are about the same as in the panel estimation (col. 1). Looking at the controls in column 5 we see that Luapula and Western, the two provinces with a high degree of diversification even though they are remote, had a strongly negative effect on income levels. In column 6 we see that the total effect of the deeper variables is considerable, and that education and being in Lusaka province had a strong positive effect. We also see that the total effect of being in Luapula or Western was negative. This means that the indirect positive effect of the high probability of diversification is more than cancelled out by the direct negative effect. Column 5 shows that activity combination matters very much, even when controlling for education and province, etc.

[11] We have also tested the effect of a dependency ratio (people aged 0-14 and 65, divided by the labour force aged 15-64). It turns out that the effect on output per labourer is positive. This reflects the fact that the dependents after all contribute something to output. When we ran the regression on income per adult equivalent instead, we found a strongly negative effect. This shows that the dependents add something to output, but much less than proportionately.

Table 14. Fixed-effects Regressions (col. 1-2) and Pooled OLS-regressions (col. 3-6) for Level of Income, 2001 and 2004

	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6
female	-0.138*	-0.168**	-0.437***	-0.520***	-0.287***	-0.316***
	(0.079)	(0.084)	(0.027)	(0.029)	(0.028)	(0.029)
landplabor	0.134***	0.131***	0.063***	0.057***	0.061***	0.058***
	(0.040)	(0.040)	(0.009)	(0.008)	(0.010)	(0.009)
fa	0.351***		0.268***		0.277***	
	(0.062)		(0.050)		(0.048)	
fn	0.714***		1.022***		0.779***	
	(0.052)		(0.039)		(0.037)	
fb	0.711***		0.684***		0.729***	
	(0.034)		(0.026)		(0.025)	
fab	0.748***		0.562***		0.619***	
	(0.073)		(0.058)		(0.056)	
fnb	1.086***		1.214***		1.095***	
	(0.063)		(0.056)		(0.051)	
t04	0.168***	0.143***	0.168***	0.148***	0.179***	0.158***
	(0.016)	(0.017)	(0.021)	(0.023)	(0.020)	(0.022)
age					-0.021***	-0.021***
					(0.005)	(0.005)
agesq					0.000***	0.000***
					(0.000)	(0.000)
primary					0.179***	0.246***
					(0.031)	(0.033)
secondary					0.444***	0.601***
					(0.038)	(0.040)
tertiary					1.304***	1.780***
					(0.066)	(0.067)
lusaka					0.263***	0.476***
					(0.068)	(0.072)
copperbelt					0.135***	0.191***
					(0.052)	(0.055)
central					0.148***	0.174***
					(0.046)	(0.049)
eastern					0.146***	0.091**
					(0.039)	(0.041)
luapula					-0.410***	-0.276***
					(0.043)	(0.046)
northern					-0.152***	-0.117***
					(0.043)	(0.045)
nwestern					-0.222***	-0.212***
					(0.055)	(0.060)
western					-0.540***	-0.381***
					(0.047)	(0.050)
Constant	12.408***	12.756***	12.547***	12.921***	12.924***	13.202***
	(0.060)	(0.058)	(0.023)	(0.020)	(0.117)	(0.124)
Observations	9638	9638	9638	9638	9638	9638
	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6
	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6

Note: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%

6.4. Growth of Income and Changes for Activity-combinations

Instead of looking at levels of income per labourer, in this section we look at the determinants of annual growth of income per labourer. In the first regression (Table 15, col. 1) we include the effects of changes in activity combination. The dummy "F to FN" captures those households that had the activity combination F 2001, and had changed to FN in 2004, and so on. Having the activity combination F both years, "F to F", is the default. In the second regression (col. 2) we only consider the impact of the deeper determinants. This means that in the latter regression these variables are allowed to affect income also via activity choices. In both regressions we also control for initial income, that is, income per labourer in 2001, plus the same controls as in the previous two regressions. To capture diminishing negative effects of high initial income we add the squared value of initial income.

Table 15. Regressions for Growth of Income and Changes in Activity Combinations, 2001-2004

	Col. 1	Col. 2		Col.1 (cont.)
lnincomeplabor01	-0.613***	-0.704***	ftofa	0.092***
lnincomeplaborsq01	0.016***	0.019***	ftofb	0.215***
age01	-0.007***	-0.008***	ftofn	0.185***
agesq01	0.000**	0.000**	ftofab	0.233***
primary01	-0.003	-0.000	ftofnb	0.285***
secondary01	0.039**	0.059***	fatof	-0.173***
tertiary01	0.190***	0.299***	fatofa	0.105***
female01	-0.063***	-0.072***	fatofb	0.150*
landplabor01	0.010***	0.008***	fatofn	0.121*
lusaka	0.095***	0.126***	fatofab	0.163**
copperbelt	0.096***	0.090***	fatofnb	0.059
central	0.051**	0.052**	fntof	-0.187***
eastern	0.136***	0.101***	fntofa	0.033
luapula	0.018	0.016	fntofb	0.110
northern	0.047**	0.067***	fntofn	0.200***
nwestern	0.093***	0.071***	fntofab	0.012
western	-0.053**	-0.051**	fntofnb	0.296***
Constant	5.405***	6.079***	fbtof	-0.104***
Observations	4819	4819	fbtofa	-0.047
R-squared	0.408	0.322	fbtofb	0.144***
			fbtofn	0.056*
			fbtofab	0.111**
			fbtofnb	0.204***
			fabtof	-0.170***
			fabtofa	0.022
			fabtofb	0.122*
			fabtofn	0.364***
			fabtofab	0.245***
			fabtofnb	0.469***
			fnbtof	-0.214***
			fnbtofa	-0.012
			fnbtofb	0.006
			fnbtofn	0.127***
			fnbtofab	0.165***
			fnbtofnb	0.267***
			resttraj	0.026

Resttraj is a dummy for any other trajectory, except those included in the regression and F to F (the default). * significant at 10%; ** significant at 5%; *** significant at 1%

One has to be careful when interpreting the parameter estimates for the dummies. The parameter estimate of FNB to FAB is positive and statistically significant, but since the default is F to F it is not obvious how to interpret this estimate. The positive estimate does not mean that it pays to change from Non-agricultural work to Agricultural work if you start in FNB. To say something about the likely effect of that change one should compare with the status quo, and since the parameter estimate for FNB to FNB is larger than the parameter estimate for FNB to FAB, the likely effect is negative on income growth.

The overall result is that in general it pays to switch from a less diversified activity state into a more diversified one. It certainly pays to leave farming only (F). It is negative to revert from FA back to F, although we considered FA as a distress diversification. If a household is in the category FN it pays to diversify into business as well. If a household starts out as mixed (FAB and FNB) it should stay mixed, and the best option is to be fully diversified (FNB), albeit without agricultural wage-work.

When we drop the changes in activity-combination (col. 2) we get the total effect of the deeper variables, including the effect via change in activity-combination. The effect of secondary education is 6%, while the effect of tertiary education is 30%. Of course, only 2.7% of the household heads have tertiary education. There is also a small positive effect of land/labourer (0.8% per hectare/labourer). Age is negative to start with, but positive after a certain age. The impact of female head (about 7%) is significant and negative. As in the levels analysis when estimating the effect of education and gender, the effect is lower in column 1, since much of the effect goes via activity combination choices. Compared to Southern, Lusaka had a 13% higher income growth rate, while Central, Copperbelt, Eastern, Northern, and North Western had 5-10% higher, and Western 5% lower; Luapula was more or less the same as Southern. The initial income level had a increasing, effect in growth.

The major result is that diversification helped substantially to increase income. Education also had a positive effect, increasing quite dramatically with the level of education. Female-headed households did worse than male-headed ones, while a high land/labourer ratio had a positive effect.

6.5. Income Growth within an Activity Combination

So far we have analysed the impact of activity combinations, change in activity-combinations, and deeper determinants of incomes and income growth. What remain to investigate are the determinants of income growth within activity-combinations. We thus estimate income growth per category according to their activity-combination in 2001. Some may have added or dropped some activity over the period, but we do not correct for this. We correct for sample-selection bias by using the results from the multinomial selection estimates presented in Table 13.[12] The results for our six income categories using the Lee (1983) sample selection correction method are reported in Table 16.[13] Since there are statistically significant correlations between the residuals in the income growth regression and the residuals from the multinomial logit model, the selection correction model should be used.

[12] In regressions like this there is always the risk of selection bias. We first ran a Heckman estimation with two states, F vs. all others. This showed that we had significant selection bias. Therefore we use a selection-correction model.

[13] For comparison we ran an OLS regression on each activity combination without sample selection correction. The estimates are shown in Table A6 in Appendix E. Except for the province parameters the estimates are similar to our Lee (1983) estimates. The OLS province estimates for F are much weaker than the Lee (1983) estimates.

The estimates for all activity combinations except F have very high standard errors. This is both due to the small samples and the estimation method, and results in low power for these regressions. Therefore very few estimates are statistically significant. But the estimates are in line with what our expectations; education matters most for FN and FNB, and female headed households are most punished within FN and FNB. The land per labourer ratio has a positive effect for the households that are full-time farmers as expected, but the stronger and positive effect for FNB is harder to explain. Looking at the influence of province, we see that it matters for those households that were full-time farmers in 2001. Being in Lusaka province is associated with 56% higher annual growth than living in Southern province. Those households that are engaged in the activity combinations FN or FNB benefit from living in Lusaka (where there are more well-paid jobs available). Those engaged in FB or FNB benefits from living in Copperbelt.

Table 16. Regression Results for Income Growth 2001-2004 by Activity Combination
(Selection bias correction based on the multinomial logit model, the Lee (1983) correction method)

	F	FA	FN	FB	FAB	FNB
lnincomeplabor01	-0.806***	-0.462	-1.202***	-0.526***	0.310	-0.564
lnincomeplaborsq01	0.024***	0.011	0.040***	0.012**	-0.018	0.014
age01	-0.012***	0.010	-0.007	0.006	-0.032*	-0.007
agesq01	0.000**	-0.000	0.000	-0.000	0.000	0.000
primary01	0.062***	-0.040	-0.004	-0.052	-0.070	0.148
secondary01	0.166***	-0.107	0.186	0.022	-0.081	0.301*
tertiary01	0.484***	-0.422	0.239	0.510***	Dropped	0.800***
female01	-0.082***	-0.091	-0.136	-0.069***	0.316	-0.302***
landplabor01	0.008***	-0.038	0.004	0.004	-0.088	0.022**
lusaka	0.561***	0.161	0.168*	-0.038	1.095	0.431***
copperbelt	0.173***	0.082	0.091	0.186***	1.050	0.294**
central	0.076***	0.046	0.082	0.063	0.431	0.123
eastern	0.078***	-0.003	0.107*	0.200***	0.476	0.096
luapula	0.227***	-0.109	0.007	-0.058	0.846	0.141
northern	0.042*	0.124	0.116**	0.062	0.283	0.055
nwestern	0.114***	-0.024	0.076	0.041	-0.743	0.133
western	0.130**	-0.043	-0.019	-0.141**	0.820	0.186
_mF	0.476***					
_mFA		-0.129				
_mFN			0.046			
_mFB				0.443***		
_mFAB					-1.003	
_mFNB						-0.384
Sigma2	0.212	0.215	0.102	0.521	8.427	1.135
Rho	1.034	-0.278	0.143	0.613	-0.345	-0.360
Constant	7.085***	3.876	8.942***	5.308***	-2.927	4.109

Note: F = Farm income, A = Agricultural wage-work, N = Non-agricultural work, B = Own-business income. The variables labelled _m are consistent estimators of conditional expected values of the residuals derived from the multinomial logit model. The coefficients on these variables are functions of the covariance between the residual in the regression and the residuals (or some function of the residuals) from the multinomial logit model.

7. POLICY CONCLUSIONS

Bigsten and Shimeles (2007) analysed the growth-redistribution trade-off for various African countries, and found that to reduce poverty by half by 2015, Zambia would need to achieve an annual increase in per capita income of 4.0%, assuming an unchanged income distribution (Gini-coefficient). However, the impact of growth on poverty depends on the pattern of growth. A pro-poor growth-pattern would be one where smallholders, who make up the majority of the poor in Zambia, did well. As we have noted in this paper, fast income growth for this category is associated with diversification of their incomes. This paper has sought to understand what the constraints are to smallholder diversification and income growth.

We first showed that poverty as measured by the head-count index declined by about 5.4 percentage points between 1998 and 2004. We decomposed this change into a 6.6 percentage point reduction due to growth, and a 1.2 percentage point increase due to a slight change in inequality. We also looked at growth-incidence across consumption-deciles. According to our estimates, all deciles experienced an increase in consumption during the period. Overall, the increase seems to have been somewhat larger in rural areas, with the exception of the top urban decile, which experienced an even more rapid consumption increase. Still, poverty remains much more severe in rural than in urban areas.

Our descriptive analysis of the pattern of income diversification then showed, among other things, that the lower quintiles had strikingly low incomes per adult-equivalent, but one should keep in mind that this does not mean that consumption levels are that low. The overall picture is that the higher the quintile, the lower the farm-income share of income. Households engaged in non-agricultural work or had their own business had generally higher incomes than others.

To be able to identify some livelihood strategies, we classified households according to which sources they derived income from. The most common activity-combinations were F, FB, FN, FA, FNB and FAB, in falling order. About 30% of the households that were full-time farmers (F) in 2001 had diversified further into wage-work and/or business in 2004. Most of those getting income from a combination of their own farm and work on the farms of others (FA) in 2001 did not do any agricultural wage-work in 2004. Thus, working on others' farms is not generally a permanent feature of smallholder income generation in Zambia.

Panel-data analysis showed that greater diversification is associated with higher income per labourer. In line with this we also found that shifting into more diversified activity-combinations was associated with higher growth of income per labourer. Further we studied what determines selection into an activity combination. The most striking result is that location, that is, province, matters a lot. If you are in a more diversified and urbanised environment, you are able to diversify more easily. Luapula and Western stand out, however, as remote regions but nevertheless having a high probability of diversification into business. Primary and secondary education opens up opportunities for non-agricultural wage-work. It also opens up the route to business, though this is less dependent on education. Diversification into agricultural wage-work depends especially on land shortage, which suggests that this is more of a distress-diversification. Households with more market-oriented agricultural production were more likely to have diversified into business (FB), which also reduces the probability of entering also agricultural wage work (FA). A possible interpretation of this is that the cash income generated by market-oriented agriculture helps lift the cash-constraint on entering business. Female-headed households were less likely to

have the combination FN, which may reflect the fact the females are often less geographically mobile (because of traditional household or family duties) than males.

Land per labourer, education and gender of the household head, and province did not just influence income indirectly via choice of activity-combination, but also directly. In other words, the endowments and constraints that a household faces not only affect the possibility for diversification, they also affect how successful the household is within the activity-combination chosen. The negative direct effect of being in Luapula or Western more than offset the positive indirect effect via high probability of diversification.

Policy-makers should thus keep in mind that rural household incomes are not derived from agriculture alone. A major focus should be on measures that strive to facilitate smallholder income-diversification. Typically, these are policies that develop the overall economic environment and help smallholders get better market access. Agriculture is a major part of the private sector in Zambia, and should receive higher priority. Of course, poverty may also be reduced by households leaving agriculture altogether and migrating to town. This will also be the long-term pattern, but at this stage in the development of Zambia this type of migration will only be relevant for a minority (Bigsten 1988).

It is thus clear that the focus of poverty-oriented policies must largely be on the rural sector. Since Zambia is a very unequal society, with a high Gini coefficient, poverty-levels could also be reduced by lowering inequality. But since average income and consumption are extremely low, growth is crucial for poverty reduction. To make agriculture more efficient, and thus reduce rural poverty, resources should be used to improve infrastructure such as roads and electricity, extension services, and education, rather than for subsidy schemes. The strongest result of our regressions is that province matters very much, which can be seen as an indicator of the quality of infrastructure or access to markets. More than half of the Ministry of Agriculture budget has gone to fertilizer subsidies (mostly for maize) and maize programmes. However, there has been diversification, and in recent years it is for example, cassava, sweet potatoes, and livestock production that have performed well. Secure property rights are of course also a crucial determinant of rural investment. Cash constraints hinder diversification both into business and into new crops. Therefore it is crucial to give more household's access to credit. This can be via direct measures, but also by strengthening the overall economic environment. While the Fifth National Development Plan emphasises the measures just mentioned, implementation in these areas seems to be low and slow.

Strengthening the position of women could have a strong positive effect on smallholder income, both indirectly by making it easier for female-headed households to diversify, and directly via higher income irrespectively of activity combination chosen. We also find that education had a strong positive effect on income, both directly and indirectly. Empowering women and improving education are obviously not things that can be handled easily and quickly, but rather things that should be integrated into policies in general. But there are measures that could also have short run effects. One is child support, conditional on school-attendance, and higher for girls. It could be in the form of free school lunches, or school uniforms, or cash transfers to families whose children showed up frequently enough in school. Such measures can be focused on girls and on districts with low income levels, and that could be a signal that women and their education are important. At the same time, it would strengthen education, and stimulate rural income.

In the 1980s, up to 17% of the national budget was devoted to maize and fertilizer policies, but this programme was later scaled back. However, in recent years as much as 70% of the

Ministry of Agriculture budget has gone to fertilizer subsidies and maize marketing, plus stockholding programmes, but still only 20% of small farmers in Zambia use fertilizers. Farmers' effective demand for fertilizer must be built up by making it profitable to use it, by developing output markets and regional trade. Jayne et al. (2007) argue that "sustained investment in crop science, effective extension programs, physical infrastructure, and a stable and supportive policy environment" is where public sector resources could be best used. Our analysis certainly supports the notion the market access is a key determinant of smallholder income-diversification and growth, and, for peripheral regions, improvements in market access require investments in infrastructure. The regional gaps in Zambia are very substantial.

Development of agriculture itself is also important to bring about the structural change required for long-term growth. But the introduction of a complex set of subsidy programmes via local governments and cooperatives does not seem to be the most efficient route to develop agriculture. Private sellers of fertilizer are in trouble, and many do not even hold fertilizer stocks any more, since their market has been taken away. Local traders and network sellers need a predictable environment for incentives for long-term engagement in the sector. The recent huge government maize-purchases point in the wrong direction. The private traders who had entered the market are squeezed, holding back development of a sustainable marketing infrastructure in the rural areas is held back.

The Food Reserve Agency should be just that, not a buyer of last resort. The policy in this area was straightforward until the last election, when purchasing by the agency shot up from 50 to 400 thousand tonnes. The surplus was supposed to be exported but there is considerable uncertainty about that. In addition, there seems to be a high risk that physical and financial losses will be very high. The government seems to have had a roadmap for private sector growth in agriculture, but now there seems to be a move toward more state-intervention, more subsidy-schemes. Now subsidised fertilizers are sold through farmers' unions and the like, and well-connected farmers end up getting it. There seem to be very extensive rent-seeking activities going on, where the elite get some of the cheap fertilizer, and other portions of it are sold onto the open market for other farmers to purchase at higher prices.

Hence, the introduction of these subsidy-schemes is problematic, not only from an efficiency perspective but also from a distributional point of view. Since 75% of farmers do not sell maize at all and a small (2%) minority sell half of it, the distributional impact of these subsidies is highly skewed. The subsidy-scheme has also had other distortionary effects. Since the guaranteed prices are higher than in neighbouring countries, it seems obvious that in some years maize is being carried over the border and sold into the Zambian reserves. There are at least four places along the borders where in past years buying stations have bought much more than the local farmers produced and sold.

There is high variation within districts in terms of land-ownership, which is an important income-determining factor. In areas under traditional tenure (94% of the land), the chief decides on allocation of land. Everyone is supposed to have land according to capability, but this is of course a flexible concept; influence seems to matter a lot as well. Local allocation of land in fairer ways seems highly important. Insecurity of tenure may have substantial effects on the willingness of farmers to invest, and on their ability to use land as collateral for loans to finance investment. Since land-ownership is clearly related to income, it is also a problem that some cultivable Zambian land is not cultivated.

The analysis in the previous section showed that smallholders in Zambia are dependent on a range of off-farm income sources, and that it is therefore important not to look at rural

policies as only those concerning agriculture. Paving the way for diversification is key in a package of poverty-reducing policies. Infrastructure that facilitates income-generating activities other than agriculture of course includes many things that are also beneficial for agriculture, e.g., good transportation. The diversification route to higher income for rural households requires a well-functioning economic environment and general policies that make it possible for new income-generating activities to emerge.

APPENDICES

Appendix A. Poverty Estimates in Zambia

Zambia has conducted a series of countrywide surveys since 1991 to measure the living standards of its people (CSO 2005). The 2002/03 Living Condition Monitoring Survey III (LCMS III) was an Integrated Household Budget survey; a diary method was used and a 12-month period covered. The other five were Indicator Monitoring Surveys, one-spot (single interview) surveys. It is therefore not completely appropriate to compare the results from LCMS III with the results from the other surveys. The poverty lines in the Indicator Monitoring Surveys were originally derived from a 1981 International Labour Office, Jobs and Skills Programme for Africa (ILO/JASPA) basic needs mission to Zambia. [14] The Zambian poverty-lines have been based on the Food-Energy Intake approach, and in 1991 the cost of the food-basket (the poverty-line) was updated.[15] The poverty lines were then again updated in subsequent surveys by the change in the CPI (Situmbeko, n.d.) In all of them the calorie requirement per adult-equivalent was set at 2721, not at 2450 as recommended by WHO (CSO 2004). This means that the estimated level of poverty is higher than if the WHO recommendation had been used.

The surveys collected data on household consumption-expenditures. Two poverty lines are used by the CSO: The extreme poverty line is the food poverty-line, which was K78,223 (1.02 PPP adjusted international 2000$/day) in 2004. The moderate poverty-line also includes consumption of "some minimum basic non-food items such as health, shelter, and education". This part is assumed to make up 30% of the consumption bundle of the poor. Thus, the moderate poverty-line is simply 1/(1-0.3) times the food poverty line, or K111,747 (1.45 PPP adjusted international 2000$/day). This can be compared with the World Bank poverty-line of 1.22 PPP adjusted international 2000 $/day (World Bank 2007b). The World Bank has 28% non-food in the basket defining the poverty line.

The levels of poverty recorded for Zambia by the CSO are significantly higher than those of other African countries at a similar income level. The World Bank (2007a) argues in their analysis of poverty in 2002/03 that the poverty line used by the CSO is too high. While CSO's moderate poverty-line for 2002/03 was estimated to be K92 185, the World Bank estimated it to be K73,394. Their respective estimates of the incidence of poverty were 67% and 56%.

The methodologies used by the World Bank and the CSO to estimate the level of poverty for 2002/03 are similar, but the assumptions underlying the estimations differ in several respects. The first difference between the two poverty line estimates is that CSO sets the calorie requirement per adult-equivalent to 2,721, while the World Bank uses the WHO (1985) recommendation of 2,464 calories. Secondly, there is a difference in how the consumption basket of the poor is constructed. CSO uses Lusaka prices from the first of the ten cycles in the survey as reference prices, while the World Bank uses national median prices. To determine the food basket underlying the poverty line, CSO calculates quantities by dividing national average expenditure shares by Lusaka cycle-one prices. This means that the CSO basket has less of foods that are expensive in Lusaka, relative to the national representative food basket. Then both institutions compute district poverty lines using district prices relative to the baseline prices. There are some small further differences between the two estimates in how the price-index is constructed. The discussion of the CSO and the World Bank is of some importance with regard to the poverty discussion within Zambia, but it is mainly with regard to international comparisons that it is important to keep measurements consistent

[14] See the discussion in the Appendix of Bigsten and Tengstam (2008).
[15] By the National Food and Nutrition Commission, and the Price and Incomes Commission.

across countries. The CSO-estimated poverty line seems quite high, so the World Bank estimate gives a more internationally comparable estimate of the level of poverty in Zambia. However, with regard to changes over time, the level of the poverty line matters less. Here it is important that the procedures to compute the poverty line do not change over time. We stick to the CSO line in our estimates for 1998-2004, although we do find the World Bank line preferable for some uses.

The 1998 food poverty line was K32 861 per adult equivalent. The CPI adjusted poverty lines from 1993, 1996, and 1998, are updated versions of the 1991 line using CPI (CSO, 2005:112). However, it seems that the 2004 poverty line was not updated accordingly; instead it was updated (with CPI) based on the 2002/03 line, which was calculated from scratch. The increase of the poverty line between 1998 and 2004 is smaller than the CPI increase, suggesting that the 2002/03 computations probably were done based on food prices (which makes sense, given the way the poverty-line is constructed).

Appendix B. The Variables

Activity combinations[16]:

F	Farm income
A	Agricultural wage income (or "Farm work")
N	Non-agricultural wage income (or "Non-farm work")
B	Own business income
FA	Farm income and Agricultural wage income
FN	Farm income and Non-agricultural wage income
Etc…	
FAB	Farm income, Agricultural wage income and Own business income
Etc…	

Other variables

Tot_hect	land in hectares
Laborforce	labor-force aged 15-64
LandpLaborer	Tot_hect/laborforce
Dependency	(hh_size - labor force)/labor force
Age, education	referring to the household head
Female	Female headed household
Market orientation	The fraction of agricultural output that a household sells in the market
Total income	Total real income in June/July 2004 Kwacha
Incomeplabor	real income/labor force
Incomeplaborgrowth	annual percentage change of Incomeplabor

District

Southern is the default

Change of activity combinations:

fatof = FA in 2001 and F in 2004, etc.

F to F is the default

Education

Primary	Grade 1-7
Secondary	Grade 8-12 (Form 1-5)
Tertiary	Form 6 or College or higher
Default	No education

[16] We also tried a stricter definition, where a household must get over 2000 Kwacha from a source for it to count, but there was very little difference..

Appendix C. Summary Statistics

Table A1. The Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
IncomepLaborer01	4819	776220.7	1489086	1019.518	5.64e+07
IncomepLaborer04	4819	930026	1844360	1818.182	5.72e+07
landplabor01	4819	1.35538	3.106761	.0144643	139
landplabor04	4819	1.338156	3.203653	.015625	139
Laborforce01	4819	3.245072	1.868085	1	22
Laborforce04	4819	3.356505	1.968806	1	26
IncomepLaborerGrowth	4819	.0457709	.4041199	-2.224043	2.473509
tot_hect	4819	3.810365	7.429152	.06	240.8725
totalincome01	4819	2424640	5003368	5209.096	1.38e+08
totalincome04	4819	2916466	6935249	10000	1.85e+08
age01	4819	45.19485	14.16938	15	91
agesq01	4819	2243.304	1388.86	225	8281
age04	4819	47.70845	14.10105	16	94
agesc04	4819	2474.894	1448.391	256	8836
primary01	4819	.6032372	.4892768	0	1
secondary01	4819	.2056443	.4042136	0	1
tertiary01	4819	.0269766	.1620317	0	1
primary04	4819	.6051048	.4888789	0	1
secondary04	4819	.2014941	.4011578	0	1
tertiary04	4819	.0292592	.1685496	0	1
central	4819	.1093588	.3121212	0	1
copperbelt	4819	.0576883	.2331773	0	1
eastern	4819	.2129072	.4094051	0	1
luapula	4819	.1110189	.3141881	0	1
lusaka	4819	.0298817	.1702786	0	1
northern	4819	.1873833	.3902594	0	1
nwestern	4819	.0589334	.2355244	0	1
southern	4819	.1263748	.3323057	0	1
western	4819	.1064536	.3084493	0	1
female01	4819	.1851006	.3884195	0	1
female04	4819	.2029467	.4022349	0	1
f01	4819	.5196099	.4996672	0	1
a01	4819	.000415	.02037	0	1
b01	4819	.0041502	.0642952	0	1
n01	4819	.0012451	.0352673	0	1
fa01	4819	.0464827	.2105498	0	1
fb01	4819	.2712181	.4446345	0	1
fn01	4819	.0800996	.2714755	0	1
ab01	4819	.000415	.02037	0	1
an01	4819	0	0	0	0
nb01	4819	.0006225	.0249455	0	1
fab01	4819	.0244864	.1545697	0	1
fan01	4819	.0029052	.0538268	0	1
fnb01	4819	.0446151	.2064786	0	1
anb01	4819	0	0	0	0
fanb01	4819	.0037352	.0610085	0	1
f04	4819	.5490766	.4976373	0	1
a04	4819	.0014526	.038089	0	1
b04	4819	.0041502	.0642952	0	1
n04	4819	.0020751	.0455109	0	1

Variable	Obs	Mean	Std. Dev.	Min	Max
fa04	4819	.0508404	.2196945	0	1
fb04	4819	.2236979	.4167651	0	1
fn04	4819	.0931729	.2907047	0	1
ab04	4819	.000415	.02037	0	1
an04	4819	0	0	0	0
nb04	4819	.0006225	.0249455	0	1
fab04	4819	.0236564	.1519919	0	1
fan04	4819	.0043578	.0658761	0	1
fnb04	4819	.0425399	.2018384	0	1
anb04	4819	0	0	0	0
fanb04	4819	.0039427	.0626737	0	1
market01	4786	.2709844	.2694527	0	1
market04	4777	.3116856	.2867224	0	1
dependency01	4819	1.336875	1.025442	-2.98e-08	14
dependency04	4819	1.888227	1.830631	-2.98e-08	48
Own business income01	4819	369360.5	2109611	0	7.08e+07
Remittances01	4819	24268.14	95300.64	0	1945000
Non agric. wage income01	4819	214393.5	914397.7	0	1.64e+07
Agricultural wage income 01	4819	30538.75	206146.5	0	3600000
Adult equivalts01	4819	5.051373	2.642368	.1733333	32.58
Household size01	4819	6.500709	3.37819	.6666667	41
Non agric. wage income04	4819	431948.2	2122798	0	4.86e+07
Remittances04	4819	31451.55	189738.9	0	5000000
Own business income04	4819	606862.7	3607145	0	1.20e+08
Agricultural wage income 04	4819	60086.05	415558.4	0	9455000
Adult equivalts04	4819	5.199104	2.619725	.0833333	32.53833
Household size04	4819	6.259373	3.123211	.0833333	40.66667
farmincome01	4819	761857.8	1211612	0	2.44e+07
farmincome04	4819	1817569	4958687	0	1.83e+08

Table A2. Trajectories, Frequencies

paths from one type of combination to another		frequency
	ftof	.3552604
	ftofa	.0211662
	ftofb	.0906827
	ftofn	.0282216
	ftofab	.008923
	ftofnb	.0112056
	fatof	.0205437
	fatofa	.0116207
	fatofb	.0062254
	fatofn	.0035277
	fatofab	.0022826
	fatofnb	.0014526
	fbtof	.1236771
	fbtofa	.0097531
	fbtofb	.1004358
	fbtofn	.0155634
	fbtofab	.0070554
	fbtofnb	.009338
	fntof	.0217888
	fntofa	.0039427
	fntofb	.0070554
	fntofn	.0327869
	fntofab	.0006225
	fntofnb	.0105831
	fabtof	.0116207
	fabtofa	.0020751
	fabtofb	.0051878
	fabtofn	.0012451
	fabtofab	.0024901
	fabtofnb	.0010376
	fnbtof	.0114132
	fnbtofa	.0022826
	fnbtofb	.0105831
	fnbtofn	.0103756
	fnbtofab	.0016601
	fnbtofnb	.0068479
	resttraj	.0294667

Appendix D. Descriptive Tables

Table A3. 2001 Activity Combinations, and 2001 Explanatory Variables

activity	frec. %	2001 Income per ae 000'	2004 Income per ae 000'	Age of head	hhsize	ae	tot_hect	laborforce	primary	secondary	tertiary
F	52,81	256	448	46,9	6,000	4,656	3,347	2,803	0,618	0,153	0,004
FA	4,57	346	368	43,7	6,256	4,891	1,878	2,948	0,628	0,154	0,000
A	0,04	53	189	27,7	2,555	2,153	8,283	1,950	1,000	0,000	0,000
FN	7,94	849	1195	42,8	6,842	5,336	2,647	3,166	0,406	0,324	0,193
N	0,12	610	651	35,6	4,679	3,783	0,764	2,657	0,568	0,432	0,000
FB	26,70	559	538	43,4	6,015	4,631	3,540	2,749	0,655	0,207	0,004
FAB	2,34	361	431	43,3	5,880	4,554	2,108	2,743	0,617	0,185	0,000
FNB	4,35	1006	829	42,7	7,175	5,556	3,632	3,261	0,479	0,363	0,081
B	0,45	283	496	44,9	7,097	5,231	1,339	2,832	0,819	0,071	0,000
AB	0,04	467	348	36,5	6,329	5,408	0,454	3,805	1,000	0,000	0,000
BN	0,05	532	712	43,2	6,653	5,052	0,404	2,463	0,674	0,326	0,000
FAN	0,30	402	484	47,3	6,512	5,112	3,334	3,008	0,512	0,222	0,000
FABN	0,29	605	509	50,8	8,935	6,992	3,584	4,539	0,626	0,198	0,104
All	100,00	425	545	45,2	6,144	4,760	3,247	2,848	0,606	0,192	0,023

Table A3. (cont.)

activity	female	central	copperbelt	eastern	luapula	lusaka	northern	nwestern	southern	western
F	0,234	0,113	0,054	0,276	0,080	0,010	0,196	0,071	0,127	0,073
FA	0,221	0,145	0,104	0,264	0,121	0,064	0,049	0,054	0,078	0,121
A	0,000	0,000	0,000	0,000	0,606	0,000	0,394	0,000	0,000	0,000
FN	0,080	0,129	0,053	0,218	0,092	0,049	0,167	0,090	0,131	0,071
N	0,000	0,172	0,000	0,000	0,198	0,139	0,150	0,198	0,000	0,143
FB	0,204	0,107	0,049	0,153	0,165	0,031	0,169	0,073	0,105	0,149
FAB	0,356	0,065	0,119	0,177	0,237	0,070	0,036	0,012	0,011	0,274
FNB	0,136	0,076	0,070	0,135	0,197	0,070	0,126	0,053	0,117	0,157
B	0,246	0,073	0,000	0,000	0,177	0,213	0,178	0,106	0,038	0,214
AB	0,484	0,000	0,000	0,000	0,516	0,484	0,000	0,000	0,000	0,000
BN	0,000	0,000	0,000	0,000	0,000	0,537	0,463	0,000	0,000	0,000
FAN	0,066	0,000	0,000	0,266	0,237	0,166	0,121	0,076	0,007	0,127
FABN	0,080	0,134	0,000	0,071	0,142	0,204	0,062	0,018	0,022	0,348
All	0,211	0,111	0,057	0,227	0,116	0,028	0,172	0,070	0,115	0,105

Table A4. 2004 Activity Combinations, but still 2001 Explanatory Variables

Activity	frec. %	income01	income04	age	hhsize	wae	tot_hect	laborforce	primary	secondary	tertiary
f	56,22	337775	366575	46,940	5,986	4,638	3,448	2,784	0,626	0,150	0,005
fa	5,08	367728	390224	46,028	6,416	4,978	2,504	2,921	0,581	0,156	0,000
a	0,16	550922	368244	48,317	4,742	3,648	2,449	2,488	0,763	0,237	0,000
fn	9,02	730328	939225	44,075	6,794	5,289	2,933	3,158	0,451	0,328	0,129
n	0,16	510548	571918	40,096	5,516	4,429	1,913	2,709	0,478	0,282	0,227
fb	21,58	466314	740498	42,064	6,007	4,633	3,204	2,771	0,642	0,222	0,011
fab	2,33	348441	498067	41,827	6,726	5,238	2,975	3,031	0,668	0,223	0,014
fnb	4,10	745376	1285474	42,344	7,017	5,479	2,972	3,314	0,482	0,313	0,119
b	0,43	1338257	910851	37,095	5,079	3,790	1,603	2,100	0,587	0,286	0,000
ab	0,02	168794	26965	37,864	5,000	3,748	0,501	2,087	0,000	0,087	0,000
nb	0,05	1252486	1416815	33,754	6,212	4,922	1,371	2,609	0,226	0,000	0,774
fan	0,46	460566	376781	46,763	6,331	5,018	2,451	2,962	0,734	0,089	0,000
fanb	0,39	295995	525364	39,127	6,974	5,380	2,212	3,247	0,578	0,287	0,013
All	100,00	425	545	45,2	6,144	4,760	3,247	2,848	0,606	0,192	0,023

Table A4. (cont.)

activity	female	Central	Copperbelt	Eastern	Luapula	Lusaka	Northern	Nwestern	Southern	Western
f	0,235	0,107	0,057	0,303	0,095	0,013	0,164	0,077	0,104	0,080
fa	0,227	0,139	0,086	0,146	0,091	0,060	0,045	0,053	0,198	0,182
a	0,322	0,000	0,000	0,210	0,000	0,205	0,000	0,000	0,472	0,114
fn	0,123	0,113	0,061	0,209	0,085	0,041	0,152	0,094	0,144	0,101
n	0,000	0,000	0,000	0,141	0,124	0,000	0,369	0,123	0,013	0,231
fb	0,197	0,120	0,055	0,106	0,165	0,031	0,224	0,061	0,101	0,138
fab	0,216	0,092	0,034	0,048	0,275	0,112	0,142	0,010	0,186	0,101
fnb	0,141	0,105	0,048	0,115	0,133	0,069	0,230	0,052	0,075	0,172
b	0,164	0,138	0,018	0,000	0,148	0,000	0,259	0,000	0,217	0,219
ab	0,000	0,000	0,000	0,000	0,913	0,000	0,000	0,000	0,087	0,000
nb	0,405	0,000	0,000	0,000	0,000	0,000	0,000	0,405	0,226	0,369
fan	0,140	0,000	0,000	0,113	0,151	0,109	0,149	0,039	0,300	0,139
fanb	0,166	0,000	0,042	0,122	0,262	0,144	0,193	0,013	0,124	0,099
All	0,211	0,111	0,057	0,227	0,116	0,028	0,172	0,070	0,115	0,105

Table A5. The Provinces

Province	Capital	Average income per hh and month, 000'	Population	Density (people /km²)	Line of Rail	Distance to market (km)[17]
Lusaka	Lusaka	734	1,391,329	63.5	X	4.2
Copperbelt	Ndola	665	1,581,221	50.5	X	3.9
Central	Kabwe	443	1,012,257	10.7	X	17.6
Southern	Livingstone	474	1,212,124	14.2	X	16.4
Eastern	Chipata	490	1,306,173	18.9		20.0
Luapula	Mansa	318	775,353	15.3		18.6
Northern	Kasama	378	1,258,696	8.5		25.0
North-Western	Solwezi	427	583,350	4.6		19.7
Western (Barotseland)	Mongu	356	765,088	6.1		23.0
Zambia	Lusaka	502	9,885,591	13.1		14.8

Note: Income from CSO (2005). Pop (for 2000) and pop density from Administrative Divisions of Countries ("Statoids"), http://www.statoids.com/, by Gwillim Law. Distance to markets from Thurlow and Wobst (2004).

Map A1.

[17] Dist to markets = Average distance from household to food and input markets.

Appendix E. Regressions

Table A6. Regression Results for Income Growth 2001-2004 by Activity Combination without Sample Selection Correction

	F	FA	FN	FB	FAB	FNB
lnincomeplabor01	-0.831***	-0.476	-1.205***	-0.527***	0.554	-0.528
	(0.113)	(0.464)	(0.312)	(0.190)	(1.025)	(0.527)
lnincomeplabor012	0.025***	0.012	0.040***	0.012	-0.027	0.013
	(0.004)	(0.018)	(0.012)	(0.007)	(0.039)	(0.020)
age01	-0.010***	0.011	-0.004	-0.004	-0.036**	-0.021*
	(0.003)	(0.010)	(0.011)	(0.005)	(0.017)	(0.013)
age012	0.000***	-0.000	0.000	0.000	0.000*	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
primary01	0.003	-0.037	0.002	0.020	-0.094	0.088
	(0.019)	(0.060)	(0.066)	(0.030)	(0.094)	(0.098)
secondary01	0.037	-0.083	0.210***	0.085**	-0.071	0.136
	(0.024)	(0.087)	(0.070)	(0.035)	(0.136)	(0.114)
tertiary01	0.098	-0.342***	0.306***	0.194**	0.000	0.455***
	(0.094)	(0.086)	(0.080)	(0.090)	(0.000)	(0.124)
female01	-0.062***	-0.089	-0.150**	-0.065**	0.033	-0.273***
	(0.018)	(0.064)	(0.075)	(0.025)	(0.077)	(0.097)
landplabor01	0.010***	-0.021	0.001	0.007**	-0.022	0.022***
	(0.002)	(0.021)	(0.006)	(0.003)	(0.033)	(0.008)
lusaka	0.217***	0.087	0.179**	0.045	-0.092	0.271**
	(0.058)	(0.087)	(0.072)	(0.077)	(0.390)	(0.116)
copperbelt	0.051	0.011	0.095	0.186***	-0.073	0.228***
	(0.033)	(0.083)	(0.080)	(0.050)	(0.370)	(0.084)
central	0.021	0.012	0.085	0.100**	-0.186	0.179**
	(0.028)	(0.091)	(0.060)	(0.042)	(0.393)	(0.086)
eastern	0.088***	-0.015	0.111*	0.156***	-0.091	0.121
	(0.024)	(0.081)	(0.057)	(0.038)	(0.381)	(0.078)
luapula	0.033	-0.132	0.006	0.075*	-0.148	0.025
	(0.031)	(0.091)	(0.080)	(0.040)	(0.373)	(0.094)
northern	0.041	0.146	0.117*	0.097***	0.143	0.083
	(0.025)	(0.106)	(0.060)	(0.037)	(0.416)	(0.099)
nwestern	0.077**	-0.021	0.083	0.085	-0.722*	0.182*
	(0.035)	(0.098)	(0.067)	(0.054)	(0.387)	(0.105)
western	-0.084**	-0.057	-0.025	0.022	-0.246	0.074
	(0.036)	(0.105)	(0.086)	(0.043)	**(0.379)	(0.096)
Constant	6.849***	4.178	8.822***	4.895***	-1.530	4.961
	(0.720)	(2.923)	(2.078)	(1.257)	(6.768)	(3.534)
Observations	2504	224	386	1307	118	215
R-squared	0.330	0.328	0.217	0.289	0.218	0.295

REFERENCES

Barrett, C. B. 1998. Immiserized Growth in Liberalized Agriculture, *World Development* 26.5: 743-53.

Barrett, Christopher B., Mesfin Bezuneh, Daniel C. Clay, and Thomas Reardon. 2005. Heterogeneous Constraints, Incentives and Income Diversification Strategies in Rural Africa. *Quarterly Journal of International Agriculture* 44.1: 37-60.

Bigsten, A. 1988. A Note on the Modelling of Circular Smallholder Migration, *Economics Letters* 28.

Bigsten, A., B. Kebede, and T. Mekkonen. 2003. Growth and Poverty Reduction in Ethiopia: Evidence from Household Panel Surveys. *World Development* 31.1.

Bigsten, A., and A. Shimeles. 2007. Can Africa Reduce Poverty by Half by 2015? *Development Policy Review* 25.2.

Bigsten, A., and S. Tengstam. 2008. *Growth, Rural Diversification and Poverty Reduction in Zambia.* Sida Country Economic Report No 2008:4. Stockholm: Sida.

Central Statistical Office, Republic of Zambia. 2004. *Living Conditions Monitoring Survey Report 2002-2003*.

Central Statistical Office. Republic of Zambia. 2005. *Living Conditions Monitoring Survey Report 2004*.

Datt, Gaurav, and Martin Ravallion. 1992. Growth and Redistribution Components of Changes in Poverty Measures: A Decomposition with Applications to Brazil and India in the 1980s. *Journal of Development Economics* 38: 275-95.

Doss, Cheryl, John McPeak, and Christopher Barrett. 2006. *Interpersonal, Intertemporal, and Spatial Variation in Risk Perceptions: Evidence from East Africa*. Yale University Working Paper 948. New Haven: Yale University, Economic Growth Center.

Food Security Research Project. 2005. Second Supplemental Survey to the 1999/2000 PHS. Lusaka, Zambia: FSRP and MSU.

IMF. 2007a. *International Financial Statistics.* May. Washington D.C.; International Monetary Fund.

Jayne, T. S., J. Govereh, P. Chilonda, N. Mason, A. Chapoto, and H. Haantuba. 2007. *Trends in Agricultural and Rural Development Indicators in Zambia.* FSRP Working Paper No. 24. Lusaka: Food Security Research Project.

Law, G. 2008. *Administrative Divisions of Countries.* Statoids website. http://www.statoids.com/

Lee, L.F. 1983. Generalized Economic Methods with Selectivity. *Econometrica* 51.2: 507-12.

Lewis, W. A. 1954. Economic Development with Unlimited Supplies of Labor. *The Manchester School of Economic and Social Studies* 22: 139-91.

Megill, D. J. 2005. *Recommendations for Adjusting Weights for Zambia Post-harvest Survey Data Series and Improving Estimation Methodology for Future Surveys.* FSRP Working Paper No. 13. Lusaka: Food Security Research Project.

National Food and Nutrition Commission. 1993. An Update on Minimum Monthly Food Requirements for an Average Zambian Family.

Reardon, T. 1997. Using Evidence on Household Income Diversification to Inform Study of the Rural Non-farm Labor Market in Africa, *World Development* 25.5: 735-48.

Republic of Zambia. 2006a. *Economic Report 2005.* Lusaka: Ministry of Finance and National Planning.

Republic of Zambia. 2006b. *Economic Report 2006.* Lusaka: Ministry of Finance and National Planning.

Republic of Zambia. 2006c. *Fifth National Development Plan 2006-2010.* Lusaka: Ministry of Finance and National Planning.

Situmbeko, L. C. no date. *Poverty and Inequality in Zambia*. Nairobi, Kenya: AERC.

Thurlow, J., and P. Wobst. 2004. The Road to Pro-poor Growth in Zambia: Past Lessons and Future Challenges. Washington, D.C.: IFPRI. mimeo.

Venables, T. 2006. Notes on The Zambian Economic Situation. London: DFID. mimeo.

WHO. 1985. *Energy and Protein Requirements.* WHO Technical Report 724. Geneva: WHO.

World Bank. 2007a. *Zambia Poverty and Vulnerability Assessment.* Report 32573-ZM. Washington DC: World Bank.

World Bank. 2007b. *World Development Indicators.* New York: World Bank. Online at http://web.worldbank.org.ezproxy.ub.gu.se/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20398986~menuPK:64133163~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html

Zulu, B., T. S. Jayne, and M. Beaver. 2007. *Smallholder Household Maize Production and Marketing Behaviour in Zambia and its Implications for Policy.* FSRP Working Paper No. 22. Lusaka: Food Security Research Project.