Trends in agriculture producers' income in rural Mozambique

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Abstract

This paper assesses whether or not the PARPA's overarching goal of significantly reducing rural poverty is met. We analyze trends in farmers' real incomes over the last six years. The results are drawn from three nationally representative household income surveys from rural Mozambique. The paper combines a set of different descriptive and analytical tools, including OLS regressions. The PARPA II outlined policies in various development areas to enhance farmers' incomes, such as the promotion of self-employment and expansion of the private sector, infrastructure, and increase in agricultural productivity. The results suggest that PARPA II failed to enhance farmers' incomes, and that in rural areas poverty headcount may have remained fairly constant. The results also show that diversification of income sources is an important strategy to reduce poverty. Poor households, however, appear to be squeezed into low paid activities which confer them lower wage incomes, while wealthier households enjoy the benefits conferred by high return off-farm activities. Moreover, poverty has spatial, demographic, occupational, and asset holding dimensions.

JEL Classification: I3; O16; P46; Q18.

Keywords: PARPA II; rural Mozambique; income trends; poverty.

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1 Introduction

Poverty reduction has long been the foremost development priority in Mozambique. The country has made great strides in recent years, reducing poverty headcount from 69 percent in 1996 to 54 percent in 2003 (MPF/IFPRI/PU, 2004). Poverty headcount, however, is higher in rural areas (55%) where most of the population lives and agriculture is the main economic activity. Enhancing farmers' incomes is thus vital to significantly reduce rural poverty in Mozambique. Using a set of three nationally representative household income surveys, this paper analyzes trends in farmers' real incomes over the last six years (from 2002 to 2008).

The government through its poverty reduction strategy plan for 2006/09 (PARPA II) envisaged a reduction in poverty incidence to 45 percent in 2009. Such a reduction would require significant increases in farmers' income. However, recent research on income dynamics shows that the real median household income has decreased and the distribution of farmers' incomes (income inequality) has become wider between 2002 and 2005 (Cunguara and Kajisa, 2009; Mather et al., 2008).

The paper takes advantage of the availability of recently collected nationally representative surveys and seeks to answer the following questions: (i) how has the income changed from 2005 to 2008? (ii) how has the income distribution changed? (iii) and more importantly, has the PARPA II goal of significantly reducing rural poverty been met? The results suggest that PARPA II failed to significantly increase farmers' incomes. Furthermore, income inequality has increased over the last years.

2 Data sources

We use data from the National Agricultural Survey (TIA) of 2002, 2005, and 2008. The surveys were implemented by the Department of Statistics within the Directorate of Economics of the Ministry of

Agriculture, for the agricultural seasons of 2001/02, 2004/05, and 2007/08. The sampling frame draws heavily on the Census of Agriculture and Livestock of 1999-2000. The sample was stratified by province and agro-ecological zone. Table 1 provides details on the sample and selected demographic characteristics.

Table 1. Sample size and characteristics

	TIA02	TIA05	TIA08
Number of observations	4908	6159	5968
Number of sampled districts	80	94	All 128
Widow female headed households (%)	9.06	8.45	10.63
Male headed households (%)	75.68	74.75	74.61
Head is engaged in salaried employment (%)	15.04	26.94	28.20
Head is self-employed (%)	32.83	43.43	37.24
Head's age	42.04	43.99	43.07
Head's year of educational attainment	2.23	2.57	2.95

Sources: Authors' calculations based on TIA02, TIA05, and TIA08

All three surveys were designed to collect data on income sources. Household incomes are calculated as the value of own crop production, livestock holdings, value of remittances, wage and self-employment incomes, less any paid out costs, such as the cost of fertilizers, pesticides, and improved seeds. Given the importance of agriculture to total household incomes, and extremely low use of irrigation, the results from income surveys are affected by the weather (Walker et al., 2004).

3. Methods

In a money-metric approach to measuring poverty, various authors argue that there are theoretical reasons why consumption is believed to be more accurate than income as the welfare measure (Gradin et al., 2004; Thorbecke,2005; Alderman, 1992). Nevertheless, when analyzing rural poverty the analysis of consumption data may not lead to specific, actionable conclusions as data on relevant agricultural variables may be missing, incomplete, or variation in consumption data may be relatively small and more difficult to explain. Furthermore, for the period under analysis there is no available consumption data. Thus, we use household income as the welfare measure bearing in mind that this is expected to produce higher poverty rates than compared to welfare measures based on consumption.

Total household incomes are obtained from five sources: livestock, remittances, wages, self-employment, and crops. Crop income includes the incomes from fruit sales (including cashew and coconuts), horticultural sales, production value of cereals, pulses, roots, and cash crops. Livestock income corresponds to the value of livestock sales, including the sale of livestock by-products. The estimate of total household income provides a base for comparison between households. Its absolute value, however, is far from accurate for several reasons. For instance, crop income is underestimated because we only value fruit sales and horticultural sales, even though part of the production is retained for home consumption. The same argument is valid for livestock.

We use farm gate prices to estimate crop and livestock incomes. The prices are "averaged" (medians) by district, province, and region, and used in this particular order. For example, if a farmer produces 100 kilograms of maize, the value of production of maize is obtained by multiplying the quantity produced by the median price for that district. If district prices are not available, then we use provincial prices. If provincial prices are also not available, then we use regional prices.

All income figures are inflated to 2008 prices. For each product in TIA08, we compute the price ratio between TIA08 and TIA05. These price ratios are based on median prices from each year and district in TIA08 and TIA05. Since TIA08 had a larger coverage, some of the districts sampled were not used in the calculation of the deflators. Then we aggregate the price ratios at the provincial level, and thus obtain 10 provincial deflators, corresponding to 10 provinces sampled in TIA, which excludes Maputo and Matola cities. TIA02 had already been inflated to 2005 price levels and the deflator/inflator is described in Mather et al. (2008).

3.1. Determinants of household income

We use a regression model (ordinary least squares) to assess the factors associated with household's income in rural Mozambique, and apply the same model to each of the three years of survey data. The dependent variable is the total household income (in logs), and independent variables include demographic characteristics, asset endowments, access to credit and extension services, agricultural technology used, and location dummies.

4 Descriptive analysis

Figure 1 depicts household income distribution over time. The results suggest that the distribution has become more unequal. While wealthier households experienced an increase in their incomes from 2002 to 2005 (Cunguara and Kajisa, 2009; Mather et al., 2008), the distribution in 2008 has almost entirely shifted to the left and become slightly wider. One direct implication, other than a rising inequality, is that poverty headcount may have stayed fairly constant over the last 6 years, whereas both poverty gap and the squared poverty gap measures may have worsened[1].

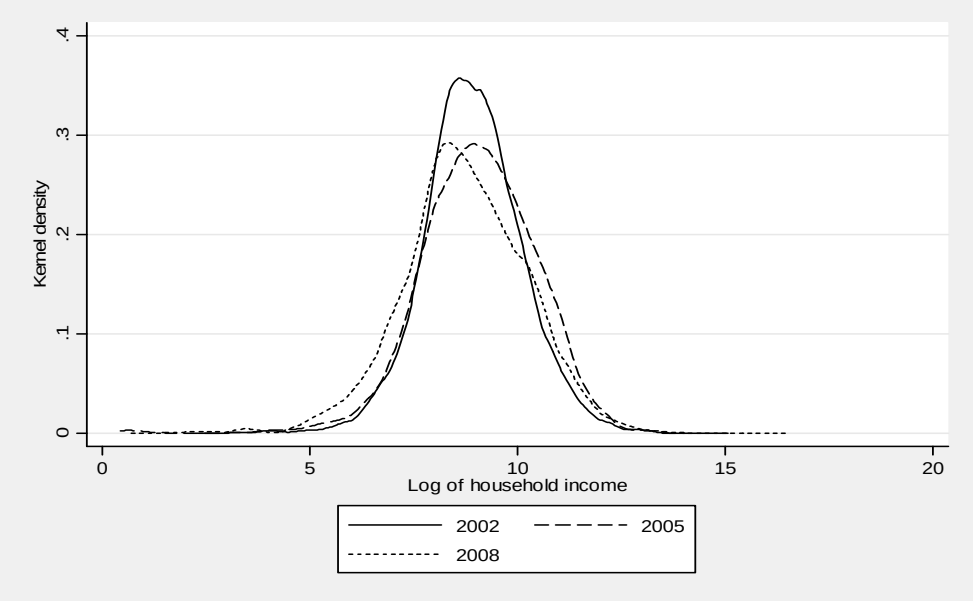

Figure 1. Household real income (in logs) distributions by year

[1] One could calculate the Gini coefficient of inequality, but such measure is usually high when we use household income rather than expenditure data.

A decline in poverty headcount could take place via a shift of the whole income distribution to the right, or a narrower distribution, assuming that the distribution center was initially above the poverty line. While in the former scenario a reduction in poverty headcount would be sustained by an increase in household income among the poor in each year, in the latter scenario the reduction would come from a re-distribution of incomes from wealthier to the poorest households, and hence a reduction in inequality. None of these two scenarios is observed in Figure 1, which is a supportive evidence of income poverty incidence in rural Mozambique remaining either constant or deteriorating.

At the core of the patterns observed in Figure 1 lies the structure of household income. Poorer households are more dependent on rain-fed crop income, whereas wealthier households have more diversified income sources. For instance, crop income accounted for over 82 percent of total household income among the poorest households (bottom quintile) in 2002, compared to less than 40 percent among the top quintile for the same period (Figure 2)[2]. The share of crop income, however, has decreased over time suggesting that rural households have successfully diversified their income sources. Nevertheless, Mather et al. (2008) and Cunguara and Kajisa (2009) suggest that the decline in the share of crop income from 2002 to 2005 was mainly due to a relatively poorer agricultural season in 2005. In the case of 2008, three possible reasons figure prominently in the explanation of a decline in the share of crop income, namely the climatic conditions in 2008, changes in cropped area, and diversification of income sources. We focus the discussion on the last two possible explanations.

[2] The quintiles were calculated for each province and year to account for differences between provinces (in terms of infrastructure) and year (in terms of agricultural season).

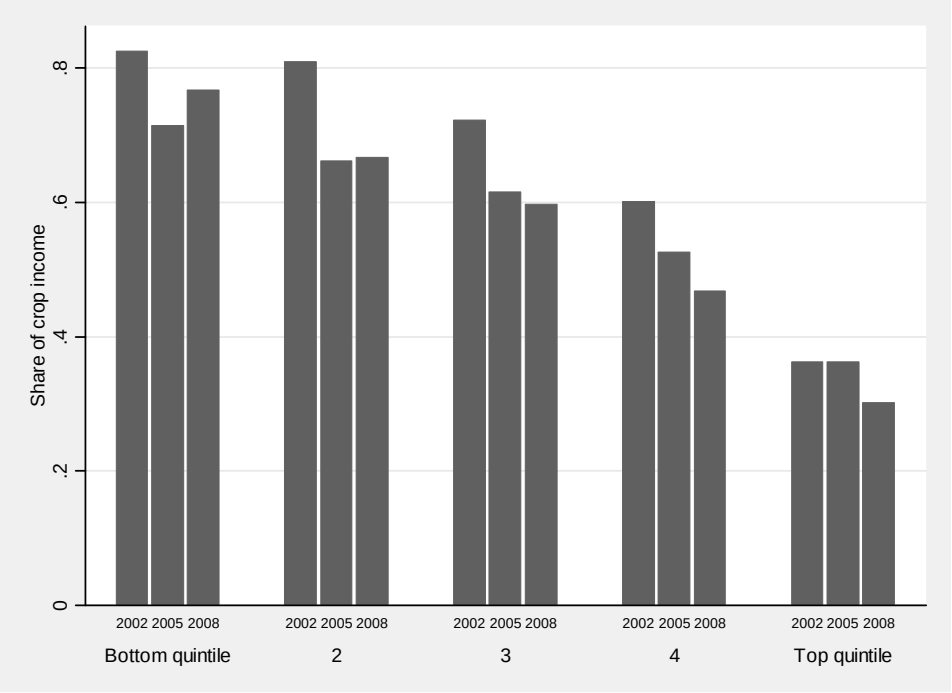

Figure 2. Share of crop income over time by household income quintile

Figure 3 is the flip side of the share of crop income. While the share of crop income decreases when moving from the lower to the upper quintiles, the share of wage income increases sharply from the poorest to the wealthiest households. Households in the top quintile are thus more resilient to weather shocks since they have a relatively higher share of off-farm income.

The top two quintiles managed to sustain an increase in their shares of wage income. These results, however, should be interpreted with caution, given that the share is a relative measure. As such, one would expect the share of wage income to increase in a drought year (2005) due to a fall in crop income. Analyzing trends in the number of salaried and self-employed members helps disentangle whether or not there is some evidence of structural change on income sources.

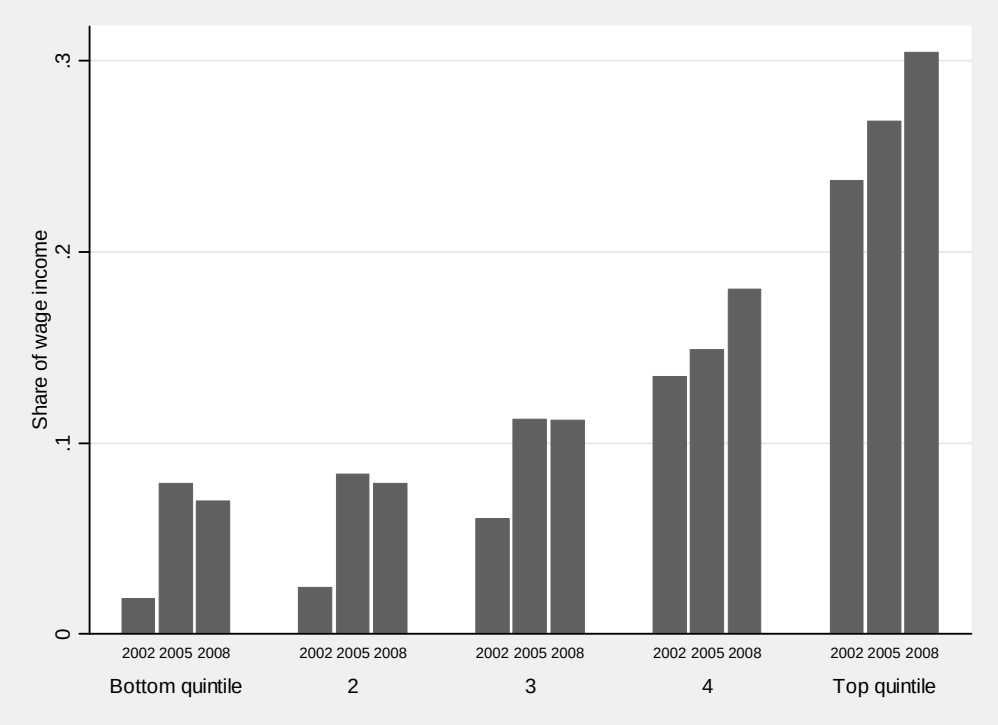

Figure 3. Share of wage income over time by household income quintile

Figure 4 shows the average number of household members undertaking off-farm activities, either salaried or self-employment activities. Two distinct patterns are worth mentioning. First, wealthier households (top quintile) have significantly more members engaged in off-farm activities. This explains their higher share of off-farm income, relative to the other income quintiles. Second, the number of both self-employed and salaried members increased between 2002 and 2005, but decreased from 2005 to 2008 for all quintiles.

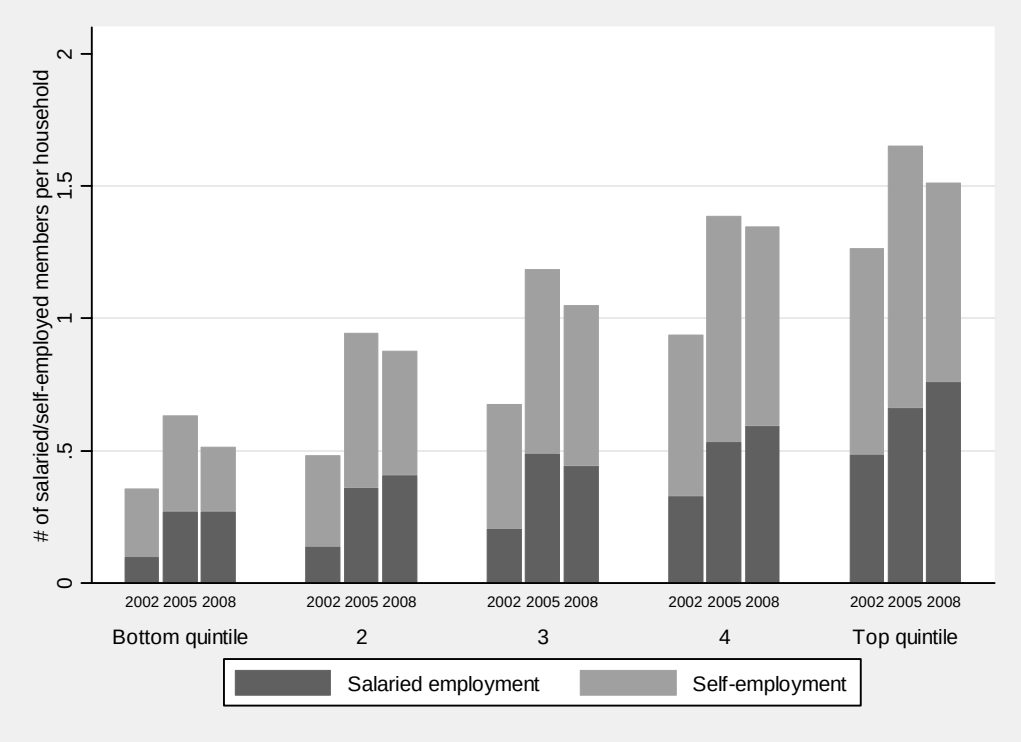

Figure 4. Mean number of salaried and self-employment household members by quintile and year

The analysis of absolute real incomes reveals that off-farm income remains extremely low among the poorest households (Figure 5). We suggest two possible explanations for such finding. First, poor households typically have lower access to assets (including education and the emerging credit market), which restrict them from accessing off-farm employment opportunities of high return. Second, even if poor households take up off-farm opportunities, they are usually confined to low paid off-farm activities (Ellis and Freeman, 2004).

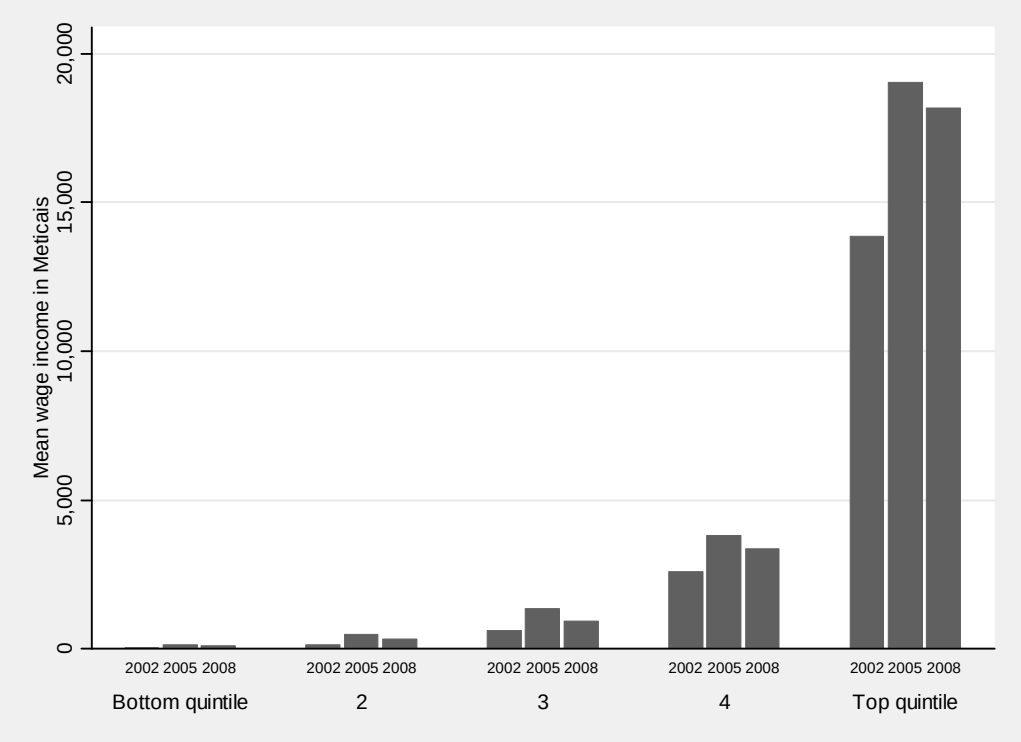

Figure 5. Mean wage income by quintile and year

5 Poverty profile

It is well warranted that we identify the characteristics associated with the poorest households. Such an effort has the advantage of providing valuable information for development projects to target the poor. Starting with gender, we find that female headed households fare among the poorest households in all three years of data. The percentage of male headed households increases as we move from the bottom to the top quintile (Figure 6). This result is in line with previous poverty research on Mozambique (Boughton et al., 2006; Boughton et al., 2007; Cunguara, 2008; Cunguara and Kajisa, 2009; Mather et al., 2008; Walker et al., 2004; Walker et al., 2006) showing that poverty in Mozambique has a strong gender dimension. PARPA II also acknowledges a gender dimension of poverty and its counteractive measures included the promotion of improved agricultural technologies and adoption of labor saving technologies (Government of Mozambique, 2006, p. 27). PARPA II, however, failed to have the

desired impact in reducing gender inequalities in rural areas considering that income inequality has persisted over time for all income quintiles.

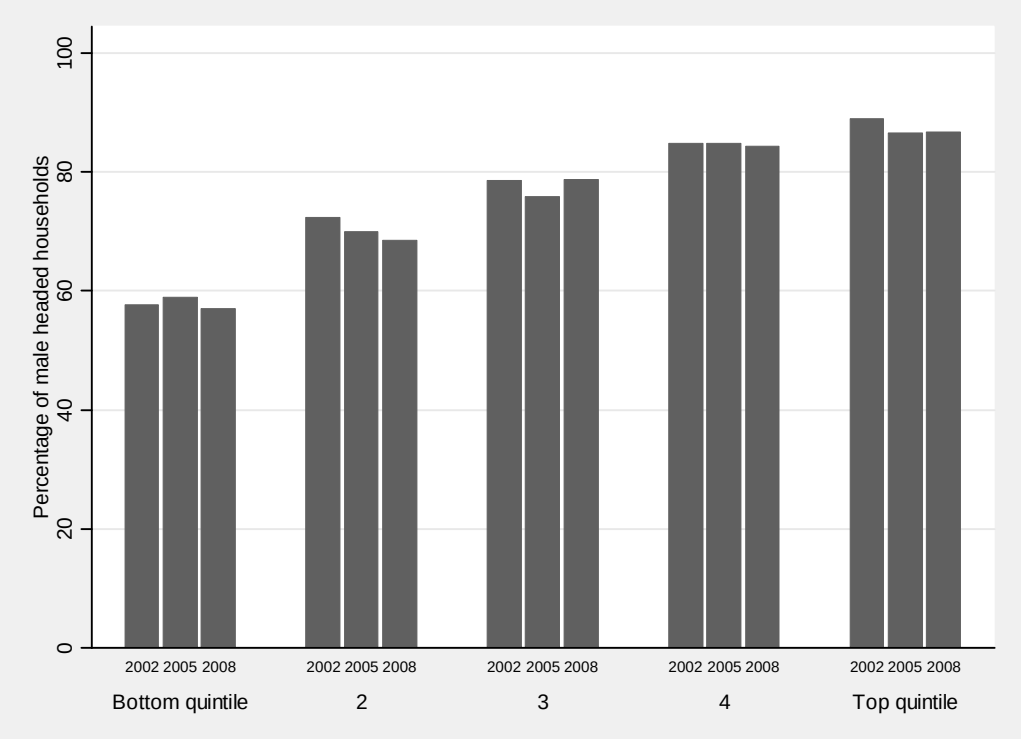

Figure 6. Percentage of male headed households by income quintile and year

The heads of poorer households tend to be less educated than heads from better-off households (Figure 7). Education plays a key role in breaking some of the barriers into the off-farm sector (Schultz, 1999; Reardon et al., 2001). Educational attainment, however, remains fairly low in rural Mozambique, despite the education increase experienced by household heads from all income quintiles. On average, a household head has less than 3 years of schooling, and household income rise sharply with increases in educational attainment[3]. This implies that poverty in rural Mozambique has an asset dimension. The importance of education, in advancing economic and social development and in reducing poverty is well documented.

[3] Head's years of schooling has slightly decreased between 2002 and 2005 (Mather et al., 2008).

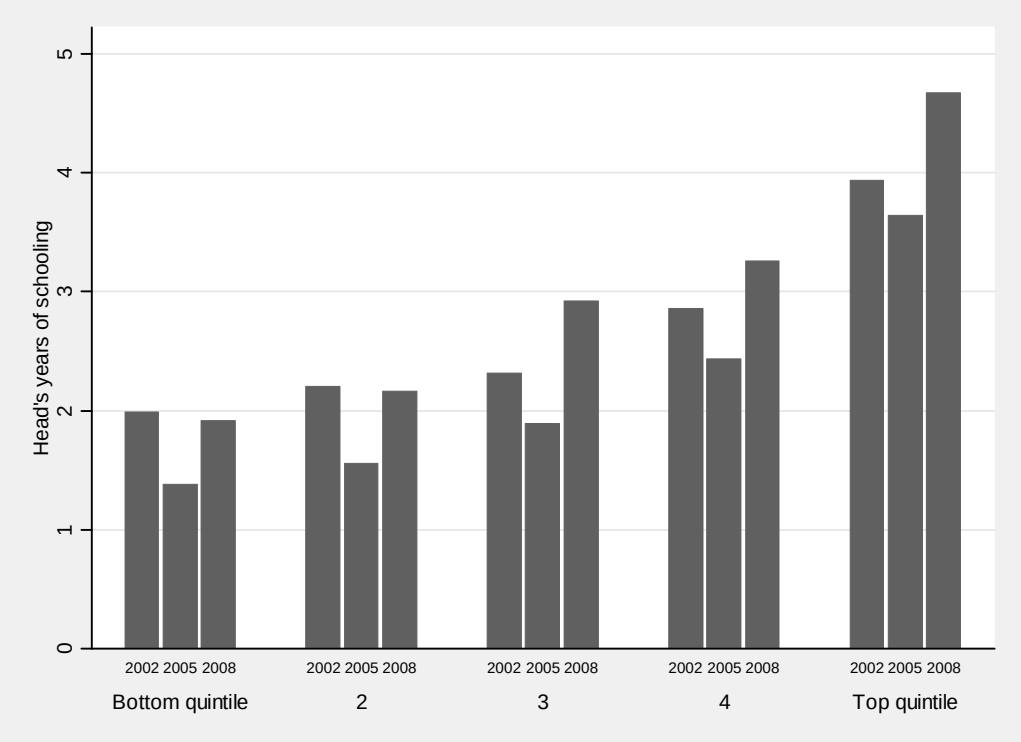

Figure 7. Head's years of educational attainment (means) by income quintile and year

Other assets are also important. For instance, landholding size significantly increases when we move from the bottom to the top quintile (Figure 8). This basic pattern recurs across other assets, including livestock ownership, and is also in line with previous poverty research in Mozambique and elsewhere. For the poorest households who own less land, a possible pathway out of poverty is likely to come from outside the agriculture sector by promoting off-farm employment opportunities. The promotion of such opportunities, however, can increase inequality given that breaking some of the barriers into the high paid off-farm activities requires substantial investment in education and financial capital, which are both unlikely to be met in the short-run.

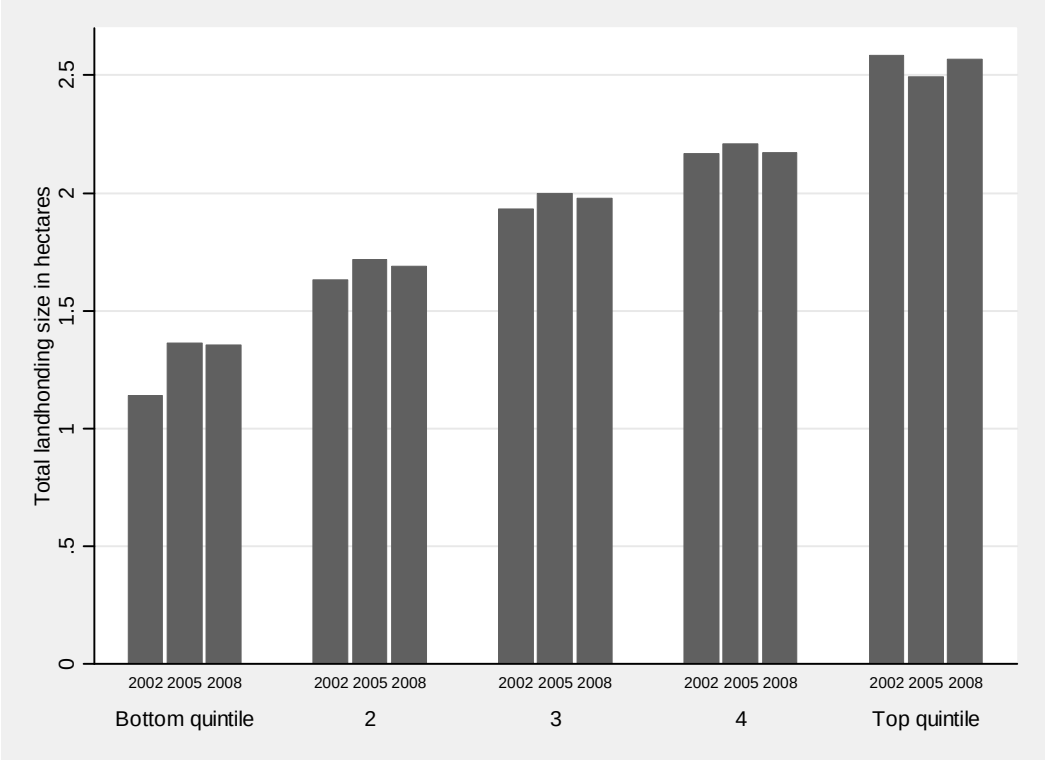

Figure 8. Mean land holdings by income quintile and year

In terms of agricultural technology used, Figure 9 shows that the adoption of chemical fertilizers rises with increases in household income. A similar pattern is observed with the use of pesticides and animal traction. The use of improved agricultural technologies is significantly greater among the top quintile in all three survey years.

The promotion of improved agricultural technologies can thus significantly increase household incomes, provided that other resources are also available, including labor and irrigation/water harvesting and conservation technologies. The question that still lingers on, though, is related to the reasons why adoption of some of the improved technologies has decreased, and which counteractive measures should be put into place. PARPA II envisaged an increase in the use of improved agricultural technologies such as fertilizers, but the results suggest that the use of chemical fertilizers has decreased over time.

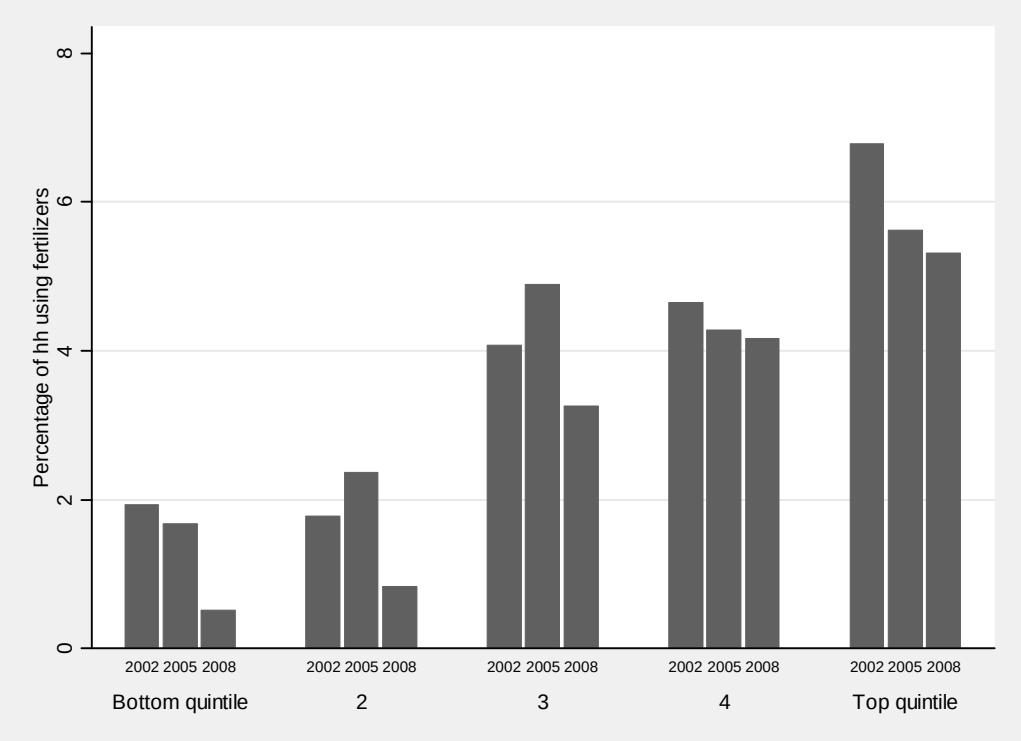

Figure 9. Percentage of households using chemical fertilizers by income quintile and year

With regard to the access to extension services, the same pattern is evident (Figure 10). Access to extension services is positively correlated with household incomes. If extension services are to have a greater role in fighting poverty, then a greater focus should be placed on poorer households. Such households, however, may not take the full advantage of extension services as they lack sufficient resources to follow up the extension recommendations (e.g. adopt improved seeds, chemical fertilizers, and other improved inputs).

The results also show that extension services reached significantly more households in 2005, but drastically fewer households in 2008, falling short of the target set in the PARPA II. Furthermore, the number of households receiving extension visits in 2008 was actually smaller than in 2002, despite the increase experienced in 2005. Similar to the adoption of improved technologies, access to agricultural

extension should be promoted and sustained over time. This is already acknowledged in PARPA II (Government of Mozambique, 2006, p. 127), but this goal is also off-target.

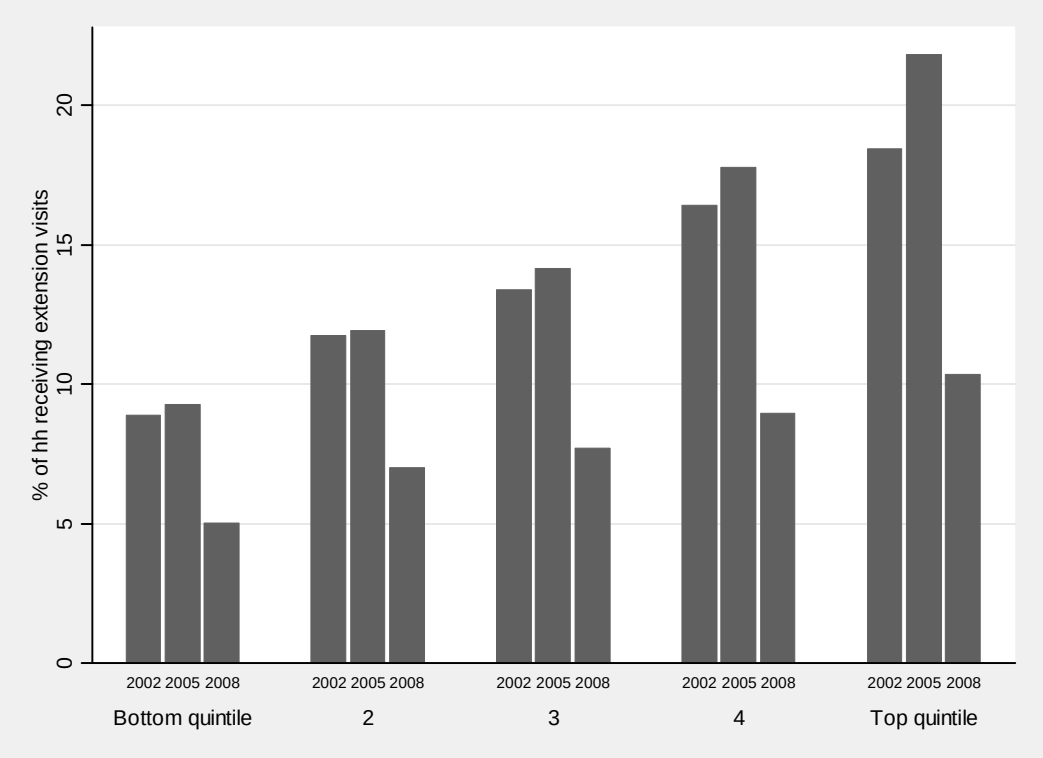

Figure 10. Access to agricultural extension by income quintile and year

6 Determinants of household income

The model results re-enforce the descriptive statistics presented earlier in sections 4 and 5. The results are briefly commented upon next. Poverty in rural Mozambique has many dimensions. The first dimension relates to demographic characteristics. We find that male headed households have significantly greater incomes than their female counterparts. One explanation is that women are significantly less educated than men, and hence they will have less income opportunities outside the agricultural sector, ceteris paribus. A second possible explanation is that female headed households usually have more dependents, and hence fewer members contributing to the total household income. A third explanation may have to do with cultural reasons where women play a relatively smaller role in

off-farm activities of high return while helping more with household chores and child caring (Burton and White, 1984).

Poverty has also an occupational dimension. Households whose head is either salaried or self-employed tend to be relatively well-off. The promotion of jobs and self-employment opportunities is likely to reduce poverty, provided that the poor can take up such opportunities, especially the high paid activities. Participation in off-farm activities has the advantage of providing a steadier income source (Reardon et al., 1998).

The results also highlight the importance of improved agricultural technologies. Those who use animal traction, fertilizers, and pesticides attain higher productivity levels which then translate into better incomes[4]. This is related to another poverty dimension, the asset-dimension. Asset-poor households are usually unable to invest in improved technologies. All these poverty dimensions prompt development policy to target the poor, and poverty profiling is fundamental in identifying the target group.

6 Concluding remarks and policy implications

This paper evaluates trends in farmers' real incomes and income distributions over time, as well as the structure of household incomes in rural Mozambique. The results are drawn from three nationally representative household income surveys. The main objective of this paper was to assess whether or not PARPA's goal of significantly reducing poverty incidence in rural areas between 2005 and 2009 (the period of the implementation of PARPA II) is met.

[4] The variables on agricultural technology (fertilizer, animal traction, and pesticide use) are usually endogenous and one would need to use an instrumental variable approach or a panel data to control for time invariant unobserved effects.

The results suggest that PARPA II failed to enhance farmers' income, and thus poverty incidence in rural Mozambique may have remained fairly constant over the last six years. Nevertheless, consumption based poverty measures, which PARPA II's poverty goal is based on, may give other results, because income tends to overstate poverty. Enhancing farmers' incomes requires in part a diversification of income sources, but such strategy may not have a significant impact on poverty reduction in the short-run because breaking some of the barriers into high paid self-employment activities is rather a long-term investment (in education and financial capital).

Given the importance of rain-fed agriculture both as a source of employment and its contribution to total household incomes, reducing rural poverty in the short-run may require more investments in the agricultural sectors. Subsequent poverty reduction plans should help spur growth in the agricultural productivity, via adoption of improved technologies and irrigation use/water conservation technologies.

Poverty profiling provides valuable information to target the poor. Female headed households are found to be consistently disadvantaged. Moreover, poor households have smaller land and livestock holdings, receive extension visits less often, and tend to adopt improved agricultural technologies with less frequency. The use of improved agricultural technologies has the potential to enhance farmers' incomes, but counteractive measures should be put into place in order to promote and sustain its adoption.

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Appendix

Table A1. Determinants of total household income (OLS regression) by agricultural season

	2001/02 agricultural season			2004/05 agricultural season			2007/08 agricultural season		
	Coeff.	Std. Err.	Pvalue	Coeff.	Std. Err.	Pvalue	Coeff.	Std. Err.	Pvalue
Gender of household head (1=male)	0.276	0.049	0.000	0.203	0.059	0.001	0.196	0.074	0.009
Head's years of schooling	0.028	0.007	0.000	0.093	0.011	0.000	0.081	0.009	0.000
Head is engaged in salaried activities	0.698	0.057	0.000	0.392	0.052	0.000	0.559	0.063	0.000
Head is self-employed	0.526	0.041	0.000	0.513	0.048	0.000	0.677	0.056	0.000
Household size (# of members)	0.085	0.008	0.000	0.078	0.008	0.000	0.095	0.009	0.000
Total cropped area in hectares	0.058	0.021	0.007	0.080	0.017	0.000	0.128	0.028	0.000
Household received extension visits	0.156	0.053	0.003	0.182	0.064	0.004	0.116	0.100	0.248
Household used chemical fertilizers	0.377	0.097	0.000	0.271	0.136	0.047	0.361	0.196	0.066
Household used pesticides	0.212	0.065	0.001	0.236	0.113	0.038	NA	NA	NA
Household used animal traction	0.327	0.078	0.000	0.181	0.095	0.055	0.342	0.081	0.000
Intercept	7.675	0.317	0.000	8.293	0.355	0.000	7.404	0.318	0.000
Number of observations	4011			4093			5708		
F Statistics	16.56			14.90			21.36		
Prob > F	0.000			0.000			0.000		
Adjusted R-square	0.331			0.267			0.351		

Notes: District dummies were used but are not reported
Sources: Authors' calculations based on TIA02, TIA05, and TIA0