THE CHALLENGES AND EFFECTS OF AGRARIAN REFORM IN AFRICA: EVIDENCE FROM RURAL MOZAMBIQUE

By

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ABSTRACT

THE CHALLENGES AND EFFECTS OF AGRARIAN REFORM IN AFRICA: EVIDENCE FROM RURAL MOZAMBIQUE

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Land has long been a focus of struggle between different parts of Mozambican society, and although the Government has embraced a more liberal and market oriented development model, poverty rates are still high. The size of landholdings are small and decreasing and the performance of the land administration system is low and even with empirical evidence showing a positive correlation of the size of landholdings with income (Walker *et al*., 2004; Jayne *et al*., 2003), there has been little consideration of landholdings as a potential cause of the stagnant agricultural growth. Therefore, understanding the relationship between landholdings and poverty as well as the relationship between the structure of the land administration system and its performance make three important contributions to the debate on the effect of land reforms to economic development: (1) as policy recommendations on the importance of landholdings in the national development program for poverty reduction; (2) as a basis for developing future development strategies on pathways out of poverty; and (3) as policy recommendations on how to improve the land administration system.

This dissertation tackles these issues in three complementary essays, which aim to: (1) understand the nature and magnitude of the effect of landholdings on income and poverty in the context of rural Mozambique; (2) assess the pathways out of poverty and distinction between chronic and transitory poverty, and most importantly the effects of the size of the landholdings on the ability of people to move out of poverty which has an important interest for policymakers;

and (3) understand how to improve land administration system in Mozambique. The main conclusions of this study are: First, the incomes and poverty were found to have infrastructural, demographic, asset and technological dimensions and increased the cultivated land was found to be raising rural household incomes. Unlike earlier studies, results show that the pathways out and into poverty are more structural (productive asset and production technologies) than demographic confirming the argument that the initial asset distribution is important in pro-poor growth. Second, 66 percent of poverty is transient and 34 percent in chronic and unlike most of earlier studies, the determinants of chronic and transient poverty are not congruent, however, policies to address chronic poverty can as well tackle the transient poverty. Third, the performance of land administration system in Mozambique in general and specifically in Southern region is a function of its structure as measured by indicators of concentration, fragmentation, and power difference. Higher authority level involved in processing land use rights applications is more efficient than the lower levels. Fourth, the policy implications from this study include: promoting agricultural technologies, rural financial services and microcredit, risk coping strategies through establishment development of drought resistant crop varieties; small and medium enterprises; facilitating access to input and output markets through improving and expanding infrastructures and public services and implementing land reforms conducive to in increased landholdings to ensure income generation. The large competition among clients and high concentration of land administration units increase the performance, therefore decentralization of land administration units to lower geographical units as well as the improvement in data capturing, recording, and keeping are recommended.

In memory of my parents: Simão João Pitoro and Esperança Raul.
I wouldn’t be gone so far if it was not with your unconditional support, love, and encouragement.
Rest in Peace with Glory of God!

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KEY TO ABBREVIATIONS

AE	Adult consumption equivalent
DLAU	District Land Administration Office
DNTF	National Directaorate for Land and Forest
DUAT	"*Direito de Uso e Aproveitamento de Terra*" or Land Use Right (an official document provided by the land administration office providing formalized, long-term use rights for a specific land parcel)
GDP	Gross Domestic Product
IAF	National Household Survey
IOF	National Household Budgeting Survey
iTC	"*Iniciativa de Terras Comunitarias-iCT*" (the Community Land Initiative)
LTR	Land Tenure Regularization Project
MCA	Millennium Challenge Account
MCC	Millennium Challenge Corporation
MINAG	Ministry of Agriculture
MPD	Ministry of Development and Planning
MSU	Michigan State University
MZN	Mozambique Meticais (the Mozambique's currency)
PARPA	Annual Plan for Absolute Poverty Reduction
SDAE	Districtal Services for economic Activities
TIA	"*Trabalho de Inquerito Agricola*" (a household agricultural survey conducted by the Ministry of Agriculture)

1 INTRODUCTION

Land administration has long been a focus of struggle between different parts of Mozambican society, and it often involves opposing commercial interests and smallholder farmers' communities. Both pre- and post-independence land policies have pushed these people and their communities to marginal lands where they are confined to small plots for mainly subsistence agriculture. The Government of Mozambique has embraced a more liberal and market oriented development model. However, there has been little consideration of landholdings and tenure arrangements as a potential cause of the stagnant agricultural growth in the light of decreasing landholdings, correlated with declining income (Walker *et al*., 2004).

With the majority of country's land under the traditional land tenure system and lack of reliable information on land ownership, Mozambique's land sector faces challenges in investments as well as efficient and low cost land transfers. Given high associated cost and complexity to provide full title, the Government of Mozambique has realized the need to establish lower-cost options in the form of investment in capacity building of the existent land administration system (Ghebru et al., 2015). Such efforts include the recent five-year compact signed by Government of Mozambique and the Millennium Challenge Corporation (MCC) aiming to facilitate and accelerate land registration which is expected to lead to increased investments, land market development, and higher land values. Several other interventions are in progress, including the community land registration currently funded by multiple donors through the community land initiative (locally known as "*Iniciativa de Terras Comunitarias-iCT*").

These concerns motivate this dissertation research, which aims to understand the impact of landholdings on income and poverty and the effect of and the potential institutional reforms needed to improve land administration. It is almost a consensus that there is a strong link between landholdings, agricultural productivity and poverty. Therefore, land reform policies that encourage both secure tenure and increased landholdings for poor families are likely to generate positive impacts in reducing poverty. The proposed dissertation research is composed of three essays, including: (1) estimation of potential effects of landholdings on livelihoods (poverty and income); (2) estimation of the routes out of poverty which is of interest to policymakers; and (3) development policy recommendation to improving land administration in Mozambique.

The first essay is motivated by the dramatic increase in food prices in the international market and the inequality in land distribution and smaller size of the landholdings, affecting the ability to maintain reasonable amount of imports which have motivated the search for strategies to face the crises. According to MSU (2011), the food prices in Mozambique increased drastically in the cropping season 2007/08, with Maize for example experiencing about 100 percent price increase compared to previous years (to 4.5-5.5 Meticais per Kilogram or MZN/Kg). Therefore, understanding smallholders' cultivated land and its poverty effect has an important policy application as it can help to estimate the impact of agricultural reform in general and land reform in particular on poverty reduction.

In the last decades, several attempts to link landholdings to agricultural productivity, income, and poverty have taken place in several African countries but more often there is disagreement about its impact in households' livelihoods.

This disagreement have led to four strains of empirical literature that try to associate the landholdings and poverty, namely: (1) those that show a strong positive and significant causal effect of landholdings on welfare indicator (Boughton *et al.*(2005), Boughton *et al.* (2006), Cunguara, 2008; and Mather, 2012 in Mozambique; Mukherjee and Benson, 2003 in Malawi; Mukherjee and Benson, 2003 and Wodom, 1999 in Bangladesh ; Burgess, 2001 for China; Bigsten *et al.* , 2003 for Ethiopia; Jayne *et al.*, 2003 for Ethiopia, Kenya, Rwanda, Mozambique, and Zambia; and Finan *et al.*, 2005 for Mexico; Deininger, 2003; Adhikari and Chatfield, 2008; Adhikari, C. & Bjorndal, T. (2014) for Nepal); (2) those showing a small effect (Lopez and Vales, 2000 for Chile, Colombia, El Salvador, Honduras, Paraguay, and Peru; (3) those that fail to find any impact (Geda *et al*. (2005) in Kenya; Carter and May, 1999 in South Africa); and (4) those negative effect such as Grootaert (1997) who found that the large farm land appeared to increase the probability to be poor in both rural and urban Cote d'Ivoire, and Valente (2009) in South Africa, found that land recipients in a land re-distribution program in South Africa are more food insecure than comparable non-participants. As per this literature, there has been very little evidence or mixed conclusions on the impact of landholdings on livelihoods. Therefore, understanding the linkages between landholdings on income and poverty, which are main components of the Millennium Development Goals (MDG), becomes important.

More specifically to Mozambique, Tschirley and Weber (1994) found that incomes and calorie consumption were highly correlated with landholdings, and argued that landholding size would continue to be a key determinant of household income and consumption for the foreseeable future. In line with these findings, Jayne *et al.* (2003) also found a positive association between landholding size and per capita income in several African countries (including Mozambique),

and acknowledged that the ability of households in the bottom land per capita quartile to escape from poverty directly through agricultural productivity growth is limited by their constrained landholdings and other resources. Most importantly, this study recommends that the way out of poverty among the land constrained households is either to increase landholding size or off-farm income. Similar findings are presented by Mather (2012) using nationally representative agricultural survey panel data in two waves 2002 and 2005, that found large and significant effects of increased landholding on crop income and that a 5 percent increase in total landholding significantly increases crop income by 1.9 percent, 2.1 percent, and 1.2 percent in the Northern, Central, and Southern regions of Mozambique; respectively. The higher landholding impact in Central and Northern regions reported to be linked to among other things its agricultural production potential.

Boughton *et al.* (2005) and Boughton *et al.* (2006) also documented the role of landholding size in reducing poverty. They argue that the key constraints to achieving more favorable distributional outcomes are stagnant crop productivity and limited area expansion. Cunguara (2008) found a positive effect of increases in landholding size on poverty reduction (as measured by income per adult equivalent) in rural Mozambique, conditional to the provision of inputs such as labor, fertilizers, and animal traction.

While various studies have pointed out the importance of landholding size to poverty reduction, the average farm size in Mozambique is still very low and very few studies have investigated the main causes of such small land sizes. According to Mather (2012), an important constraint to increased landholding could be the low use of animal traction in the Central region of

Mozambique. The adoption of animal traction was found to increase total landholding by 13.8 percent and 18.5 percent in the Central and Southern regions; respectively.

The objective of the first essay is to understand the nature and magnitude of the effect of landholdings on income and poverty, and the potential for institutional reforms to address poverty in the context of Mozambique. More specifically, the study aims to answer the following research questions: (1) Are there changes in the size of landholdings during the study period, 2008 and 2011? (2) If so, how have these changes impacted household income and poverty rates? Two main hypotheses are tested in this study: (1) Based on the current economic growth trajectory observed in Mozambique, the size of land landholdings may have increased during the period of food price crises, leading to increased agricultural production and, subsequently, a reduction of poverty in Northern-Central Mozambique. Essentially, uunder an assumption that households with more land have experienced larger income gain than those with smaller farmland holdings and greater poverty reduction, this study adds to the earlier research that assessed the determinants of household incomes (Cunguara, 2008; Mather, 2012; Walker *et al*., 2004) and rural and urban poverty from the perspective of consumption expenditure (Datt *et al*. 2000; MPF, 2004; MPD, 2010).

The second essay is motivated by the fact that while poverty is well documented in Mozambique, few studies have systematically assessed the routes out of poverty (or made distinction between chronic and transitory poverty); issues that are of an important interest to policymakers, development practitioners, and economists. Motivated by the fact that available poverty studies report a relatively small or no poverty change over time, this essay contributes to the poverty

literature by using panel data, allowing for controlling of unobserved time-invariant household characteristics to assessing factors that can help the non-poor avoid falling into poverty as well to distinguish chronic to transient poverty and their determinants. The distinction between transitory and chronic is of important value for policy makers and development economists, as it gives guidance of whether the safety net or more activist policies to remove poverty traps are the focus (Dang et al., 2014). The essay tests the research hypothesis acclaimed by Jayne et al. (2003) that the initial asset holding (more specifically the cultivated[1] land) is a determinant to poverty reduction, with a focus on land, as it is the most important household productive asset. The main research question to be addressed by this essay is: Which pathways out of poverty can be implemented that are likely to lead to meeting the Millennium Development Goals (poverty reduction)? Are the determinants of chronic and transient poverty congruent?

The hypotheses from the first and second essays are tested using data drawn from the panel survey conducted by the Mozambique Ministry of Agriculture (MINAG) covering the period before the food price crises (TIA2008)[2] and a partial panel[3] (using TIA 2008's instrument with some improvements) conducted in 2011 with financial assistance from USAID/Mozambique and TechnoServe (NGO), covering the period after the food price crises. The data was collected on 1,186 households in five provinces with high agricultural potential namely: Manica, Tete, sofala, Nampula, and Zambezia.

[1] Cultivated land defined as land operated by the household including: cropped land with annual crops, perennial crops and pasture.

[2] National Agricultural survey, locally known as "*Trabalho de Inquerito Agricola"* (TIA).

[3] The partial panel have a total sample size is 1,186 households, in five provinces (Nampula, Zambezia, Tete, Manica, and Sofala).

The third essay is motivated by "*Burtland Declaration*" that asserts that a sustainable development requires a sound land administration system and by the fact that a successful land administration should be able to guarantee property right leading to reduction in land conflicts, cost-effective administration, supporting economic development, environmental management, and social stability (Steudler *et al.*, 2004). These assumptions have motivated a considerable number of countries to engage on land administration reforms aiming to increase level of land governance, socio-political stability. Using the available administrative data, this essay, aims to assess the relationship between the structure of the land administration system and its performance in order to draw lessons on potential improvements to land administration system in Mozambique.

These three essays make several important contributions to the debate on the effect of land reforms to economic development: (1) as policy recommendations to the debate on the importance of land tenure in the national development program through development of scenarios for poverty reduction with respect to landholdings; (2) as a basis for developing future development strategies on pathways out of poverty; and (3) draw lessons on how to improve the performance of the land administration in Mozambique. The remainder of the report is organized as follows: Chapter 2 analyzes the effect of landholdings on rural household income and income poverty, the Chapter 3 estimates the drivers of escaping poverty and determinants of chronic and transient poverty, the Chapter 4 analyzes the performance of the land administration system in Mozambique; and finally, the Chapter 5 summarizes the conclusions of the study and the implications for future research.

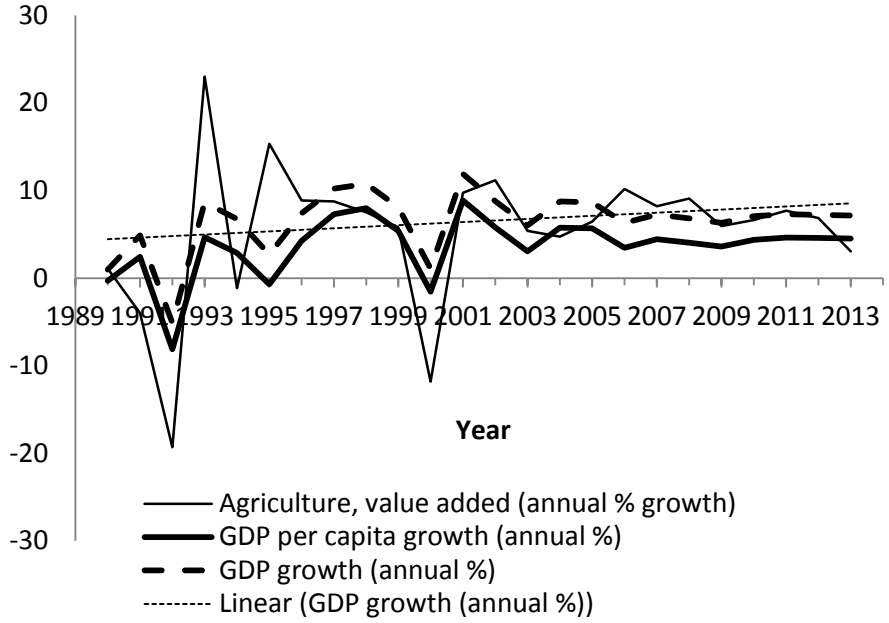
2 THE EFFECT OF LANDHOLDINGS CHANGES ON LIVELIHOODS IN AFRICA: THE CASE OF NORTHERN-CENTRAL MOZAMBIQUE

2.1 INTRODUCTION

Poverty, hunger and malnutrition are three main constraints affecting the livelihoods of human beings. In developing countries these are important causes of child mortality; and governments in developing countries, such as Mozambique, have long struggled to defeat hunger (Garrett & Ruel ,1999). In the context of Mozambique, this situation is surprising as it contradicts the economic growth that is being observed in Mozambique as a result of government efforts in implementing a set of development programs and policies including the national *Action Plan for the Reduction of Absolute Poverty*. The government of Mozambique has committed to reduce poverty from 70 percent in 1997 to 40 percent by 2015 (MINAG, 2010). Several interventions to reduce poverty have been implemented by the government of Mozambique, including: the construction of silos with 50,000 metric ton capacity for grain storage in Tete province, improvement of infrastructure such as the construction of the bridge across the Zambezi River which links the main production and consumption areas (Mabiso *et al*., 2014) and increasing agriculture production. All these interventions witness an impressive economic growth illustrated in Figure 1 and Table 1, which show GDP growth of more than 6.3 percent per year, since 2006.

Despite these impressive growth figures, macroeconomic indicators show that poverty has not decreased, Mozambique was ranked 178th of 187 on the 2013 UNDP Human Development Index and 64th out of 78 on the 2013 Global Hunger Index (IFPRI, 2013; UNDP, 2014).

Figure 1: Growth rate of GDP, GDP per capita, and agricultural value added in Mozambique (1990-2013)



Source: World Development indicators databank (World Bank, 2014)

Lack of access to basic health, education, and sanitation services are the main factors exacerbating poverty in the country, in part due to budget misallocation in agriculture in benefit of other fast growing sectors, such as the energy sector under the energy boom era. Knowing that small-scale agriculture is the main source of livelihood for most rural households, which accounts for a majority of the nation's agricultural production (85 percent) (Shapito *et al*., 2009), and that 80 percent of the area under cultivation in Mozambique is used for rainfed production with limited use of improved inputs; efforts to increase production and productivity should be top priority in the government's development agenda. MINAG (2010) reported that despite the poor agricultural sector, the potential for increasing farm productivity is significant through extension services (about 8 percent) and that Mozambique's central and northern provinces have higher agricultural potential, including: more fertile soils and more abundant rainfall than other parts of the country; these regions generally produce agricultural surpluses.

Table 1: Macroeconomic indicators for Mozambique

Macroeconomic indicator	1996	2003	2009
Agriculture, value added (annual percent growth)	8.9	5.4	6.0
Income share held by highest 20percent	50.7	53.3	51.5
Poverty headcount ratio at national poverty lines (percent of population)	69.4	54.1	54.7
Urban poverty headcount ratio at national poverty lines (percent of urban population)	62.0	51.5	49.6
Rural poverty headcount ratio at national poverty lines (percent of rural population)	71.3	55.3	56.9
GINI index	44.5	47.1	45.7
GDP per capita growth (annual percent)	4.3	3.1	3.6
GDP growth (annual percent)	7.4	6.0	6.3

Source: World Development indicators databank (World Bank, 2014)

It is argued that the most prominent cause of poverty is land scarcity (Burgess, 2001) and the general consensus is that there is a strong link between landholdings and poverty. Therefore, land reform policies that encourage increased landholdings to poor families are likely to generate positive impacts in reducing poverty. Gugerty and Timmer (1999) argue that an initial good distributions of assets, both agricultural and non-agricultural, benefits the poorest household slightly more in percentage terms, while in countries with bad initial asset distribution, the economic growth or well-being is skewed towards the wealthier households, causing a large gap between rich and poor. As it is widely known, access to landholdings has a positive effect on poor people, particularly in terms of food security (Valente, 2009). Under the assumption of available labor for agricultural production, the large farmland households are expected to be less poor than those with small farmland.

Another perspective on this relationship is provided by Burgess (2001), who argues that land generates income but under imperfect food markets, land can serve as source of cheaper food relative to market purchased food. So, if the markets are imperfect as most of the times they are in developing countries, households with large farm size will still get cheaper food and

consequently be less poor . Since in the African context farm size is one indication of wealth, increased landholdings will increase income and consequently higher standard of living (quality of life) through: (1) direct income value of additional production or renting out land if land is considered a liquid asset that can be sold or rented; (2) increased returns to family labor in the presence of labor market constraints; and (3) reduced vulnerability to shocks due to larger savings and enhanced insurance if land can be used as collateral.

Tschirley & Weber (1994) found that income and calorie consumption were highly correlated with landholdings, and argued that landholding size would continue to be a key determinant of household income and consumption for the foreseeable future. In line with these findings, Jayne *et al.* (2003) also found a positive association between landholding size and per capita income in several African countries (including Mozambique), and acknowledged that the ability of households in the bottom land per capita quartile to escape from poverty directly through agricultural productivity growth is limited by their constrained access to land and other resources. Most importantly, this study recommends that the way out of poverty among the land constrained households is either to increase landholding size or engage in off-farm income activities. Similar findings are presented by Mather *et al*. (2012) using nationally representative agricultural survey panel data in two waves 2002 and 2005, that found large and significant effects of increased landholding on crop income and the higher landholding impact in central and northern regions are linked to among other things its agricultural production potential.

When all this dynamic is coupled with a decrease in the cultivated area per adult equivalent since 2005, understanding the income and poverty effect of cultivated land size has an important

policy application as this can help estimate the impact of agricultural reform on poverty reduction among rural smallholders. This study aims to address three main questions: (i) How has cultivated land size changed over time? (ii) How have livelihoods changed over time? (iii) What drove those changes, specifically to what extent changes in cultivated land size influenced income and poverty changes? Finally, finding answers to the above questions will allow drawing policy implications to address poverty reduction in rural Mozambique.

2.2 DESCRIPTION OF DATA

The data for the analysis are drawn from a regionally representative repeat household agricultural survey conducted by the Mozambique Ministry of Agriculture to understand the investments needed to guarantee a robust response to the new rural environment resulting from the spike in food prices in the domestic and international markets. For that purpose, data covering the period before and after the food price crisis, in 2008 and 2011; respectively was collected. This survey was implemented with financial assistance from USAID/Mozambique and technical assistance from Michigan State University, and a total of 1,186 households were surveyed in the Central and Northern regions in the five provinces with high agricultural potential (Manica, Tete, Sofala, Nampula, and Zambezia). This type of data has the advantage of allowing to control unobserved time-invariant household characteristics, which is one of the limitations of using cross-section data in empirical studies (Garrett & Ruel, 1999). The use of panel data provides the opportunity to have in depth understanding of how size of the landholdings, poverty, and dynamics in rural Mozambique and contribute to more effective policy intervention design by controlling for unobserved time invariant household characteristics.

Before delving into the estimation approach, some considerations need to be made with regard to the data: First, although the panel is covering only 5 provinces out of 10 originally interviewed in 2008, it uses the weights of TIA[4]2008 because in 2011 there was no random replacement, implying that the sample is only representative to 2008 population. The TIA 2008 weights are used along with an attrition correction factor (Inverse Probability Weights) to control for the attrition bias. Two main sources of attrition in 2011 were identified on the 2008-2011 panel data. First, the 2011 survey team did not go to all the TIA2008 districts in the center/north (due to financial reasons). Second, in the TIA2008 villages that were revisited in 2011, not all the households re-interviewed (due to refusal or unavailability of the respondents and because some households had moved or beens dissolved). Tests for attrition have shown the evidence of presence of attrition bias and as proposed by Woodridge (2002), the appropriate inverse probability weights (IPW) were applied to the data. Donovan & Mather (2007) provide a detailed application of this method for Mozambican data using the panel data TIA2002 and TIA2005, a similar approach was followed on the data used in this study.

Out 72 districts sampled in 2008, a total of 42 districts were not re-visited in 2011 in Zambezia, Manica, Tete, and Sofala provinces, therefore the data is no longer representative at the provincial level, but remain representative of the areas surveyed in 2011. The Nampula province is the only one that did not drop a district between the two survey years; therefore the data are representative at province level.

[4] Is the household agricultural survey conducted by the Ministry of Agriculture locally known as "*Trabalho de Inquerito Agricola* "

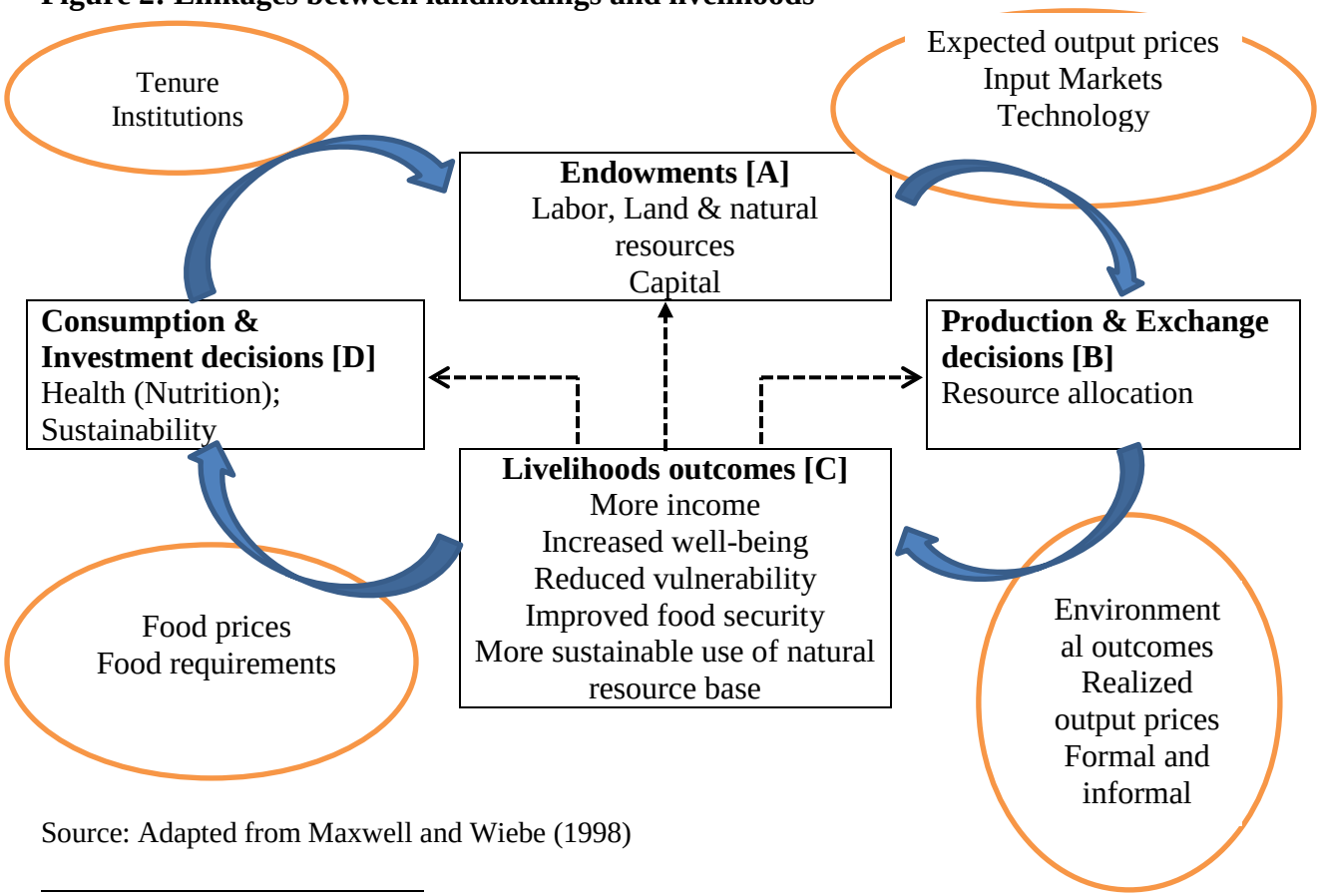
2.3 CONCEPTUAL FRAMEWORK

The conceptual framework for this study is drawn from insights by Maxwell & Wiebe (1998) and from the sustainable livelihoods literature. These establish the household as a unit with initial endowments of resources (the access to land, capital, etc.), that depending on their access to markets and the environmental conditions, make resource allocation decisions, including agricultural production or off-farm income. These decisions, along with market and environmental outcomes, affect the access to food and other commodities, the form of what Sen (1981) calls entitlements. Under strong institutions, households are able to make productive investments from which they enjoy long-run benefits that are translated in income gains leading to increased consumption leading to improved nutrition (Roth, 2010). The over-arching feature of this framework is that it recognizes that natural resource capital, including land, are also safety nets for securing livelihoods and subsistence when markets are weak or nonexistent, therefore granting and securing property rights contribute to achieving food needs. This framework summarizes the four quadrants in which most of the research tends to fall into and the econometric framework presented in the subsequent section uses Figure 2 to explore and estimate the linkages between [**A**], [**C**] and [**D**].

My contribution to this framework is based on the recognition that the linkages between landholdings and livelihoods are complex and dynamic and given that the production and consumption decisions may not be separable under market imperfections (e.g. functional and complete markets; exogeneity of prices; absence of price band; and substitutability of market-purchased by farm-produced goods), as is the case when transaction costs (e.g. with bad access to roads, loans, agricultural extensions, and weak market integration) are high, common in many

developing countries like Mozambique, households will not act to maximize profit but they will use their resources to meet their subsistence needs, suggesting the linkage between points [**C**] to [**B**] and [**D**] (dashed line). Recognizing that the recent research in Africa show that the emergence of medium scale farmers in Kenya and Zambia is not only by graduating from small scale but from the resource accumulation of urban elites (e.g. Jayne *et al*., 2014) which is translated into wealth, it suggests a direct linkage between points [**C**] and [**A**] (dashed line). Therefore, I argue that point [C] can also be the starting point contrary to the perception of that the point [**A**] as the starting point as implied by Maxwell & Wiebe (1998).

Figure 2: Linkages between landholdings and livelihoods[5]



Source: Adapted from Maxwell and Wiebe (1998)

[5] In the sustainable livelihoods framework, the livelihoods strategies are equivalent to A and D while the livelihoods assets are equivalent to A.

2.4 EMPIRICAL ESTIMATION

Panel data estimation is complicated due to the need to adjust the standard errors to account for the correlation between each time period (Cameron and Trivedi, 2010). The most common estimation methods are the random- effects (RE), fixed-effects (FE), first-difference (FD), and pooled Ordinary Least Squares (POLS). The FE models permit the regressors to be correlated with random individual-specific effects, uncorrelated with the idiosyncratic errors and correlated with the time invariant component of the random individual-specific effects; using an appropriate differencing transformation, this unobservable heterogeneity can be eliminated. The RE models, however, imposes a strong assumption that the random individual-specific effects are purely random, implying that they are uncorrelated with the regressors. POLS model assume that regressors are exogenous and the estimation is straightforward, but it requires controlling for correlation of error over time for a given individual or between individuals. However, no estimation method is free of limitations, like RE, the consistency of pooled models is conditional on the assumption of exogeneity. In any case, for inferences, we use cluster robust standard errors.

The FE is preferred in the empirical studies due to its properties, however, given that with FE the time-invariant variables are dropped from the estimation, but because the variable of interest, landholdings, is time-invariant, the RE was chosen for estimation, despite the strong assumption between the unobserved heterogeneity and the explanatory variables.

2.4.1 HOUSEHOLD INCOME MODEL

In developing the empirical model to assess the effect of cultivated[6] land size on income, multiple models are estimated in which the dependent variables are the natural log of income per adult equivalent[7] (AE) of the total, crop, livestock, self-employment, and wage income. The total net household income is calculated using the full income approach, consisting of: (1) valuing all crop production, regardless of whether it was for home consumption or sales, and cash inputs (hired labor, purchased seed, fertilizers, etc.) are deducted from the production and summed to (2) the value of non-agricultural income from various sources (salaries and wages, non-farm self-employment, retirement and other transfers, and rental of land or other assets). Previous studies in Mozambique have successfully applied this method (Walker *et al*., 2004; Mather *et al*., 2012).

The approach to studying the determinants of income based on modeling the natural logarithm of income as the welfare indicator is widely used in poverty studies. The choice of logged value of the welfare indicator is due to the fact that it better approximates a normal distribution than does the absolute value of welfare indicator. The other advantage of using logged income is provided by Nargis & Hossain (2006) who argue that when measuring changes, log scale is more appropriate than using the absolute scale in poverty analysis because the log transformation compresses the income at the higher levels therefore giving more weight to changes at the lower income levels.

[6] Defined as all operated land under the households' rights or not, including all cropped land (permanent and annual crops, pasture, fallow land and land rented-in).

[7] Defined as a household index taking into account the consumption/production ability of the household based on Deaton (1997). The weights are based on gender and age (e.g. adults of either sex = 1.0, children aged 0-4 = 0.4, and children 5-14= 0.5).

To establish the relationship between landholdings and welfare, a multivariate analysis linking the human and physical capital to income per AE is conducted, in the sense that it provides insights as to how specific human and physical capital and other characteristics are potential correlates to welfare. To assess empirically the income effect of smallholder's landholdings, following the "*sustainable livelihoods*" framework which states that rural household welfare depends on the economic activity they are engaged in and the context in which they develop their livelihoods strategy, and accumulated assets (Bandeira & Sumpsi, 2009). To implement this approach econometrically, for the five main income sources (total, crop, livestock, wage, and self-employment), the following empirical model is estimated in panel data context:

$$\ln Y_{it} = \beta_0 + \beta_1 Land_{it} + \beta_2 X_{it} + c_i + \mu_{it}; t = 1,...,T \quad (1)$$

where *i=1, 2,.., N*. Here $\ln y_{it}$ is the log per AE income in real Meticais (in 2011 MZN) of household *i*, in year *t*. X is a vector of exogenous household specific characteristics such as (i) demographics, (ii) natural and physical endowments, (iii) human capital, (iv) technology, (v) infrastructure, and (vii) village fixed-effect. $Land_{it}$ is the cultivated land size per AE (ha); *ci* is the unobserved heterogeneity. The coefficient β measures the return to a specific household resource with respect to percentage change in the per capita income across households and the coefficient of interest is β_1. μ_{it} is the idiosyncratic error term assumed to be normal, independent and identically distributed with mean zero and constant variance. A RE is estimated to explain the variation of log per AE income across the households. However, since the samples are drawn from a complex sampling strategy, cluster-specific differences may exist that cause per AE income to vary systematically across the cluster or villages, which lead to violation of the

assumption of the constant variance of μ. Therefore, the robust standard errors are used to estimate the t-values.

The use of per AE specification in this study is to capture the observable difference between households (Atkinson, 1991; Lanjouw & Ravalion, 1995). For instance, 2 households with three members, one with two adults and one child and other with all 3 adults have different consumption needs and production capacities which are better captured by the adult consumption equivalent specification. The welfare measure is expressed in real terms, i.e. converting the nominal values of income per adult equivalent to 2011 real prices using the national consumer price index available from the Statistical Yearbook of National Statistical Institute (INE).

2.4.2 HOUSEHOLD INCOME POVERTY MODEL

2.4.2.1 WELFARE AND POVERTY MEASURES

Despite the popularity of the income-based approach, researchers disagree on its usefulness. According to Mukherjee & Benson (2003), two main arguments can be made against the use of the income-based welfare indicator. First, in developing countries income is often very seasonal. Farmers receive greater portions of their income after harvesting (in Mozambique this is around May and June) and little during the rest of the year. But, contrarily, they are spending their income on consumption throughout the year, which makes consumption and expenditure a much smoother measure of welfare throughout time than income. Second, in developing countries the majority of households derive their income from agriculture and self-employment activities (in Mozambique these sources contribute to more than 85 percent of total household income) which means that in many cases it is difficult to assess their monetary value. In addition, as pointed out

by Cunguara (2008), household income fluctuates in response to agricultural year, especially in regions that rely on rainfed agriculture like Mozambique. In summary, the disadvantages of using income-based welfare include: (i) assuming that a market for all goods exists and are perfectly functional, which is not the case in developing countries like Mozambique (Thorbecke, 2005); (ii) there is no guarantee that the allocation of income for households with income at or even above the poverty line will lead to purchasing the minimum basic needs bundle (Cunguara, 2008); and (iii) as stated by Alderman (1992), income is more likely to be underreported than consumption expenditure, making it hard to collect accurate figures.

Despite this criticism, the choice of using income-based welfare indicator in the particular case of this study is based on two reasons. First, there is a lack of consumption/expenditure information for short-term poverty dynamics. So far, Mozambique has implemented three national poverty assessments (which collect information on consumption) in 1996/7, 2002/03, and 2008/09 but not in 2011, which is the last year of this study period. Second, Walker *et al.* (2004) pointed out that when the research objective is to analyze the rural poverty determinants in short-term (transient poverty) to formulate policy interventions for poverty reduction, income-based welfare indicator is more informative because it captures a more significant number of agricultural related variables than consumption-based welfare would, because the income has greater variation than consumption.

All in all, although household consumption varies less over time than income, and even though consumption is mostly the preferred welfare indicator as it represents actual consumption obtained by the household; income represents a measure of potential consumption and its large

variability is of great importance for this research as it intends to capture poverty dynamics in the short-run, rendering it more informative than consumption.

2.4.2.2 THE CHOICE OF POVERTY LINES

Mukherjee & Benson (2003) define poverty line as the level of welfare at which we can distinguish a poor from non-poor households. Essentially, the poverty line is the per capita recommended daily calorie requirement for the household as established by nutrition researchers (the values range from 2,000 to 2,500Kcal). According to Okurut *et al.* (2002), there are many ways to establish the energy requirement, but the common procedure is to run a regression of the cost of a basket of commodities by each household over the calorie equivalent or the food energy implied from the basket of goods, this is called the food energy intake (FEI) method. Commonly the total poverty line is used (adding food poverty line to nonfood poverty line) because households generally sacrifice certain amounts of food items to purchase and consume nonfood goods (Mukherjee & Benson, 2003).

One important consideration to bear in mind when dealing with poverty lines is the temporal and geographical variation. In fact, tastes and preferences for food change over time and vary between places; thus, estimating poverty measures using a unique poverty line has its own limitations. Note that when the food basket is used to estimate the poverty line, if changes in preferences on food vary, the resulting poverty line will also vary. According to Mukherjee & Benson (2003), an alternative to this limitation is to have different poverty lines for each region to reflect any difference in tastes or consumption preferences, price differences between areas, and differences in demographics of the household composition. In the same line, Okurut *et al.* (2002) found that in Uganda, while households may look relatively better off according to the

national poverty line, they could actually be poor in their region if the cost of living is higher than the national poverty line. The results in Uganda suggest that poverty study should not only use the national but also regional poverty lines. These authors suggest that if the poverty study is used for budgetary allocation, the best approach is to use regional poverty lines instead of national poverty line.

In this study, both local (provincial) and the international poverty lines are used to test the robustness of the estimates. The local poverty lines are available for 2007/08 at provincial level for rural and urban areas and are deflated to the baseline and end line year using the available Consumer Price Index (CPI). The international poverty line of $USD1.25 per capita per day converted into national currency units using purchasing power parity *(PPP)* exchange rates for consumption is used[8]. Given that this study concentrates in a period in which an international phenomenon occurred (food price crisis), using the international poverty line allows making international comparisons.

2.4.2.3 ESTIMATION STRATEGY

The estimation of the poverty effect of cultivated land size is implemented in three main steps. First, for each year, the income model is estimated using the cross-section specification of equation 3 in OLS. Second, the fitted values from this estimation were used to generate the predicted poverty measures developed by Foster *et al.* (1984) in each period (more detail on this

[8] The World Bank (2008) defines *purchasing power parity (PPP)* as exchange rates that convert a value from one currency to another while equalizing their purchasing power. PPPs are more preferred than exchange rates to compare consumption between different economies because they reflect differences in price levels. Essentially, represents the number of units of a country's currency required to buy the same amounts of goods and services in the domestic market as one United States dollar would buy in the United States. It is based on the System of National Accounts' concept of actual individual consumption.

approach is provided in Chapter 3). The general expression for poverty measures of Foster *et al*. (1984)'s class is given by:

$$P_{\alpha} = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z - y_i}{z}\right) \qquad (2)$$

where *n* is the total population; *y* the predicted real income per AE; *z* the food consumption poverty line per AE ; q the number of households with predicted income per AE below the poverty line; and $\alpha \geq 0$ is the "poverty aversion" parameter, such that as the parameter gets large more emphasis is given to the poorest poor. Three measures of poverty are considered to shed light on different aspects of poverty as reported in Table 2:

1 When $\alpha=0$, $P_0 = q/n$ where q is the number of poor people, known as the head count ratio (HC) which shows the proportion of total population whose annual income falls below the poverty line. Essentially, it measures the incidence of poverty that shows the percentage of people failing to meet the basic consumption requirements of household members.

2 When $\alpha=1$, is the poverty gap ratio (PG), measuring the depth of poverty by averaging the distance of per adult equivalent income of poor from the poverty line income as percentage of the poverty line income over the entire population. This indicator, measures how much would need to be transferred to bring poor's expenditure up to poverty line in the other words, the minimum cost for eliminating povery.

3 When $\alpha=2$, is the measure of severity of poverty, in that gives greater weight to income shortfall, known as squared poverty gap (SPG). Essentially, this is a weighted sum of poverty gaps and considers the inequality among poors, such that the transfers from poor to less poor increase the index.

Third, we estimate three household poverty models as:

$$P_{\alpha it} = \beta_0 + \beta_1 Land_{it} + \beta_2 X_{it} + c_i + \mu_{it}, t = 1,...,T \quad (3)$$

where $P\alpha_{it}$ is the poverty measures (for α=0 the $P\alpha_{it}$ is a dummy variable on the poverty status of the household with value of one assigned to poor and zero otherwise; for α=1 and α=2 the $P\alpha_{it}$ are continuous variables with non-poor assigned value of zero) of the household *i* in year t, $Land_i$ is the cultivated land size per AE in hectares, X_i a vector of other income drivers, *ci* the unobserved heterogeneity, and μ_{it} is the idiosyncratic error. Appropriate differencing technique is used to eliminate *ci*.

Generally, poverty measures are estimated at the household member level, however, the survey data was captured at the household level, and the poverty measures were estimated by converting the household income into member level by dividing the total household income by the HH AE size resulted in an average income per AE which was compared to the local poverty line at per AE basis, converting the local poverty lines at per capita basis by a fraction (per capita/AE) to come up with a comparable poverty line/AE. To test the robustness of the empirical results, a different poverty line was used, the international benchmark poverty line of $1.25/day (in 2005 PPP exchange rate)[9]. In this case, the poverty measures were estimated by comparing the income/capita to the $1.25/day PPP poverty line. These strategies were previously used in

[9] Although the international poverty line has been raised to $1.90/day (in 2011 PPPs) recently (see http://blogs.worldbank.org/developmenttalk/international-poverty-line-has-just-been-raised-190-day-global-poverty-basically-unchanged-how-even), given that the data used is about 4-5 years old, the previous poverty line is a valid benchmark for the data.

poverty analysis in Mozambique (Cunguara, 2008; Walker et al., 2004) using household survey data.

2.4.3 UNOBSERVED HETEROGENEITY

An important estimation concern is endogeneity. For this particular study, the endogeneity of landholdings is the major concern, as cultivated land size may result from income accumulation implying that households make decisions on their cultivated land sizes depending on the income they have or generate. For each empirical model described above, concerns of endogeneity of cultivated land sizes are tested using the control function approach. This approach consists of three main steps: 1) estimation of the auxiliary regression in which the dependent variable is the cultivated land size on the instrument (inherited land size); 2) obtain the residuals from 1); and 3) estimate the outcome model on the exogenous variables and the residuals from the auxiliary models in 1). The second stage involves specifications described above in which the cultivated land variable is substituted by the residual of the auxiliary model. This estimation model tested the null hypothesis of exogeneity of the cultivated land size. Rejecting the null (e.g. the coefficient of the residual variable is not statistically different from zero) suggests that cultivated land size is endogenous and an appropriate IV estimation is needed, otherwise, the models described above suffice. Although the reliability of IV-estimates depends on the validity of an instrument, given that the estimated models are all just-identified, the no further IV tests were implemented. The inherited land size is used as an instrument for land size, assuming that the decision of transferring land from the predecessors is not made by the heirs who are being investigated, so it is an exogenous decision, and therefore, meets the required conditions for an instrumental variable.

2.4.4 INCOME AND POVERTY COVARIATES

The human capital is embodied in the members of the household and the ability to use this capital in the labor market (Grootaert, 1997). As such, I hypothesize that the human capital has a significant effect on generating income, which in turn reduces poverty. To capture the effect of human capital, the size of the household, education and age are included as covariates. It is expected that education contributes to reducing poverty as found in previous studies elsewhere (Grootaert, 1997; Mukherjee and Benson, 2003; Achia *et al*., 2010; Geda *et al*., 2005; Okurut *et al*., 2002). The age of the head is included to capture the life cycle effect and it has been found to have an inverse relationship with the probability of the household being poor, be negatively correlated to poverty reduction, and likely to be poor (Grootaert, 1997; Achia et al., 2010;Mukherjee and Benson,2003).

The household size can have both negative and positive effects depending on the composition of the household. The household size is included through the number of available family labor. But, in the context of Mozambique, where the dependency ratio is relatively high (many people in a household are not economically active), extended households may result in limited income generation ability, thus more likely to be poor. The gender of the household head is included to capture gender earning differences in rural Mozambique and it is expected that female-headed households are disadvantaged in both welfare measures (income and poverty). I hypothesize that female-headed households are more likely to be poor than male-headed households as found elsewhere by Geda *et al*. (2005). The civil status of the head is expected to have a significant effect on income and poverty as widowed households are expected to have lower income and consequently more likely to be poor compared to their counterparts.

Variables to capture physical capital variation in rural Mozambique are also included in the models. The physical capital covariates included are productive assets such as the amount of cultivated land, land quality, and income sources, which are expected to be positively correlated with income in rural Mozambique because such productive physical capital makes a significant contribution in reducing poverty. Poverty literature reviewed indicates that asset variables such as land ownership were found to be correlated to poverty (see Grootaert, 1997). Soil quality is another productive asset included as covariate in the models because good soil quality is associated with lower poverty and its coefficient is expected to be positive for income models and negative for poverty. Previous research found raising livestock aid welfare gain strategies in Mozambique (Cunguara, 2008; Walker *et al*., 2004). Therefore, similar effects are expected in this study, hence are included in the models.

To measure the livestock owned by the households, as perceived as an important asset and indicator of wealth in rural Mozambique, the total Tropical Livestock Units proposed by FAO (2008)[10] were used to aggregate the units of livestock owned. Note that livestock is used as a safety net in case of unexpected events, e.g. crop failure, funeral, or other unforeseen events that require additional expenses, therefore a positive effect on income is expected. Similar to livestock ownership, the aggregated crop production, measured by an aggregated crop production into wheat equivalents using weights proposed by Mohammad (1992) is expected to have a positive effect on income and poverty reduction. In addition, the possession of other assets such as bicycle, radio, good housing quality (good walls of the main house); possession of

[10] The conversion rates are: Sheep and goat=0.10; Pig=0.25; Donkey=0.75; and poultry=0.01

latrine are also included and expected to have a positive effect on poverty reduction. The combination of these variables gives an indication of the wealth status of the rural households.

Better access to infrastructure is believed to have a positive effect on income and poverty. Results from Okwi *et al.* (2007)'s study show that longer travel time to main roads significantly increase poverty levels. This is because the greater the travel time to a good road, the more costly it is and the more difficult it becomes to access markets, which reduces the livelihood options, leading to high poverty levels. Remoteness is included in this study to represent limited access to roads, services (education and health) and general infrastructure, markets and other public services and consequently leading to lower income generating opportunities. The remote villages are defined as a binary variable taking a value of one if there are roads with limited transitability and lack public transportation services throughout the year and zero otherwise.

Access to credit, technology adoption, extension services and non-farm income jobs are hypothesized to be positively correlated with income, assuming that these services are available at the right time, amount and quality. The agricultural technology adoption, measured by use of high-yielding varieties of the main staple foods along with the improved agronomic practices, is expected to increase income and reduce poverty as it increases crop production. Therefore, a positive effect on income is expected.

2.5 RESULTS AND DICUSSION

2.5.1 DESCRIPTIVE EVIDENCE

This section is aimed at describing: (a) trends in total land owned and cultivated land size and the observed statistical differences over time and across household landholdings quintiles on average in each year; (b) differences in total land owned and cultivated land size across the provinces of the Central and Northern regions over the period; and other sampled household characteristics over time. These relationships are then further investigated through econometric analysis in section 2.5.2 based on the framework described in methods section.

2.5.1.1 SPATIAL DISTRIBUTION AND TRENDS IN LANDHOLDINGS

It is noted that land possession in Mozambique is low although land is considered abundant, resulting from low population density as found by Mather *et al*. (2012). Results from the panel household survey in Central and Northern Mozambique indicate an average of 0.70 ha per adult equivalent of total owned land and 0.58 hectares per adult equivalent of cultivated land.

Table 2 presents trends in landholdings over time across landholdings quintiles in each year. In both measures of land size (total owned and cultivated), little and insignificant change is observed over time either in aggregate terms or across quintiles, but, dynamics across quintiles are observed where for instance, in the lower quintiles the cultivated land increased significantly between 2008 and 2011.

The results in Table 2 highlight three key findings: First, landholdings per adult equivalent have increased over the period for bottom quintile households but have shrunk for higher quintile groups. Second, the difference between the bottom and top quintile (with the top quintile holding

smaller areas) decreased significantly from 178 percent in 2008 to about 158 percent in. Third, land distribution has been stable over the two survey years with a Gini coefficient of 0.41.

Table 2: Landholdings per Adult Equivalent, by Quintiles of landholdings, 2008-2011

Farm size per AE Quintiles[1]	Size of landholdings per AE						
	2008		2011		Total		Difference 2011-2008[3]
	Mean	SE	Mean	SE	Mean	SE	
Total land owned per AE (ha)							
1st Quintile (lowest)	0.17	0.004	0.17	0.004	0.17	0.003	
2nd	0.33	0.004	0.34	0.004	0.34	0.003	
3rd	0.53	0.005	0.53	0.004	0.53	0.003	
4th	0.82	0.008	0.83	0.009	0.82	0.006	
5th Quintile	1.76	0.058	1.67	0.059	1.72	0.042	
Central & Northern	0.71		0.69		0.70		
Difference: Q5-Q1 [2,3]	1.58***		1.50***		1.54***		
N	1,172		1,172		2,344		
Cultivated land size per AE (ha)							
1st Quintile (lowest)	0.12	0.004	0.14	0.004	0.13	0.003	**
2nd	0.27	0.003	0.28	0.003	0.28	0.002	*
3rd	0.44	0.004	0.44	0.004	0.44	0.003	
4th	0.69	0.007	0.70	0.008	0.70	0.005	
5th Quintile	1.44	0.056	1.40	0.049	1.42	0.037	
Central & Northern	0.59		0.58		0.58		
Difference: Q5-Q1[2,3]	1.32***		1.26***		1.29***		
N	1,172		1,172		2,344		

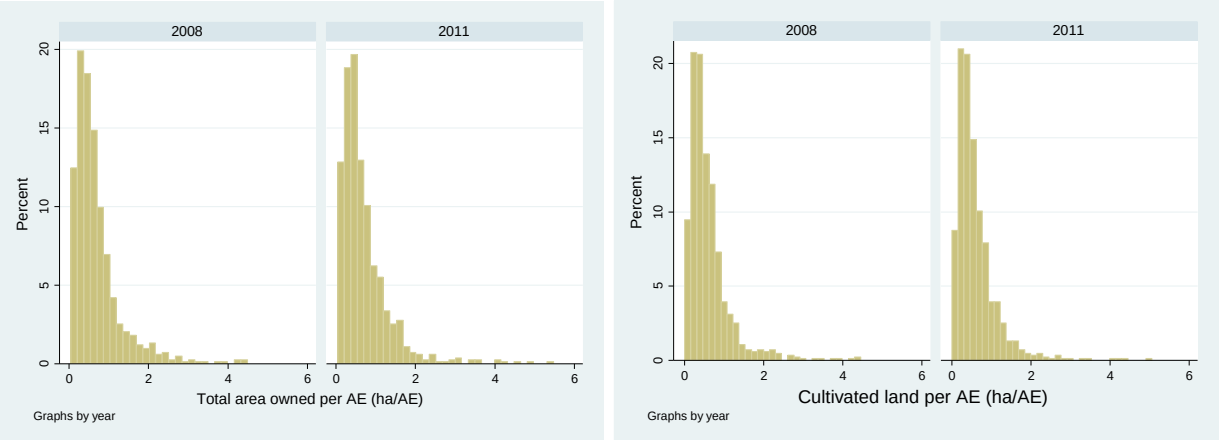
Source: Author's computation from TIA 2008 and Partial Panel 2011
Notes: 1) quintiles defined separately by column for each definition of land size; 2) Difference between highest and lowest Quintiles; 3) Significance level of difference in land size 2011-2008: * p<0.05, ** p<0.01, *** p<0.001, + p<0.1

Although there was no change in landholdings between 2008 and 2011, land distribution in Northern-Central Mozambique is still highly skewed as depicted in Figure 3. The histograms show clearly that the majority of households have very low landholdings. About 65 percent of

households have 0.70 ha per adult equivalent of total land owned while only 5 percent of households have more than 1.74 ha of total land owned. Acknowledging that incomes and calorie consumption were highly correlated with landholdings (Tschirley & Weber, 1994; Mather *et al*. 2012), land access to smallholders in Mozambique becomes a concern for agricultural growth and poverty reduction. As such, investments in strategies that encourage land access become an important policy intervention.

The cultivated land portion of Figure 3 (the last two histograms on the right) shows the same pattern, with about 63 percent of surveyed households having lower than the average cultivated land size in Central and Northern Mozambique. Given that landholdings are found to be positively correlated with incomes and calorie consumption (Tschirley & Weber, 1994; Mather *et al*. 2012), increasing land sizes of the smallholders in Mozambique becomes a concern for agricultural growth and poverty reduction. Therefore, policies that encourage land expansion become an important political endeavor to consider.

Figure 3: Land Distribution in Central and Northern Mozambique, 2008-2011



Source: Author's computation from TIA 2008 and Partial Panel 2011

To complement the analysis above and recognizing that there are severe land inequalities in many African countries and that "*pro-poor*" economic growth is associated with equitable initial asset distribution, the land distribution pattern among the smallholder farmers was examined was examined by: estimating mean total land owned per household across the land size quintiles of per capita land size, estimating the Gini coefficients of total land size per household, estimating the land size per capita and land per AE ;and comparing between the bottom and top quintiles in the pooled and cross-sectional samples. .

As shown in the third column on Table 3, the average operated land size per household in smallholder sector in rural North-Central Mozambique is 2.5 hectares with the largest average areas observed in Tete province and the smallest in Nampula province. On per capita basis, landholdings vary from 0.42 hectares in Manica to 0.79 in Tete province. These figures indicate the level of severe land inequality characteristic of Sub-Saharan Africa. In fact, the estimated Gini coefficient of 0.58 is not surprising if we consider the skewed distribution of land where a small proportion of large-scale farmers are observed in rural Mozambique.

After ranking the smallholders by quintiles of cultivated land, a great inequality on land size among smallholders in the study area is observed. The top quintile households own about 3 times more than households in the lowest quintile. Results in Table 3 indicate that the bottom 20 percent of smallholders is approaching landlessness, controlling only 0.18 hectares per capita. In this situation, a question of concern is whether households in the bottom quintile are "*Sunday farmers*" or not (primarily engaged in off-farm activities). To test this hypothesis, income shares from farm and off-farm activities were computed for each land quintile and reported in Table 3.

Given that in smallholder sector, the production technology is homogeneous (Jayne *et al*., 2003), characterized by limited use of improved inputs, limited knowledge on improved production practices, and limited access to extension services, it is expected that land access is equally distributed among smallholder households. Essentially, land would be distributed according to household size, meaning that the distribution of land per capita and per adult equivalent should be more or equal than land per household, which would imply smaller Gini coefficients for per capita and per adult equivalent land sizes than those for land sizes per household (Jayne *et al*., 2003. Results in Table 3 indicate smaller Gini coefficients for landholdings per capita and per adult equivalent, suggesting that land access is proportional to household size and there is no evidence of more land concentration over time.

Comparing land sizes across provinces for each of the two survey years, results show that in both 2008 and 2011, relatively higher land sizes were observed in Tete and Sofala (Central) and by 2011, the households' land sizes decreased slightly but maintained higher in those regions.

Table 3: Smallholder land distribution in Northern-Central Mozambique, by province, 2008-2011

Province	Sample size	Average total land owned per HH (ha)	Cultivated land size per HH (ha)	Cultivated land size in 2008's Quintiles							Gini coefficients		
				1st Quintile (low)	2nd	3rd	4th	5th Quintile (high)	Total	Difference (Q5-Q1)[2]	Land per HH	Land per capita	Land per AE
				Cultivated land size per capita (ha)									
NAMPULA	396	2.66	2.12	0.24	0.28	0.36	0.51	1.06	0.48	***	0.38	0.43	0.36
ZAMBEZIA	498	2.72	2.15	0.16	0.26	0.41	0.51	0.95	0.47	***	0.34	0.43	0.38
TETE	508	4.02	3.73	0.19	0.26	0.42	0.53	2.11	0.79	***	0.61	0.62	0.40
MANICA	420	2.41	2.00	0.16	0.24	0.39	0.56	1.07	0.42	***	0.39	0.51	0.47
SOFALA	522	3.12	2.76	0.16	0.26	0.34	0.50	1.40	0.51	***	0.46	0.53	0.43
Northern-Central	2,344	2.95	2.50	0.18	0.26	0.39	0.52	1.30	0.53	***	0.49	0.54	0.41
Difference ('11-'08)[3]		-0.19	-0.15						-0.03		-0.01	-0.01	-0.01

Source: Author's computation from TIA 2008 and Partial Panel 2011
Significance level of difference in land size: * p<0.05, ** p<0.01, *** p<0.001, + p<0.1

2.5.1.2 STRUCTURE AND TREND OF RURAL HOUSEHOLD INCOME AND POVERTY

As reported in Table 4, the average annual net household income per adult equivalent at 2011 constant prices fell from 10,680 MZN in 2008 to 8,168 MZN in 2011. At the prevailing exchange rate in 2011 from the Central National Bank (US$1=27.14 MZN), the household income decreased from US$ 393 in 2008 to US$ 309 in 2011 in the study area. This trend was almost entirely on the account of farm income which decreased from US$ 229 in 2008 to US$ 146 in 2011. Note that farm income is by far the main income component of rural households in the study area contributing to more than 65 percent of the household income. As noted by Benfica *et al*. (2014), this trend could be associated to the fact that despite the presence of high or favorable price environment for output and increased market participation, increased production efficiency, there was an observed slow pace of intensification due to high output/input price ratio, making the intensification to enhance production not profitable.

In summary, the household income composition did not change between the two survey years and the crop income is by far the most important source of the surveyed households account for about 60 percent of total income, followed by self-employment income (18 percent); and non-farm wage income (15 percent). The share of income from sources other than farming in the total household income is about 40 percent (note that all wage income is non-farm wage), confirming the claim by Haggblade *et al.* (2010) that rural non-farm economy (RNFE) accounts for 35-50 percent of the rural household income in developing countries. The household income composition did not vary significantly over time.

The household income reported in Table 4 further reveal that although the share of crop income in the farming sub-sector and self-employment in non-farm sub-sector in the total income have increased slightly, their effects were not enough to result in overall income growth. Among the nonfarm components, the income share from wage dropped contrary to that of self-employment. Evidently, in the short-run, the income earning opportunities in the nonfarm farm sector shifted from wage to self-employment with a 2.5 percentage points drop in wage income and 1.1 percentage points increase in self-employment.

Table 4: Sources of rural income in Northern-Central Mozambique, 2008-2011

Income	2008	2011	Total
Percentage contribution:			
a. Crop	60.9	61.1	61.0
b. Livestock	4.3	4.4	4.3
A. Total farm income (a+b)	*65.1*	*65.5*	*65.3*
c. Pension and remittances	0.9	0.9	0.9
d. Self-employment	18.0	19.1	18.5
e. Wage (non-farm wages only)	16.0	14.5	15.3
B. Total non-farm income (c+d+e)	*34.9*	*34.5*	*34.7*
Total household income (A+B)	100.0	100.0	100.0
Average income/AE (in 2011 MZN):			
Total Net income	10,680.70	8,168.65	9,428.39
Total Net crop	6,051.63	3,792.39	4,925.35
Total Net livestock	155.86	161.43	158.64
Total Net self-employment	2,161.97	1,825.27	1,994.12
Total wage	1,142.73	1,155.29	1,148.99
Total Net farm	6,207.48	3,953.82	5,083.98
Total Net off-farm	3,330.49	3,059.55	3,195.42
Average household size (AE)	4.5	4.4	4.4
Number of observations	1,172	1,172	2,344

Source: Author's computation from TIA 2008 and Partial Panel 2011

Table 5 presents poverty measure estimates (the local poverty lines are reported in the Appendix A). Results show that headcount ratio increased from 32 percent in 2008 to 40 percent in 2011. In only three years the headcount ratio increased 8 percentage points, corresponding to a 2.7 points decrease on average per year between 2008 and 2011. The poverty increase was further

strengthened by an increase in the poverty gap by an average of 2 percentage points per year although the squared poverty gap ratio decreased 2 percentage points in three years. Using the international poverty line of US$1.25 per capita per day based on purchase parity price (PPP), the poverty rate was much higher with similar trend although at slower pace, although the difference between the two survey periods is not significant.

Table 5: Incidence, depth and severity of income poverty, 2008-2011

Poverty	2008	2011	Total	% change	Significance
Local poverty lines					
Head count index	0.32	0.40	0.36	3.0	**
Poverty gap ratio	0.23	0.29	0.26	1.0	**
Squared poverty gap	0.43	0.41	0.42	-1.0	+
Poverty line =US$ 1.25/day based on Purchasing Power Parity (PPP)					
Head count index	0.78	0.80	0.79	2.0	
Poverty gap ratio	0.56	0.58	0.57	1.0	
Squared poverty gap	0.48	0.49	0.48	1.0	
Number of observations	1,172	1,172	2,344		

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Source: Author's computation from TIA 2008 and Partial Panel 2011

These poverty estimates are below those by MPD (2010) using consumption indicator and local poverty lines which in 2008/09 estimated at 54.7 percent of people living in poverty in the entire country with the estimates at 49.6 and 56.9 percent in the Northern and Central Mozambique; respectively.

2.5.1.3 CHARACTERISTICS OF SAMPLED HOUSEHOLDS

The 2008-2011 panel data allows us to better understand the short-term poverty dynamics over the three-year spell since 2008. The other characteristics of the sample households are presented in Table 6. The average size of cultivated land per household did not increase over time, estimated at 2.59 ha in 2008 and 2.37 ha in 2011, mainly due to limited access to man-power and alternative power sources for land expansion (e.g. animal traction) (Bolardo *et al*., 2014). However, the aggregated agricultural production and access doubled over time from an average

of about 1.6 tons of wheat equivalent units in 2008 and 2.7 percent, respectively. Representing about 52 percent of the cultivated land, the inherited land followed the same pattern as the cultivated land size with no statistical change over time. Access to good land quality observed 2.7 percentage points increase from 34 percent of sampled households that reported having good land quality in 2008. The use of improved inputs is persistently low with percentage of households using chemical fertilizer and pesticides estimated at 6 and 2.5 percent, respectively.

During the study period, a gradual shift of the rural occupational structure was observed accompanying the changing pattern of investment in physical and human capital. The number of households residing in non-remote areas observed about 0.7 percent points increase and the number of migrant workers increased over this period.

Results in Table 2 show that the adoption of improved agricultural technologies is low in rural Mozambique and did not vary over time. For instance, the use of chemical fertilizer is estimated at 6 percent, while the adoption of pesticides is estimated at no more than 2.5 percent.

The structure of family labor occupation observed significant changes over time. Results show an increase in agricultural workers more than doubled in 2011 from an average of 2 in every 10 household members reported in 2008. The local and international migration increased from 2008 to 2011, with domestic migration increasing from 0.32 members per household to 0.64 members.

Table 6: Characteristics of sample households, 2008-2011

	Total		Year				Operated land size/AE 08 quintiles		Mean differences	
			2008 (1)		2011 (2)					
Characteristics	Mean	SD	Mean	SD	Mean	SD	Q1 (3)	Q5 (4)	1-2	3-4
HH lives in non-remote village (%)	41.0	49.2	40.7	49.1	41.4	49.3	44.6	34.1		*
Total land owned (ha)	2.94	3.74	3.09	4.06	2.79	3.35	1.58	5.83		**
Cultivated land size (ha)	2.48	3.41	2.59	3.79	2.37	2.95	1.16	5.10		**
Inherited land size (ha)	1.28	4.68	1.33	5.02	1.22	4.29	0.83	2.22		**
Female-headed HH (%)	18.2	0.39	18.1	0.39	18.3	0.39	15.3	20.4		
Head's education (years completed)	3.1	2.96	3.1	2.97	3.1	2.95	3.7	2.6		**
Males in secondary school (number)	0.22	0.55	0.21	0.54	0.22	0.55	0.40	0.13		**
Head’s age (years)	42.1	13.28	42.3	13.32	41.9	13.24	43.5	41.5		
HH size (# of members)	6.0	2.79	6.0	2.84	6.0	2.75	8.1	4.5		**
HH size (Adult equivalent)	4.5	2.0	4.45	2.0	4.4	2.1	6.0	3.5		**
Number of months with food reserves	7.3	4.27	7.3	4.20	7.2	4.34	6.8	7.9		
Total Net HH income (in ‘000 2011 MZM)	40,17	252,9	47,08	339,7	32,95	101,24	65,05	27,19		*
HH's Maize production (Kgs)	792.8	1724.04	784.4	1811.21	801.7	1628.89	972.5	715.3		
Average Maize yield (Kg/ha)	925.6	1010.11	939.0	103,2	911.2	986.49	1259.8	687.1		
Mean Maize price (MZM/Kg)	5.30	2.94	5.09	2.96	5.52	2.92	5.09	5.73		
Aggregated production (in Wheat equivalent units)	2,577.2	48089.59	1,587.9	4377.77	3,610.6	68619.97	1,697.8	1,668.4		
Widowed head (%)	7.4	0.26	7.6	0.26	7.2	0.26	5.2	7.2		
People aged 15-59 years (number	2.6	1.36	2.7	1.35	2.6	1.37	3.4	2.2		**
HH is food insecure (%)	24.3	0.43	25.6	0.44	23.0	0.42	25.7	15.4		**
People with self-employment (number)	0.69	0.92	0.74	1.01	0.65	0.80	0.80	0.58		**
HH have access to credit (%)	4.1	0.20	2.7	0.16	5.5	0.23	4.2	3.7		**
HH has good land quality (%)	35.3	0.48	34.0	0.47	36.7	0.48	51.4	19.5		**
Total Tropical Livestock units per HH	0.94	2.72	0.98	2.93	0.91	2.47	1.11	1.01		

Table 6 (Cont'd)

	Total		Year				Cultivated land size/AE 08 quintiles		Mean diff.	
			2008 (1)		2011 (2)					
Characteristics	Mean	SD	Mean	SD	Mean	SD	Q1 (3)	Q5 (4)	1-2	3-4
HH used fertilizer (%)	6.0	0.24	6.1	0.24	6.0	0.24	2.6	8.6	+	**
HH used pesticide (%)	2.5	0.16	2.6	0.16	2.4	0.15	0.0	4.9		**
HH used manure (%)	4.3	0.20	4.3	0.20	4.3	0.20	3.6	3.3		
HH used irrigation (%)	3.9	0.19	3.0	0.17	4.8	0.21	3.2	4.9		
HH used improved seeds for cereals	55.0	0.50	55.8	0.50	54.2	0.50	58.6	55.0		
HH used improved seeds for beans (%)	28.5	0.45	28.1	0.45	28.9	0.45	26.3	31.3		
HH used improved seeds for vegetables (%)	12.5	0.33	12.3	0.33	12.8	0.33	13.6	11.0		
HH does crop rotation (%)	29.1	0.45	29.4	0.46	28.9	0.45	27.5	26.6		
HH does intercropping (%)	76.6	0.42	75.1	0.43	78.2	0.41	73.9	81.3		
HH does line sowing (%)	52.2	0.50	51.8	0.50	52.6	0.50	58.8	59.6		
HH used permanent labor (%)	4.9	0.22	4.7	0.21	5.1	0.22	5.7	4.7		
HH used seasonal labor (%)	28.3	0.45	27.0	0.44	29.7	0.46	30.1	25.3		
HH used animal traction (%)	11.6	0.32	12.7	0.33	10.5	0.31	9.1	15.8		*
Agricultural technologies used (number)	3.2	1.50	3.1	1.48	3.2	1.53	3.1	3.3		
HH used at least one improved agricultural technology (%)	97.5	0.16	97.9	0.14	97.0	0.17	97.0	98.6		
HH hired seasonal labor (%)	28.3	0.45	27.0	0.44	29.7	0.46	30.1	23.8		
Number of agricultural workers	0.33	0.69	0.21	0.54	0.49	0.80	0.32	0.36	**	
Number of non-agricultural workers	0.13	0.34	0.11	0.33	0.14	0.35	0.10	0.11		
Number of domestic migrants per household	0.46	0.75	0.32	0.60	0.64	0.87	0.42	0.47	**	
Number of overseas migrants per household	0.02	0.14	0.00	0.03	0.04	0.19	0.02	0.02	**	
Number of observations	3,244		1,172		1,172					

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$; SD is standard deviation

Source: Author's computation from TIA 2008 and Partial Panel 2011

2.5.2 EMPIRICAL RESULTS

2.5.2.1 DETERMINANTS OF HOUSEHOLD INCOME

Table 7 presents parameter estimates for the marginal value of the household incomes. As the dependent variable is natural log form, the estimated regression coefficients measure the percentage change in household income for an increase of the explanatory variables. The explanatory variables include, cultivated land size/AE, time-invariant and other variables. The empirical results in Table 7 highlight six key findings:

First, *ceteris paribus*, no significant income change has been observed between the two survey years and the change on cultivated land size/AE has a positive and significant effect on total and crop incomes. The empirical results show that doubling the cultivated land size/A lead to about 9 and 11 percent increase on total and crop incomes, respectively.

Second, the demographic characteristics of the household such as: availability of family labor, head's education, and age, have a significant welfare effect. Contrary to previous findings, the availability of family labor has a negative effect on income. Given the limited job opportunities in the rural areas, these findings seem to suggest that: 1) what matters is the proportion of family labor actually engaged in productivity activities not just the number of adult members, and 2) the cost differential between the family and hired labor makes rural households use hired labor instead of the available labor for their production, leaving the family labor to enjoy high return activities such investing in education and migrating to urban areas. As shown in Table 7, hired labor has a positive and significant welfare effect, especially on self-employment activities, on livestock production and on total net household income. Head's education was found to have a

positive and significant effect on household income, while income decreases significantly with head's age. The negative association between income and head's age highlights the importance of life cycle in income generation and erosion of income with time as no savings are made, which is a characteristic of poor rural families in Mozambique.

Third, access to self-employment is an important livelihood strategy for rural households in Mozambique as reflected in a positive effect on self-employment and total net household income. The possession of livestock is important as it serve as an informal household bank. Land quality is an important income driver. Results show that good land quality results in a 14 percent income increase compared to poor land quality.

Fourth, access to public services such as credit and infrastructures have positive and significant effect on income. Results show that access to credit does not result in overall income gain but it is an important factor on self-employment income, as households with access to credit have increased their self-employment up to about 76 percent while living in non-remote areas increase total net household income in 24 percent mostly due a 34 percent self-employment gain.

Fifth, the results above are robust to the potential endogeneity bias on cultivated land. Although the land market is thin in rural Mozambique, treating land as exogenous would depend on intergenerational land transfers and unobserved characteristics that determine land access and household income. The consistent estimates for the determinants of income using the instrumental variable estimation are presented in the last two columns with the inherited land size being the instrument for the cultivated land size as described earlier in section 2.4.3.

Table 7: Determinants of Household income/AE, RE and RE-IV models

	RE Models					RE-IV Models				
	Total	Crop	Lives-tock	Self-employ-ment	Wage	Total	Crop	Lives-tock	Self-employ-ment	Wage
Year=2011	-0.018	-0.030	-0.110	0.055	-0.051	-0.000	-0.014	-0.104	0.122	-0.052
	(-0.35)	(-0.39)	(-1.06)	(0.38)	(-1.52)	(-0.00)	(-0.17)	(-1.00)	(0.76)	(-1.60)
HH lives in non-remote village (1=Yes)	0.239**	0.094	-0.032	0.337*	-0.015	0.251**	0.115	-0.027	0.425*	-0.014
	(3.37)	(1.08)	(-0.27)	(2.07)	(-0.32)	(3.36)	(1.26)	(-0.22)	(2.33)	(-0.25)
Log of cultivated land per AE	0.090*	0.113*	-0.077	-0.061	0.102**	0.662**	0.573*	0.069	0.841**	0.003
	(2.17)	(2.36)	(-1.07)	(-0.71)	(3.14)	(2.82)	(2.13)	(0.18)	(3.42)	(0.02)
Male-headed HH (Yes)	0.103	0.194	0.110	0.174	0.062	0.059	0.166	0.101	0.056	0.076
	(0.81)	(1.41)	(0.60)	(0.73)	(0.64)	(0.48)	(1.20)	(0.52)	(0.20)	(0.57)
Head's education (years completed)	0.029*	-0.015	-0.016	0.059+	0.017+	0.029*	-0.015	-0.016	0.062+	0.016
	(2.11)	(-0.93)	(-0.68)	(1.84)	(1.67)	(2.02)	(-0.92)	(-0.69)	(1.89)	(0.97)
Males in secondary school (number)	0.013	-0.019	0.084	-0.054	0.004	0.020	-0.022	0.081	-0.075	0.004
	(0.17)	(-0.23)	(0.66)	(-0.34)	(0.08)	(0.28)	(-0.27)	(0.71)	(-0.45)	(0.07)
Head's age (years)	-0.010**	-0.008**	-0.001	-0.030**	-0.001	-0.007*	-0.006+	-0.000	-0.020**	-0.002
	(-3.20)	(-2.65)	(-0.25)	(-5.26)	(-0.24)	(-2.10)	(-1.69)	(-0.06)	(-2.80)	(-0.30)
Widowed head (1=Yes)	0.146	0.277	-0.035	0.009	0.129	0.064	0.209	-0.056	-0.279	0.151
	(0.80)	(1.46)	(-0.13)	(0.03)	(0.71)	(0.40)	(1.09)	(-0.21)	(-0.73)	(1.08)
People aged 15-59 years (number)	-0.169**	-0.200**	-0.065	-0.124*	-0.051*	-0.055	-0.104	-0.034	0.273*	-0.066+
	(-6.01)	(-6.33)	(-1.36)	(-2.15)	(-2.30)	(-1.00)	(-1.61)	(-0.38)	(2.12)	(-1.76)
People with self-employment (number)	0.133**	0.028	0.062	1.508**	0.012	0.162**	0.040	0.066	0.557**	0.009
	(4.11)	(0.63)	(1.00)	(12.14)	(0.65)	(4.30)	(0.85)	(1.04)	(16.68)	(0.34)
HH have access to credit (1=Yes)	0.019	-0.077	0.381	0.749*	0.023	0.103	-0.012	0.407	0.019*	0.015
	(0.13)	(-0.42)	(1.20)	(2.06)	(0.57)	(0.62)	(-0.06)	(1.47)	(2.49)	(0.13)
HH has good land quality (1=Yes)	0.147*	0.270**	0.298*	0.101	0.025	0.326**	0.446**	0.349*	0.826**	0.020
	(2.36)	(3.38)	(2.45)	(0.63)	(0.47)	(3.36)	(3.36)	(2.00)	(3.11)	(0.40)
HH used fertilizer (1=Yes)	0.282*	0.379*	0.350	-0.065	0.049	0.276**	0.009	0.277*	0.825**	-0.082
	(2.24)	(2.36)	(1.19)	(-0.20)	(0.71)	(3.61)	(0.10)	(2.18)	(4.41)	(-1.46)

Table 7 (Cont'd)

	RE Models					RE-IV Models				
	Total	Crop	Lives-tock	Self-employ-ment	Wage	Total	Crop	Lives-tock	Self-employ-ment	Wage
HH used improved seeds	0.282**	0.439**	-0.009	-0.059	0.097+	0.161	0.253	0.313	-0.612	0.046
(1=Yes)	(4.40)	(5.65)	(-0.08)	(-0.39)	(1.86)	(0.98)	(1.25)	(1.14)	(-1.51)	(0.37)
HH used permanent labor	0.058	0.195	0.536+	-0.097	-0.105	0.255**	0.420**	-0.017	-0.143	0.104+
(1=Yes)	(0.42)	(1.02)	(1.72)	(-0.25)	(-0.96)	(3.64)	(4.97)	(-0.14)	(-0.84)	(1.89)
HH hired seasonal labor	0.248**	0.003	0.273*	0.797**	-0.079	0.097	0.224	0.542*	0.001	-0.105
(1=Yes)	(3.46)	(0.03)	(2.07)	(4.29)	(-1.13)	(0.64)	(1.20)	(2.13)	(0.00)	(-0.94)
HH used animal traction	0.055	-0.203	0.209	0.446+	-0.088	0.007	-0.237+	0.196	0.309	-0.084
(1=Yes)	(0.50)	(-1.51)	(0.94)	(1.72)	(-1.13)	(0.06)	(-1.68)	(1.02)	(1.09)	(-0.95)
Total Tropical Livestock	0.020	0.014	0.167**	0.040	-0.011+	0.028*	0.018	0.170**	0.056+	-0.011
units per HH	(1.61)	(1.07)	(5.58)	(1.29)	(-1.69)	(2.14)	(1.17)	(7.94)	(1.80)	(-0.94)
Constant	7.683**	7.302**	0.573	2.238**	1.832**	7.778**	7.345**	0.589	2.406**	1.789*
	(33.61)	(23.67)	(1.63)	(4.29)	(3.37)	(24.95)	(20.99)	(1.20)	(3.44)	(2.49)
Observations	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003
R-Square	0.141	0.131	0.146	0.275	0.082	0.094	0.104	0.144	0.168	0.080

t statistics in parentheses; + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$; District FE included
Source: Author's computation from TIA 2008 and Partial Panel 2011

2.5.2.2 HETEROGENEITY AND AGRICULTURAL POVERTY TRAP

The hypothesis that extremely poor (bottom quintile) rural households in Mozambique choose livelihood strategies different from the less poor (top quintile) households is tested by disaggregating the sample into quintiles of cultivated land sizes and estimating the determinants of income on the two extreme quintiles. To gain more details on income drivers, the income models were estimated by farm size quintiles (top and bottom). Results (Table 8 and Table 9) highlight five main findings.

First, although no significant income change has been observed between the two survey years, analysis at disaggregated level show that: 1) the poorest households observed income decrease mainly due to large crop income loss, 2) a large self-employment income gain was observed among the less poor households, it was not sufficient to result in the aggregate income gain exacerbated by the 50 percent loss on the livestock income.

Second, although changes on cultivated land size/AE were found to have positive and significant effect on total and crop incomes; the results in Table 8 show that these effects are not observed among the households belonging to the two extreme landholding quintiles when the cultivated land size/AE is considered endogenous.

Third, despite the significant welfare effect of the household's demographic characteristics, such as household size, head's education, and age; this effect is not enjoyed throughout the sample. Results in Table 8 and Table 9 show that: 1) controlling for the potential endogeneity of cultivated land size/AE, the availability of family labor has not income effect on both land

quintiles and 2) head's education was found to have a positive and significant effect on household income (mainly on self-employment) among the less poor households only, while income decreases significantly with head's age among the poorest households.

Fourth, the investments in infrastructure have shown a significant net crop income gain among the less land poor households (38 percent) and a sizable 70 percent among the land poor households. This suggests that investment in infrastructures is more likely to have larger effect on the land poorest households than on the less land poor, which implies that that a pro-poor development strategy should focus on infrastructure development on the extremely poor regions to unlock the dormant income generation capacity of this group, such as promotion of self-employment activities. But, in the aggregate, the returns are high as benefits both type of households.

Fifth, the returns to land management technologies through good quality land are enjoyed by both groups of households with significant effect on crop and livestock incomes; however relatively large incomes gains are enjoyed by the less poor households.

Despite the fact that access to credit had a positive and significant self-employment income effect, this effect is undistinguishable between the two household groups. This suggests that, perhaps, households accessing credit among the poorest and lees poor do not necessarily make productive investments that lead to income gain, or if they have made such investments the returns are very small.

Although an additional tropical livestock unit was found to increase total net household income by about 3 percent and 6 percent on self-employment, this effect is mainly among the poorest households. Results in Table 8 show that an additional livestock unit leads to 7 to 8 percent increase in crop income among the poorest households. Essentially, these results suggest that raising animals may increase the ability of the extremely poor households to increase crop income either through animal traction or rental income to re-invest in livestock-crop production systems.

Table 8: Determinants of Household income/AE in the bottom and top cultivated land quintiles, RE models

	Bottom					Top				
	Total	Crop	Lives-tock	Self-employ-ment	Wage	Total	Crop	Lives-tock	Self-employ-ment	Wage
Year=2011	-0.216^{+}	-0.692**	-0.018	-0.099	0.090	0.039	0.086	-0.496*	0.748*	-0.044
	(-1.90)	(-3.79)	(-0.07)	(-0.30)	(0.92)	(0.31)	(0.50)	(-2.07)	(1.97)	(-0.58)
HH lives in non-remote village (1=Yes)	0.288	-0.130	-0.134	0.718^{+}	0.024	0.260	0.382*	-0.047	0.691	-0.211
	(1.53)	(-0.56)	(-0.45)	(1.75)	(0.28)	(1.61)	(1.98)	(-0.15)	(1.61)	(-0.97)
Log of cultivated land per AE	0.021	0.200^{+}	-0.455*	0.019	-0.058	0.056	-0.138	0.009	0.307	0.135*
	(0.19)	(1.86)	(-2.53)	(0.09)	(-1.05)	(0.59)	(-1.00)	(0.05)	(1.38)	(2.01)
Male-headed HH (Yes)	-0.095	0.117	-0.085	0.371	-0.062	0.047	0.012	0.754^{+}	-0.228	-0.142
	(-0.33)	(0.26)	(-0.15)	(0.53)	(-0.25)	(0.16)	(0.04)	(1.95)	(-0.47)	(-0.93)
Head's education (years completed)	0.003	0.027	0.013	-0.085	0.049	0.068*	-0.020	-0.048	0.204**	-0.007
	(0.09)	(0.65)	(0.26)	(-1.23)	(1.09)	(2.39)	(-0.49)	(-0.78)	(2.73)	(-0.40)
Males in secondary school (number)	-0.156	-0.075	0.285	-0.075	-0.016	-0.008	-0.346	-0.410	-0.260	-0.224*
	(-1.15)	(-0.44)	(1.23)	(-0.27)	(-0.18)	(-0.04)	(-1.06)	(-1.03)	(-0.43)	(-2.30)
Head's age (years)	-0.014*	-0.002	0.001	-0.045**	-0.012	-0.011	-0.008	0.001	-0.021^{+}	0.002
	(-2.00)	(-0.25)	(0.11)	(-2.90)	(-1.34)	(-1.51)	(-1.10)	(0.09)	(-1.76)	(0.25)
Widowed head (1=Yes)	0.104	0.296	-0.648	-0.496	-0.071	-0.133	-0.097	1.067^{+}	-0.378	-0.031
	(0.27)	(0.53)	(-0.99)	(-0.60)	(-0.43)	(-0.33)	(-0.22)	(1.85)	(-0.53)	(-0.19)
People aged 15-59 years (number)	-0.104^{+}	-0.117	-0.206*	-0.191^{+}	0.039	-0.207**	-0.213*	-0.134	-0.011	-0.108*
	(-1.74)	(-1.51)	(-2.17)	(-1.69)	(0.69)	(-2.77)	(-2.56)	(-1.19)	(-0.06)	(-2.34)
People with self-employment (number)	0.091	-0.104	-0.152	1.276**	0.005	0.015	-0.123	0.001	1.765**	0.061
	(1.32)	(-1.08)	(-1.19)	(6.07)	(0.10)	(0.16)	(-0.95)	(0.01)	(4.61)	(0.69)
HH have access to credit (1=Yes)	0.151	-0.164	0.092	0.992	-0.034	0.121	-0.237	0.673	0.637	0.006
	(0.45)	(-0.41)	(0.13)	(1.26)	(-0.32)	(0.40)	(-0.58)	(0.80)	(0.67)	(0.04)
HH has good land quality (1=Yes)	0.333*	0.532**	0.092	0.587	0.063	0.278	0.443*	0.628^{+}	-0.235	0.124
	(2.21)	(2.58)	(0.36)	(1.58)	(0.48)	(1.59)	(2.17)	(1.89)	(-0.54)	(0.74)
HH used fertilizer (1=Yes)	0.350	0.617	0.002	1.332	0.036	0.357	0.805*	1.027	0.062	-0.090
	(0.78)	(1.07)	(0.00)	(1.12)	(0.22)	(1.29)	(2.52)	(1.57)	(0.10)	(-0.52)

Table 8 (Cont'd)

	Bottom					Top				
	Total	Crop	Lives-tock	Self-employ-ment	Wage	Total	Crop	Lives-tock	Self-employ-ment	Wage
HH used improved seeds	0.167	0.180	-0.102	0.652^{+}	-0.042	0.403**	0.710**	-0.012	0.017	-0.023
(1=Yes)	(1.12)	(0.94)	(-0.40)	(1.89)	(-0.32)	(2.84)	(4.32)	(-0.05)	(0.05)	(-0.40)
HH used permanent labor	-0.338	-0.326	-0.102	-0.571	-0.045	0.172	0.466	0.590	-1.376	-0.096
(1=Yes)	(-1.03)	(-0.61)	(-0.15)	(-0.72)	(-0.38)	(0.49)	(1.19)	(0.78)	(-1.49)	(-0.60)
HH hired seasonal labor	0.445**	0.346	0.378	0.919*	0.132	0.279	0.241	0.417	0.811^{+}	-0.298
(1=Yes)	(2.90)	(1.60)	(1.33)	(2.27)	(1.47)	(1.54)	(1.18)	(1.39)	(1.77)	(-1.27)
HH used animal traction	0.163	-0.459	0.338	0.470	-0.135	-0.246	-0.177	-0.078	-0.022	-0.010
(1=Yes)	(0.72)	(-1.35)	(0.63)	(0.80)	(-1.13)	(-0.97)	(-0.52)	(-0.18)	(-0.04)	(-0.10)
Total Tropical Livestock	0.014	0.067^{+}	0.157**	0.010	-0.023^{+}	0.043^{+}	0.042^{+}	0.089	0.060	0.011
units per HH	(0.46)	(1.89)	(2.79)	(0.15)	(-1.69)	(1.72)	(1.70)	(1.47)	(0.73)	(0.99)
Constant	8.342**	6.459**	-0.129	5.290**	3.337*	7.641**	7.923**	1.681*	-0.700	0.621
	(10.51)	(8.76)	(-0.14)	(2.59)	(2.21)	(17.82)	(15.91)	(2.40)	(-0.77)	(1.50)
Observations	400	400	400	400	400	401	401	401	401	401
rho	0.457	0.098	0.265	0.078	0.932	0.404	0.024	0.135	0.087	0.962
R-Square	0.207	0.176	0.269	0.358	0.227	0.279	0.244	0.203	0.340	0.208

t statistics in parentheses;$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$; District FE included
Source: Author's computation from TIA 2008 and Partial Panel 2011

Table 9: Determinants of Household income/AE in the bottom and top land quintile, RE-IV models

	Bottom					Top				
	Total	Crop	Lives-tock	Self-employ-ment	Wage	Total	Crop	Lives-tock	Self-employ - ment	Wage
Year=2011	-0.330	-0.917**	-0.434	-0.299	0.023	0.266	0.046	-0.326	1.912*	0.190
	(-1.28)	(-2.61)	(-0.96)	(-0.50)	(0.10)	(0.77)	(0.11)	(-0.55)	(2.19)	(0.89)
HH lives in non-remote village (1=Yes)	0.279	-0.078	-0.148	0.700+	0.051	0.228	0.387+	-0.065	0.506	-0.273+
	(1.61)	(-0.33)	(-0.48)	(1.73)	(0.30)	(1.20)	(1.71)	(-0.20)	(1.06)	(-1.74)
Log of cultivated land per AE	0.226	0.622	0.358	0.433	0.069	0.509	-0.218	0.355	2.679	0.617
	(0.53)	(1.10)	(0.49)	(0.46)	(0.18)	(0.79)	(-0.28)	(0.32)	(1.64)	(1.50)
Male-headed HH (1=Yes)	-0.184	-0.077	-0.456	0.140	-0.130	0.044	0.019	0.741+	-0.345	-0.271
	(-0.50)	(-0.16)	(-0.74)	(0.18)	(-0.29)	(0.17)	(0.06)	(1.73)	(-0.53)	(-0.88)
Head's education (years completed)	-0.005	0.019	0.005	-0.089	0.043	0.062+	-0.019	-0.053	0.174*	-0.005
	(-0.14)	(0.45)	(0.10)	(-1.27)	(0.85)	(1.85)	(-0.47)	(-0.95)	(2.07)	(-0.14)
Males in secondary school (number)	-0.124	-0.056	0.230	-0.083	-0.007	0.016	-0.340	-0.413	-0.422	-0.275
	(-1.01)	(-0.35)	(1.11)	(-0.31)	(-0.04)	(0.07)	(-1.25)	(-1.07)	(-0.73)	(-1.37)
Head's age (years)	-0.014+	-0.000	0.005	-0.042**	-0.013	-0.010	-0.008	0.001	-0.021	0.004
	(-1.82)	(-0.04)	(0.38)	(-2.73)	(-1.06)	(-1.55)	(-1.11)	(0.13)	(-1.31)	(0.33)
Widowed head (1=Yes)	0.026	0.073	-1.131	-0.709	-0.121	-0.196	-0.079	1.014+	-0.753	-0.368
	(0.06)	(0.12)	(-1.42)	(-0.68)	(-0.28)	(-0.52)	(-0.19)	(1.68)	(-0.82)	(-0.85)
People aged 15-59 years (number)	-0.090	-0.094	-0.146	-0.170	0.054	-0.133	-0.224	-0.080	0.370	0.011
	(-1.48)	(-1.18)	(-1.41)	(-1.27)	(0.81)	(-0.99)	(-1.49)	(-0.36)	(1.11)	(0.09)
People with self-employment (number)	0.112	-0.110	-0.167	1.357**	0.016	0.053	-0.127	0.012	1.631**	0.088
	(1.53)	(-1.10)	(-1.30)	(8.02)	(0.22)	(0.48)	(-0.95)	(0.06)	(5.89)	(1.06)
HH have access to credit (1=Yes)	0.136	-0.072	0.571	1.072	-0.040	0.142	-0.244	0.664	0.582	-0.060
	(0.40)	(-0.15)	(0.94)	(1.34)	(-0.13)	(0.36)	(-0.51)	(1.00)	(0.59)	(-0.20)
HH has good land quality (1=Yes)	0.362*	0.652*	0.354	0.695	0.070	0.394+	0.430	0.721+	0.340	0.138
	(2.11)	(2.56)	(1.10)	(1.62)	(0.50)	(1.79)	(1.46)	(1.84)	(0.60)	(1.06)
HH hired seasonal labor (1=Yes)	0.509**	0.349	0.483	0.941*	0.157	0.359+	0.229	0.465	1.036*	-0.298*
	(2.91)	(1.44)	(1.56)	(2.31)	(0.92)	(1.91)	(0.96)	(1.43)	(2.16)	(-2.19)
HH used fertilizer (1=Yes)	0.231	0.471	-0.169	1.041	-0.014	0.424	0.810*	1.035+	0.166	0.007
	(0.47)	(0.68)	(-0.19)	(0.90)	(-0.03)	(1.30)	(2.14)	(1.91)	(0.20)	(0.02)

Table 9 (Cont'd)

	Bottom					Top				
	Total	Crop	Lives-tock	Self-employ-ment	Wage	Total	Crop	Lives-tock	Self-employ - ment	Wage
HH used improved seeds	0.171	0.134	-0.222	0.569	-0.035	0.419**	0.708**	0.005	0.095	-0.055
(1=Yes)	(1.12)	(0.62)	(-0.81)	(1.56)	(-0.24)	(2.59)	(3.62)	(0.02)	(0.23)	(-0.41)
HH used permanent labor	-0.301	-0.253	-0.027	-0.527	-0.050	0.096	0.478	0.503	-1.866+	-0.234
(1=Yes)	(-1.03)	(-0.61)	(-0.05)	(-0.75)	(-0.18)	(0.24)	(0.98)	(0.73)	(-1.83)	(-0.70)
HH hired seasonal labor	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
(1=Yes)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)
HH used animal traction	0.158	-0.418	0.224	0.454	-0.142	-0.186	-0.185	-0.040	0.240	0.096
(1=Yes)	(0.60)	(-1.17)	(0.49)	(0.75)	(-0.50)	(-0.69)	(-0.58)	(-0.09)	(0.35)	(0.42)
Total Tropical Livestock	0.016	0.073+	0.179**	0.018	-0.026	0.042	0.042	0.088*	0.076	0.013
units per HH	(0.54)	(1.85)	(3.51)	(0.27)	(-0.75)	(1.57)	(1.33)	(1.99)	(1.15)	(0.54)
Constant	8.806**	7.402**	1.625	6.176*	3.635+	7.456**	7.944**	1.565	-1.289	0.453
	(6.92)	(4.55)	(0.77)	(2.25)	(1.74)	(5.79)	(5.87)	(0.77)	(-0.41)	(0.13)
Observations	400	400	400	400	400	401	401	401	401	401
rho	0.322	0.000	0.061	0.000	0.921	0.294	0.000	0.154	0.223	0.961
R-Square	0.207	0.159	0.229	0.352	0.226	0.251	0.243	0.195	0.228	0.204

t statistics in parentheses; $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Source: Author's computation from TIA 2008 and Partial Panel 2011

2.5.2.3 DETERMINANTS OF INCOME POVERTY

2.5.2.3.1 HOUSEHOLD VARIATION OF INCIDENCE AND SEVERITY OF INCOME POVERTY

Although Walker *et al.* (2004) argues that the head count index is a crude measure of poverty and to acquire in depth knowledge about poverty, squared poverty gap is preferred as it provides information on how far people are from the poverty line. Jalan & Ravalion (1998) argue that the squared poverty gap index is a preferred empirical measure of poverty as it satisfies two important conditions: the convexity poverty function and the income transfer axion. Despite these arguments, this paper uses three poverty measures for a deeper understanding on the determinants of income poverty in rural Mozambique: headcount, poverty gap, and squared poverty gap.

The estimated parameters of determinants of poverty using the three most commonly used poverty measures are presented in Table 10 and Table 12. In the first column, head count index model is estimated in a dichotomous-variable Probit model with poor households assigned a value of one and non-poor a value of zero.

The second and third columns pertain to income poverty severity[11], the poverty gap and squared poverty gap estimated in Logit and Tobit models; respectively. The independent variables are the same as those used in the income regression models. Given that a value of one in the head count

[11] Note that these are aggregated population level indicators. Although poverty estimates are individual rather than household status, for empirical analysis the estimates were calculated at household level accounting for their composition given that the survey data was collected at household level rather than at individual level. To avoid, to make rather strong that that individuals enjoy the same level of welfare and accounting for the potential intra-household inequality, the total household income was conversion into AE and compared to the local poverty lines also converted to AE.

index is assigned to poor households, higher value in the severity measures indexes high severity, the negative signs of coefficients imply reduction of poverty and positive signs of coefficients reveal increase in poverty. As expected, many of the variables explaining variation in household income also explain variation of poverty, although with an opposite sign. Results in Table 10 indicate that keeping other factors constant, the incidence of poverty, poverty gap, and the squared poverty gap in 2011 were both significantly higher than in 2008 (a year of high food prices) by 23, 40, and 11 percent, respectively.

In fact, results show a poverty increase between the two survey years and they are consistent with the descriptive statistics in Table 5, highlighting the worsening of poverty in rural Mozambique between the two survey years.

The determinants of poverty in Mozambique have been well documented (Datt et al., 2000; Jayne *et al.*, 2003; Walker et al., 2004; Boughton *et al.*, 2005; Boughton *et al.*, 2006; Cunguara, 2008; MPD, 2010) using a variety of available nationally representative data. A common finding in those studies is the positive effect of the size of cultivated land/AE in reducing poverty. To some extent, results in Table 10 confirm the welfare effect of cultivated land size in poverty reduction. Although this relationship is true, the average farm size in rural Mozambique is very low, suggesting that creating conditions that encourage land expansion and utilization plays an important role in agricultural growth and poverty reduction. The cultivated land size does not have a significant effect on reducing incidence of income poverty although it increases significantly the total net household income and reduces severity of poverty.

Table 10: Determinants of incidence and severity of income poverty at local poverty lines

	RE estimation Models			IV-estimation Models		
	HC	PG	SPG	HC	PG	SPG
Year=2011	0.234**	0.398**	0.876+	0.240**	0.177**	0.094**
	(3.94)	(3.94)	(1.68)	(3.23)	(2.77)	(2.68)
HH lives in non-remote	-0.176*	-0.305*	-1.602**	-0.310**	-0.244**	-0.130**
village (1=Yes)	(-2.42)	(-2.46)	(-2.68)	(-3.75)	(-3.37)	(-3.27)
Log of cultivated land per AE	-0.033	-0.066	-0.765*	0.138	0.109	0.066
	(-0.82)	(-0.96)	(-2.29)	(0.87)	(0.82)	(0.96)
Male-headed HH (1=Yes)	-0.149	-0.252	-0.224	-0.321*	-0.242*	-0.144*
	(-1.34)	(-1.34)	(-0.26)	(-2.38)	(-2.22)	(-2.54)
Head's education (years	-0.017	-0.029	-0.087	-0.015	-0.003	-0.004
completed)	(-1.28)	(-1.26)	(-0.78)	(-0.89)	(-0.20)	(-0.48)
Males in secondary school	-0.073	-0.122	-0.436	0.036	0.020	0.016
(number)	(-0.99)	(-0.96)	(-0.71)	(0.41)	(0.25)	(0.42)
Head's age (years)	0.007**	0.011*	0.080**	0.007*	0.006*	0.003*
	(2.59)	(2.50)	(3.85)	(2.07)	(2.07)	(2.39)
Widowed head (1=Yes)	-0.174	-0.300	-1.249	-0.429*	-0.241+	-0.155*
	(-1.15)	(-1.18)	(-1.03)	(-2.42)	(-1.68)	(-1.99)
People aged 15-59 years	-0.041	-0.070	-0.660**	-0.031	-0.041	-0.017
(number)	(-1.40)	(-1.40)	(-2.85)	(-0.65)	(-0.99)	(-0.80)
People with self-employment	-0.187**	-0.336**	-1.308**	-0.151**	-0.206**	-0.082**
(number)	(-4.00)	(-4.15)	(-3.65)	(-2.74)	(-4.23)	(-3.43)
HH have access to credit	0.042	0.083	-0.279	0.042	0.181	0.076
(1=Yes)	(0.27)	(0.32)	(-0.20)	(0.20)	(0.95)	(0.76)
HH has good land quality	-0.128+	-0.225+	-1.333*	-0.110	-0.111	-0.049
(1=Yes)	(-1.87)	(-1.94)	(-2.30)	(-1.06)	(-1.25)	(-1.11)
HH used fertilizer (1=Yes)	-0.257+	-0.432	-1.172	-0.269	-0.254+	-0.135+
	(-1.66)	(-1.64)	(-0.90)	(-1.55)	(-1.80)	(-1.82)
HH used improved seeds	-0.249**	-0.430**	-0.868	-0.171+	-0.173*	-0.083*
(1=Yes)	(-3.56)	(-3.63)	(-1.54)	(-1.92)	(-2.34)	(-2.11)
HH used permanent labor	-0.171	-0.287	-1.416	-0.004	-0.082	-0.056
(1=Yes)	(-1.06)	(-1.02)	(-0.98)	(-0.02)	(-0.51)	(-0.69)
HH hired seasonal labor	-0.282**	-0.478**	-2.052**	0.000	0.000	0.000
(1=Yes)	(-3.61)	(-3.57)	(-3.06)	(.)	(.)	(.)
HH used animal traction	0.044	0.080	0.254	-0.017	-0.024	-0.019
(1=Yes)	(0.41)	(0.45)	(0.26)	(-0.14)	(-0.22)	(-0.32)
Total Tropical Livestock units	-0.019	-0.035	-0.136	-0.018	-0.018	-0.009
per HH	(-1.45)	(-1.55)	(-1.15)	(-1.06)	(-1.24)	(-1.22)
Constant	0.594*	1.012*	2.325	0.444	-0.388	0.125
	(2.54)	(2.57)	(1.30)	(1.36)	(-1.60)	(1.09)
Observations	2,334	2,334	2,334	2,334	2,334	2,334
Exogeneity test (p-value)				0.491	0.401	0.443

Marginal effects; *t* statistics in parentheses; + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$; District FE included
Source: Author's computation from TIA 2008 and Partial Panel 2011

Table 11: Determinants of incidence and severity of income poverty at $1.25/capita/day PPP

Variables	RE estimation Models			IV-Estimation Models		
	HC	PG	SPG	HC	PG	SPG
Year=2011	0.082	0.146	-0.009	0.054	0.032	0.017
	(1.12)	(1.13)	(-0.22)	(0.76)	(0.63)	(0.58)
HH lives in non-remote	-0.017	-0.023	-0.094^{+}	-0.099	-0.171**	-0.088**
village (1=yes)	(-0.18)	(-0.13)	(-1.91)	(-1.22)	(-2.96)	(-2.96)
Log of cultivated land per	-0.168**	-0.297**	-0.132**	-0.875**	-0.653**	-0.344**
AE	(-3.04)	(-3.05)	(-4.74)	(-7.85)	(-7.45)	(-6.56)
Male-headed HH (1=Yes)	-0.003	-0.004	0.028	0.143	-0.019	-0.013
	(-0.02)	(-0.01)	(0.36)	(0.89)	(-0.16)	(-0.21)
Head's education (years	-0.020	-0.036	-0.011	-0.013	-0.010	-0.005
completed)	(-1.02)	(-1.04)	(-1.19)	(-0.78)	(-0.86)	(-0.86)
Males in secondary school	-0.050	-0.091	-0.013	-0.045	-0.036	-0.007
(number)	(-0.53)	(-0.55)	(-0.26)	(-0.58)	(-0.63)	(-0.27)
Head’s age (years)	0.004	0.007	0.006**	0.001	0.002	0.001
	(1.04)	(1.03)	(3.47)	(0.24)	(0.66)	(0.86)
Widowed head (1=yes)	-0.222	-0.386	-0.077	-0.032	-0.122	-0.068
	(-1.01)	(-1.00)	(-0.73)	(-0.18)	(-0.86)	(-1.01)
People aged 15-59 years	0.161**	0.280**	0.015	-0.079^{+}	-0.054^{+}	-0.031*
(number)	(3.89)	(3.81)	(0.80)	(-1.67)	(-1.78)	(-2.06)
People with self-employment	-0.198**	-0.346**	-0.090**	-0.145**	-0.137**	-0.072**
(number)	(-4.01)	(-3.99)	(-3.46)	(-3.18)	(-3.94)	(-3.96)
HH have access to credit	-0.232	-0.401	-0.095	-0.284	-0.211	-0.114
(1=yes)	(-1.13)	(-1.11)	(-0.84)	(-1.56)	(-1.52)	(-1.62)
HH has good land quality	-0.101	-0.178	-0.109*	-0.379**	-0.297**	-0.155**
(1=yes)	(-1.11)	(-1.12)	(-2.32)	(-4.22)	(-4.41)	(-4.18)
HH used fertilizer (1=yes)	-0.415*	-0.712*	-0.072	-0.058	-0.032	-0.001
	(-2.20)	(-2.16)	(-0.68)	(-0.39)	(-0.28)	(-0.01)
HH used improved seeds	-0.190*	-0.336*	-0.024	-0.006	-0.016	-0.016
(1=yes)	(-2.10)	(-2.11)	(-0.51)	(-0.08)	(-0.28)	(-0.54)
HH used permanent labor	0.144	0.269	-0.006	0.106	0.079	0.028
(1=yes)	(0.68)	(0.71)	(-0.06)	(0.67)	(0.64)	(0.43)
HH hired seasonal labor	-0.313**	-0.548**	-0.155**	0.000	0.000	0.000
(1=yes)	(-3.17)	(-3.17)	(-2.96)	(.)	(.)	(.)
HH used animal traction	-0.084	-0.151	-0.012	0.101	0.082	0.041
(1=yes)	(-0.58)	(-0.60)	(-0.15)	(0.88)	(0.94)	(0.89)
Total Tropical Livestock	-0.027	-0.045	-0.010	-0.025	-0.019	-0.010
units per HH	(-1.50)	(-1.42)	(-1.15)	(-1.64)	(-1.50)	(-1.60)
Constant	2.313**	4.070**	1.099**	1.089*	0.419*	0.508**
	(5.71)	(5.53)	(6.57)	(2.47)	(2.11)	(5.41)
Observations	2,334	2,334	2,334	2,334	2,334	2,334
Exogeneity test (p-value)				0.000	0.000	0.000

Marginal effects; *t* statistics in parentheses; $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$; District FE included
Source: Author's computation from TIA 2008 and Partial Panel 2011

It is noteworthy that the results are sensitive to the poverty line that was used. Essentially, an additional percent of cultivated land/AE is capable of increasing household income, but the income gain is not sufficient to shift head count and poverty gap index of income poverty, but it allows shrinking the distance between income and poverty line (squared poverty gap index) by about 4 percent. This effect vanishes when the size of cultivated land/AE is considered endogenous. Under high poverty rates, especially when the international poverty line is used, the effect of the size of cultivated land/AE in reducing poverty is even higher, suggesting that increasing the size of cultivated land/AE is an important poverty reduction strategy under high poverty rates.

Since the transition to above the poverty line is discrete, a large income gain is needed to lift people out of poverty. Given that changes in the size of cultivated land/AE are very limited in rural Mozambique, the results of this paper echo the findings by Jayne *et al.* (2003) on the need to guarantee initial distribution of assets including land as essential for pro-poor growth and poverty reduction in developing countries. It is worth noting that increased sizes of cultivated land/AE require complementary services and assets, suggesting coordinated interventions not isolated and sporadic initiates.

In general, similarly to income, poverty is found to have asset, infrastructural, and demographic dimensions in rural Northern-Central Mozambique as reported in Table 10 and Table 11. Access to public transportation and good roads throughout the year and access to self-employment, reduces the incidence of income poverty in 31 and 15 percent, respectively. Similar results were found elsewhere in Africa, for instance, Dercon *et al*., (2009) found that access to all-weather

roads reduces poverty by about 7 percentage points while increasing consumption growth by about 16 percentage points. The use of improved agricultural technologies such as chemical fertilizer and improved seeds increase the chance of reducing poverty by about 27 and 17 percent, respectively. Results show that widowed heads are less likely to be poor as they may be benefiting from social ties within the families or social security program implemented by the government or from inherited resources from their deceased spouses.

Surprisingly, education, household size, head's education, the size of family labor, and access to credit were found to have no significant effect on poverty reduction, but have potential to increasing income. This suggests diminishing earning potentials with age when no cumulated resources or savings are available.

2.6 KEY FINDINGS

The key findings regarding to the effect of the size of cultivated land/AE on income and poverty are as follows.

No significant income change in total net household income and the size of cultivated land/AE has been observed between the two survey years. However, differential marginal effects are found based on income level between different household groups based on their size cultivated land/AE. Households in the bottom quintile observed higher crop income growth while those in the top income quintile observed larger increase in their self-employment income between 2008 and 2011. In general, head's age, infrastructures, and livestock matter the most for those in the

bottom quintile while the education and land management technologies are most important for those in the top quintile.

The size of cultivated land per AE was found to increase income mainly among those in the bottom quintile, but not the incidence of poverty when the lower poverty lines (local poverty lines) are used. With higher poverty rates (higher poverty line), the size of cultivated land/AE becomes an important asset to fight poverty in rural areas on both poverty measures, especially among the poorest households.

The availability of family labor does not have a direct effect on income per se, but what matters is the composition of the household, mainly the number of members with access to self-employment. This suggests that the family labor availability is absolved by lower earning opportunities and not in wage employment, perhaps given the limited wage employment opportunities characteristic of rural Mozambique.

Investing in infrastructures of transport such as public transportation and roads is more likely to have larger effect on the less poor households than on the extremely poor when wage employment opportunities and proper training are available. This study shows that households living in remote areas are worse-off compared to their counterparts living in accessible villages.

Access to other public services such as credit has significant welfare effect in general, especially on self-employment income.

Demographic and gender differential welfare effect was found in this study. Male-headed households and those headed by widows have high potential to increase income among the less land poor households than the land poor ones while also have significant chance of being poor under lower poverty rates (lower poverty lines) but their chances to being poor are insignificant when the poverty rates are high (higher poverty lines), suggesting a threshold in the effect of gender of the heads on poverty reduction. Similar is true for educated heads. On the other hand, older household's heads have negative effect on income, especially among the land poor households.

Regarding agricultural technologies, the study concludes that fertilizer use, improved seeds, and hiring seasonal labor for agricultural production have significant effect in increasing incomes and reducing poverty with both low and high poverty lines.

The policy implications from this study include: promoting agricultural technologies, rural financial services, risk coping strategies through establishment development of drought resistant crop varieties; small and medium enterprises for self-employment, vocational training programs in employable skills, facilitating access to input and output markets through improving and expanding infrastructures, promoting and implementing land reforms to ensure that the cash constrained households have access to land, providing public services (e.g. education and employment), and investing in physical infrastructures (roads and transports). The magnitude of the effects of such policy interventions are estimated in chapter 3.

3 THE INITIAL LANDHOLDINGS ENDOWMENTS AND THE ABILITY OF PEOPLE TO MOVE OUT OR INTO POVERTY, CHRONIC OR TRANSIENT POVERTY: EVIDENCE FROM RURAL NORTHERN-CENTRAL MOZAMBIQUE

3.1 INTRODUCTION

While poverty is well documented in Mozambique, few studies have systematically used the existent panel data to assess the pathways out of poverty or made distinction between chronic and transitory poverty and their determinants. A study of such nature is of interest to policymakers, development practitioners, and economists. Motivated by the fact that the available poverty studies report a relatively small or no poverty change over time as found in chapter 2, this paper contributes in the poverty literature by investigating the pathways out of poverty as well as by identifying the prevalent type of poverty (chronic or transient), its severity and determinants. The distinction between transitory and chronic is of important value for policy makers and development economists, as it gives guidance of whether the safety net or more activist policies to remove poverty traps are the focus (Dang *et al*., 2014). As noted by Jalan & Ravalion (1998), to design policies to harness poverty it is necessary to know the severity of each component of the total poverty to determine whether chronic or transient poverty are determined by the same or different factors.

Few studies have analyzed the pathways out of poverty focusing on land as an important factor or the correlates of chronic and transitory poverty, more specifically on the effect of the size of the initial cultivated land/AE. The aforementioned literature gaps motivate this study, which aims to assess poverty dynamics identifying the major "*push*" and "*pull*" forces into or out of poverty. According to Lohamo (2009), poverty dynamics provide rich insights into poverty

mobility as it allows providing information needed to design poverty reduction policies according to the nature of poverty in question in order to improve the targeting efficiency of the scarce resources in rural areas.

By understanding the poverty reduction effect of the size of the initial cultivated land/AE, this study aims to shed light in strategic incorporation of land issues in the poverty reduction agenda in a line with arguments presented by Jayne *et al*. (2003). The starting point for addressing the land issues is to understand its initial distribution because literature including Jayne *et al.* (2003) have shown that the initial distribution of assets including land affect the economic growth and poverty reduction. Gugerty & Timmer (1999) argues that in countries with an initial good distributions of assets both agricultural and non-agricultural growth benefitted the poorest household slightly more in percentage terms, while in the countries with bad initial asset distribution, the economic growth was skewed towards the wealthier households, causing larger gap between rich and poor.

In fact, even if one has identified the pathways out of poverty; one important aspect is whether there policies will have similar effect on addressing chronic and transitory poverty or whether the determinants of chronic differ from those of transitory poverty. To answer those questions, one needs to decompose poverty into chronic and transient components. As argued by Garza-Rodriguez *et al*. (2010), the chronic poverty is more unfair and damaging than transient poverty, because a chronically poor person have been in such state for long period of time, which may lead to a damaging social fabric of the society likely to lead to political instability. As such, understanding the causes and consequences of these types of poverty is very important in policy

making arena. However, as presented by Cunagura (2008), to distinguish transitory from chronic poverty possess an important methodological challenge in poverty analysis. It becomes much more challenging when using a two-period three-year panel to make this distinction with certainty and large panel periods would be appropriate.

So, this study aims to investigate the effects of the size of the initial cultivated land/AE endowments on the ability of people to move out or into poverty and the determinants of chronic and transient poverty, using two-period three-year panel as well as to understand whether the determinants of chronic and transient poverty are congruent. Having the clear picture about the landholdings dynamics, the study proceeds to investigate empirically the poverty reduction potential of the size of cultivated land/AE in rural Mozambique by estimating the pathways out of poverty. The research questions to be addressed in this study are: i) what is the effect of the initial landholdings endowments on ability for people to move out or into poverty? ii) are the determinants of chronic and transient poverty congruent? iii) what are the potential policy interventions leading to poverty reduction?

3.2 POVERTY TRENDS IN MOZAMBIQUE

Poverty incidence in Mozambique remains high with large variation. Results of the three consecutive surveys, namely: The Household Survey 1996/97 (IAF96) covering cropping season 1996/97, the Household Survey 2002/03 (IAF02) covering cropping season 2002/03, and the Household Budget Survey 2008/09 (IOF08) covering cropping season 2007/08; found high rates of poverty incidence but decreasing from 70 to 54 percent between 1996/97 to 2002/03, while between 2002/2003 and 2008/2009 this rate remained practically unchanged, despite sustained economic growth (MPD, 2010). As reported by the Ministry of Planning and Development, there

is a wide regional variation in the level of poverty in Mozambique, ranging from 48 to 88 percent in 1996/97, from 36 to 81 percent in 2002/03 and from 32 to 71 percent in 2008/09. The change of poverty over time also shows regional variation, including: i) sustained poverty reduction observed in only 3 provinces, including from 71 to 52 to 32 percent in Niassa; from 82 to 60 to 42 percent in Tete; and from 83 to 81 to 58 percent in Inhambane; ii) stagnant poverty in 2 provinces, namely: Gaza and Maputo Province around 65 percent; and iii) poverty rate bouncing up and down in the remaining 6 provinces, including for instance from 68 down to 45 and up to 70 percent in Zambezia and from 48 up to 54 and down to 36 in Maputo city.

Reducing rural poverty has been the main policy concern in Mozambique. To this end, the government developed and is implementing a set of development programs and policies including the national *Action Plan for the Reduction of Absolute Poverty (PRSP),* such as*:* the first Mozambique's PRSP, PARPA I approved in April, 2001 covering the period 2001-2005 (Government of Mozambique, 2001), PARPAII approved in May, 2006 and implemented with a time-frame 2006-2009 (IMF, 2007), and Poverty Reduction Action Plan (PARP 2011-2014) approved in May, 2011 (IMF, 2011), implemented in the time-frame 2011-2014.

Representing the continuation of PARPAII implemented with a time-frame 2006-2009 and extended to 2010 with main objective to reduce the incidence of food poverty from 54.7 in 2008/09 to 42 percent by 2014, PARP 2011-2014 is medium-term strategy of the Government of Mozambique to operationalize a five-year Government Program 2010-2014, aiming at achieving an inclusive economic growth for reducing poverty based on the following general objectives: i) to increase output and productivity in the agriculture and fisheries sectors, ii) to promote employment; iii) to foster human and social development, while paying attention to (iv) good

governance; and macroeconomic affairs and fiscal management (IMF, 2011). According to the International Monetary Fund (IMF, 2011), the total budget for the period 2011-2014 was expected to rise from 132 to 187 billion Meticais, with expected government revenues at the same period to rise from 73.3 to 125.7 billion Meticais and the impact evaluation is expected to be conducted in 2015.

Through these Poverty Reduction Papers, the government of Mozambique has committed itself to reducing poverty from 70 percent in 1997 to 40 percent by 2015 (MINAG, 2010). Several sectoral interventions to reduce poverty have been implemented by the government of Mozambique, including: the construction of silos with 50,000 metric ton capacity for grain storage in Tete province, improvement of infrastructure such as the construction of the bridge across Zambezi river which links the main production to consumption areas (Mabiso *et al*. 2014) and increasing agriculture production. All these interventions witness an impressive economic growth.

3.3 A DESCRIPTION OF THE DATA AND LIMITATIONS

The data for the analysis are described in Section 2.2.

Although these data contain information on agricultural sector, some limitations are observed such as lack of information on physical wealth found in earlier research as associated with low poverty and important to decreasing transient and chronic poverty (Jalan & Ravalion, 2000, Muyanga *et al*., 2006). The distance to markets, road, schools, and health-posts, commonly used as measurements of infrastructures are also lacking in the data set. As found by Muyanga et al.

(2006), distance to markets is positively associated with total poverty while Adakhiri *et al*. (2014) found in Nepal that, distances to primary schools and health-posts as significant determinants of food consumption. For instance, they found that a house that is as twice as far away from a hospital compared to another house reduces the consumption by 9 percent. With these earlier findings in mind, these omitted variables would have had effect on the ability of exiting poverty as well as reducing the vulnerability of chronic poverty.

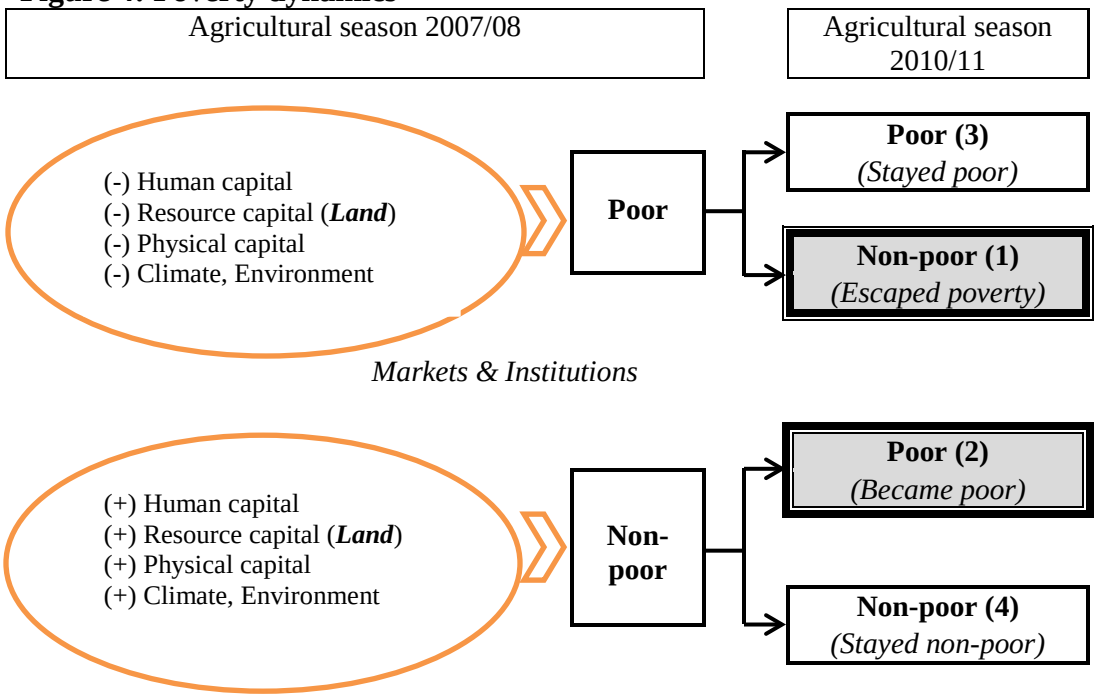
3.4 CONCEPTUAL FRAMEWORK

It has been recognized in poverty literature that poverty is not contained in an income-distribution decile graph nor in income inequality, because they say nothing about mobility of people along the income distribution decile (Dang *et al*., 2014). To assess the mobility of people along the income distribution and over time, the conceptual framework depicted in Figure 4 was adopted. For easy exposition of the framework, consider two rounds of surveys (2008 and 2011) in which households observed movements on their incomes and poverty levels for various reasons. The household can start as poor on non-poor depending on whether they have good or bad stock of various types of capital under their possession, represented by positive and negative sign in the diagram; respectively.

This framework recognizes four possible transition states that people may enjoy over time: chronically poor, transitorily poor, transitorily non-poor, and never poor. According to Carter & Barrett (2006), transitory poverty has to do with peoples' ability to use the stock of productive assets under their control, but it can also be due to bad luck. According to these authors, people may also have intrinsic characteristics that create conditions to move from lower to higher level of well-being. Moving from poor to non-poor can represent various experiences. As noted by

Carter & Barrett (2006), these transitions may be structural but can also be stochastic. The transitorily non-poor can be due to asset accumulation or enhanced returns to assets already owned. Similarly, transitorily poor could be due a stochastic return to previous level of well-being resulting from good luck after a brief time of starvation resulting from drought spell, output price fluctuation but could also be due to deterioration of returns or loss of assets.

Figure 4: Poverty dynamics



3.5 ESTIMATION STRATEGY AND EMPIRICAL MODELS

3.5.1 MODELLING ROUTES OUT OR INTO POVERTY

As presented by Cunagura (2008), to distinguish transitory from chronic poverty is an important methodological challenge in poverty analysis. It becomes much more challenging when using a two-period three-year panel to make this distinction with certainty and large panel periods would be appropriate. Hopefully, an alternative is offered McKay & Lawson (2002); McCulloch & Baulch (1997), consisting in using the predicted values from the regression of income per adult

equivalent on its drivers in order to identify the household-specific transitory shocks. The assumption is that the predicted income is more likely to reflect long-term earning potential than the current income (Cunguara, 2008); therefore, the predicted income values are used to group households into four mutually exclusive groups as depicted in Figure 4: (1) Movers: who were poor in 2008 and escaped poverty by 2011; (2) Entrants: who were non-poor in 2008 but became by 2011; (3) Chronic poor: who were poverty in both periods; and (4) Always non-poor: who was always non-poor in both 2008 and 2011.

The estimation strategy consists in three main steps:

First, using the predicted household income per AE, the households are divided in four mutually exclusive groups based on the poverty transition status:

1) Movers: who were poor in 2008 and exit from it by 2011;
2) Entrants: who were non-poor in 2008 but became by 2011;
3) Always poor: who were found in poverty trap in both 2008 and 2011; and
4) Always non-poor: who were always /non-poor in both 2008 and 2011

Second, the transition probability matrix[12] was constructed to test the mobility of the individual households in terms of income per AE and the immobility index was estimated. The immobility index was calculated by dividing the sum of frequencies on the main diagonal of the transition matrix by the total number of surveyed panel households. The dependence of households'

[12] The transition probability matrix estimates the probability of transition from one state to another expressed as: $P_{ij} = \Pr\left(X_t = j \middle| X_{t-1} = i\right)$, *where* P_{ij} *is the probability to move from state* i *to* j.

livelihood status (poverty) of 2011 on the status of 2008 was tested using Chi-squared value. Essentially, it tests the null hypothesis of independence between the two years.

Third, the forces pulling into or pushing out of poverty were found by estimating a multivariate regression in each group to identify the statistically significant characteristics and perform a between group comparison of these characteristics across these four types of households. More explicitly, the following expression is used to track the pathways of exit from poverty:

$$P_i = \beta_0 + \beta_1 Land_{i08} + \beta_2 X_{i08} + \varepsilon_{i08} \quad (4)$$

where P_i is the probability of being in one group (becoming poor relative to those always non-poor or moving out of poverty relative to those always poor), $Land_i$ represent the size of cultivated land/AE, X_i other covariates in the baseline including: characteristics of the household head, household demographics, household human capital, sector of economic activity, areas of household agricultural activity, habitation, and fixed location effects (represented by dummy variables). The last term ε represents a residual error term that is assumed to be identically distributed and independent of the explanatory variables. The dependent variable takes one of the four discrete indicators indicating the poverty or status of the household. While a number of explanatory variables are included in the model, the focuses on landholdings. As the goal is to analyze to what extent the initial endowments might affect the livelihoods of the households over time, the 2008 values of the explanatory variables are used in the regressions.

In essence, this model tries to estimate the structural reasons of transitions as it estimates the amount of assets (land) needed to explain the observed transition from one status to another. Rejecting the null that their assets are expected to yield income stream below the poverty line denotes transitory poverty while failing to reject is interpreted as structural poverty. The latter is of most importance for policy design as it represents a chronic poverty.

Previous literature has shown that the key characteristics of households who escaped poverty differ from those which remained poor or entered into poverty (Lohamo, 2009). With particular interest on the cultivated land size, Lohamo (2009) show that the ascending poor households are the only group that observed increases in land ownership while the descending poor observed a decline in net area sown.

3.5.2 TRANSITORY AND CHRONIC POVERTY

Even if one has identified the pathways out of poverty, one important aspect is to identifying which type of poverty is prevalent (chronic or transient), to assess whether policies will have similar effect on addressing chronic and transitory poverty or whether the determinants of chronic differ from those of transitory poverty. To address these issues, one needs to decompose the total poverty into chronic and transient. As argued by Garza-Rodriguez et al. (2010), the chronic poverty is more unfair and damaging than transient poverty, because a chronically poor person have been in such state for long period of time, which can lead to a damaging social fabric of the society likely to lead to political instability. As such understanding the causes and consequences of these types of poverty is very important in policy making arena. In general, mixed results are found concerning the congruency between transient and chronic poverty determinants. While in Latin America and Asia, studies found that variables explaining transient

poverty are different from those explaining chronic poverty (Garza-Rodriguez *et al*., 2010; Jalan & Ravalion, 2000); in Southern Africa, these differences are minimal, as per example from Kenya, (Muyanga *et al*., 2006).

As reported by MPD (2010), one of the Millennium Development Goals (MDGs) for Mozambique is to reach an absolute consumption poverty rate of 40 percent by 2015, from an estimated 80 percent in 1990 and 40 percent in 2015. To meet this goal, implementing development projects aiming to meet three types of needs, namely: (1) "*primary needs*" which includes food, shelter, and clothing; (2) "*secondary needs*" composed by health, income, and education; and (3) other needs which are essentially food production and subsistence, export commodity production, and integrated rural development which involves comprehensive development issues such as physical and socio-economic dimensions including support infrastructures and institutions are essential. Consistent with these general objectives and given the government priority of reducing poverty, to systematically assess the distinction between transitory and permanent poverty, the suggestion is to focus on asset accumulation by households and their access to public goods and services, which is a sort of asset-based poverty measure. This indicator reflects long-run material development processes, and less susceptible to short-term fluctuations than other measures such as consumption (MPD, 2010). According to MPD (2010), these poverty dimensions are mostly seen by households as important in their livelihoods aside from only meeting their basic consumption or monetary needs.

Given that data limitation to implement the approach described above, the distinction between chronic and transitory poverty is based on the framework developed by Jalan & Ravalion (1998),

which recognizes that chronic poverty is results of household characteristics that prevent people from meeting their basic needs resulting from long periods of limited income while the transitory poverty is results of income and other shocks which associated with household characteristics prevent them from meeting their basic needs temporarily.

Yaqub (2000) identifies two methods to distinguish chronic from transient poverty: the spells and components methods. The spells method defines chronically poor depending on the number of times the household has been in poverty. In essence, the emphasis is on the time that an individual experience deprivation (Harper et al., 2003) which is advanced by Hulme & Shepherd (2003) as five or more years. The components method identifies chronically poor if the individual's permanent income is below the poverty line.

The components method was adopted due to its advantages over the spells method. The attractiveness of the components method reside to the fact that it considers income transmission between periods (Aaberge & Mogstad, 2007) and considers the depth of poverty (MacKay & Lawson, 2003) while the spells methods do not.

Drawing on insights by Jalan & Ravalion (1998); Dulcos *et al.* (2006) in China, Garza-Rodriguez et al. (2010) in Mexico, Ribas & Machado (2007) in Brazil, Panganiban (2010) in the Philippines and Muyanga et al. (2007) in Kenya, to distinguish between chronic and transitory poverty, consider the following decomposition in general terms. Let (y_{i1}, y_{i2},.., y_{iT}) be the household i's (positive) normalized income stream over T years. At any point in time t, a household i's poverty is expressed as P_{it}^{α} based on poverty measures developed by Foster *et al.*

(1984). Jalan & Ravalion (1998) claim that using $\overline{y_i} = t^{-1}\sum_{t=1}^{T} y_{it}$ as an estimate of household i's "permanent income", then the chronic poverty is estimated by replacing household's income y_{it} (Equation 2) for all periods t by the estimated permanent income, result in an estimate of chronic poverty for the household i, $P_{it}^{C\alpha} = t^{-1}\sum_{t=1}^{T}(1-\overline{y_i})^{\alpha}$. Then, the transitory poverty is the difference between the total poverty and the chronic poverty, which is thus given by: $P_i^{T\alpha} = P_{it}^{\alpha} - P_{it}^{C\alpha}$. To obtain the regional level estimates of chronic, transient, and total poverty, the estimates of each type of poverty are summed (excluding the noon-poor), divided by all sample households, irrespective of their poverty status.

For empirical estimation of determinants of transitory and chronic poverty, the squared poverty gap is used and two models are estimated by a regression of each poverty measure ont a set of explanatory variables. The initial characteristics are used as explanatory variables. The choice of squared poverty gap is because this measure of poverty that meets several conditions for empirical work, including the convexity of the poverty function and the transfer axiom as defined by Jalan & Ravalion (1998).

The models are regressions of measures of chronic and transient poverty on the same set of explanatory variables as before. For the chronic poverty, the econometric model is expressed as:

$$P_i^{C\alpha} = C_i = \begin{cases} C^{*} \, if \, C^{*} > 0, \, where \, C^{*} = x_i'\beta^{C} + + \varepsilon_i^{C} \\ 0 \, otherwise \end{cases} \qquad (5)$$

Where C^* is latent variable and C_i is the observed chronic poverty, β^C a vector of estimable parameters and x_i a set of explanatory variables, and ε_i are the model error terms.

Similarly, the transient poverty model is estimated as:

$$P_i^{T\alpha} = Tr_i = \begin{cases} Tr^* if\, Tr^* > 0, where\, Tr^* = x_i'\beta^{Tr} + +\varepsilon_i^{Tr} \\ 0 otherwise \end{cases} \quad (6)$$

Finally, given that the significant number of observations of the dependent variables take value of zero for non-poor, to deal with this censored data issue, the censored quantile regression techniques are used following Jalan & Ravalion (1998) to address the limitation of the usual Tobit model because which is not robust to misspecification and the estimates are inconsistent and inefficiency in the presence of heteroscedasticity and non-normality in the distribution of error terms. According to Panganiban (2010), Quantile regression has advantage of being robust to distributional misspecification in the error terms and large outliers in the income data as the one used in this study. Following Garza-Rodriguez et al. (2010), to focus on the poorest, the 70th quantile is used for chronic poverty and 90th quantile for transient. The bootstrapping techniques were used to obtain the standard errors of the parameter estimates.

3.5.3 POLICY SIMULATIONS

Policy simulations are done to compare differential impact effects of various policy scenarios compared to the base scenario by changing policy parameters to reflect the current and potential policy changes likely to generate desirable outcomes. The base is estimated by setting the variables at their means.

Given that Mozambique's economy is heavily dependent on agriculture, which constitutes 24 percent of the national GDP and employs 80 percent of the active population (a majority of which is made up of women who work in lower level jobs) and considering that 60 percent of the national population lives in poverty and 43 percent of children under five are stunted (USAID, 2014), the economic development and poverty alleviation are therefore highly depended on agricultural growth. Therefore, focus on agricultural growth is central for the Mozambique's economic development. Consistent with previous studies elsewhere showing that the poverty of rural households is directly associated with the decrease or stagnant agricultural growth (Lohamo, 2009), the candidates for the policy analysis includes but not limited to: education, landholdings, and agricultural technology adoption.

The policy simulations are conducted as follows: (1) for each household in the sample, the first-difference model is estimated by changing the levels of selected policy variables above to obtain new predicted change in income/AE between 2008 and 2011; (2) the predicted changes in income/AE are added to the predicted income/AE for 2008 to obtain the revised income/AE in 2011, resulting from changes in policy variables; and (3) the poverty measures (headcount, poverty gap, and poverty gap square) are computed using the predicted original (2008) and revised income/AE in 2011. The re-estimated headcount index and squared poverty gap measures are then compared to the initial values and the percent changes from the initial values are calculated, which reflects the poverty impact from the policy simulations.

3.5.4 CORRELATES OF POVERTY

To implement the conceptual framework adopted for this study, it is hypothesized that the ability of a household to move out or into poverty and to move out of transitory and chronic poverty is a

function of its demographic characteristics (including education, age of the head, family labor), the access to rural services, agricultural production, agricultural technologies, and the assets that the households have access to and able to control as described below.

3.5.4.1 HOUSEHOLD DEMOGRAPHY

The variation on household characteristics is believed to be highly correlated with the poverty transition. For instance, the human capital theories argue that household earnings potential is a function of education attainments and age (Muller, 2002). Therefore, the initial household head's education and age are added in the model as continuous variables.

In fact, several studies have found that higher level of education of the household members decreases the likelihood of falling into poverty. Muyanga *et al*. (2007) found that household headed by educated heads experience more chronic than transient poverty. Garza-Rodriguez *et al*. (2010) found that illiteracy is inversely associated with transient poverty in Mexico, perhaps due to the fact that illiterate people are more likely to earn lower income and can hardly aspire to earn high incomes in the course of their lifetime.

To concur with earlier findings that the success of education in poverty reduction hinges on students exceeding beyond secondary school education (Muyanga *et al*., 2007) and that a change of household head's education from no-education to post-secondary education increases income by 34 percent in Kenya (Muyanga *et al*., 2013), the number of male household members with secondary school were included in the model.

Jalan & Ravalion (2000) found some evidences of life cycle events being determinants of transient poverty but falling up to 45 years of age. In their study, they found that household characteristics such as household size, education levels of the head, the labor force are more important for chronic poverty than transient poverty. On the other hand, Muyanga *et al*. (2013) found that asset holding is an increasing function of household size and age of household. As per this evidence, age of the household head was included.

Gender differences are also important poverty determinants. Garza-Rodriguez *et al*. (2010) found that male household head decreases both total and chronic poverty in Mexico while Muyanga *et al*. (2006) found that female-headed tend to experience more chronic than transient poverty in Kenya. Therefore, the gender of the household head was hypothesized to influence poverty. The household gender dummy is also included to capture gender differences in the model.

Given that the household size was found to be both burden and blessing in household livelihoods in the earlier studies. To test these relationships, in this study, the number of adult and active members was added to the model to capture the potential of income generation which is hypothesized to be more linked to transient poverty than chronic poverty as well as with the potential to move out of poverty. Muyanga *et al*. (2006) found that households with large dependence ratios experienced chronic poverty as opposed to transient poverty but, Garza-Rodriguez *et al*. (2010) found an inverse relationship between the household size and transient poverty, perhaps because the greater the number of people contributing to household income the higher the strength the household has to cope with external to reduce income variability which is the main cause of transient poverty.

3.5.4.2 RURAL SERVICES

Rural services such as infrastructures, access to credit, and self-employment were added to the models to capture their ability to reduce poverty in rural settings. Muyanga *et al*. (2007) for instance, found in Kenya that households that accessed credit either in cash or kind were less likely to be poor than those that did not.

With respect to infrastructures, Muyanga *et al*. (2013) found that a one Kilometer decrease from homestead to the nearest motorable road increases ascenders' asset wealth by 15 percent. A lower effect is found with respect to distance to health-post, where a one kilometer decrease increases income for poverty ascenders, descenders, and consistently non-poor by 2, 3 percent; respectively. Given the limitation of measures of distance, the present paper assessed the infrastructural effect through a dummy variable measuring remoteness of the village, defined as a village with public transport and roads transitable throughout the year assigned a value of zero and one otherwise.

3.5.4.3 AGRICULTURAL PRODUCTION AND TECHNOLOGIES

Higher agricultural production and the usage of improved agricultural production technologies are associated with ability to exiting poverty and transient poverty than chronic poverty, thus, added to the models. Muyanga *et al*. (2007) found that households that adopted modern productivity enhancing technologies such as fertilizer were less likely to face chronic poverty.

3.5.4.4 HOUSEHOLD ASSET ENDOWMENTS

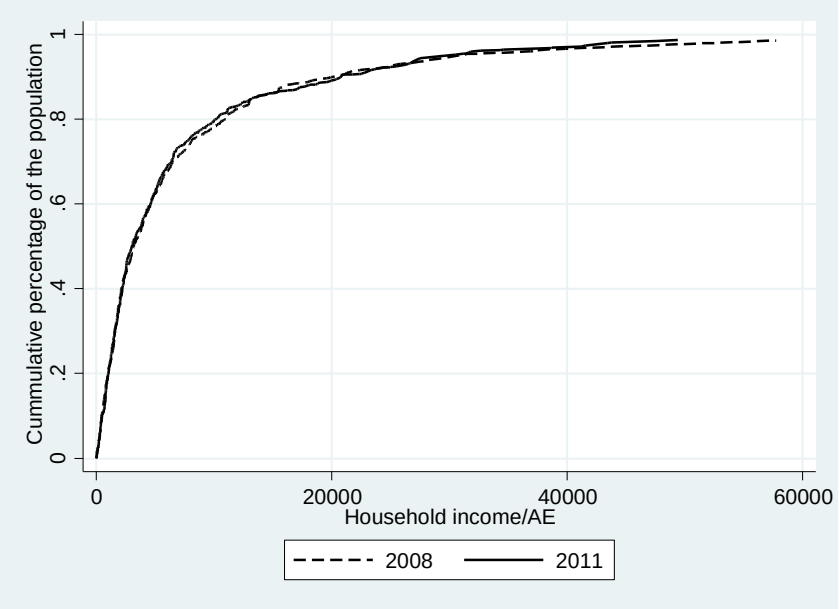
As indicated by Jayne *et al*. (2003), the initial asset endowments are important for pro-poor growth. Jalan & Ravalion (2000) found in China that households with large cultivated areas are less vulnerable to chronic poverty. Large cultivated areas were found to be positively associated with high income in Nepal (Adhikari *et al*., 2014). To account for these relationships, the cultivated land size and livestock possession measure as total household tropical livestock units were added into the models.

3.6 RESULTS

3.6.1 DESCRIPTIVE EVIDENCE

Analyzing panel households, the first question one would address is whether the income and cultivated land size of one period is superior/inferior to the other. For that purpose, the first-order stochastic dominance was used to compare the distributions of income of 2008 and 2011. With the stochastic dominance, the assumption is that certain distribution dominates completely the other. Essentially, the cumulative distributions of income per adult equivalent of 2008 and 2011 were plotted (Figure 5) and observed that the conditions for first-order stochastic dominance are violated, i.e. the distributions intercept each other, therefore it cannot be concluded that the incidence of poverty of one year is higher (lower) than the other. Given that the first-order stochastic dominance (equivalent to headcount) was not achieved, higher order stochastic dominance can be tested, the second and third, corresponding to poverty gap and squared poverty gap to assess whether poverty have declined or risen over time.

Figure 5: First-order stochastic dominance of total net income/AE

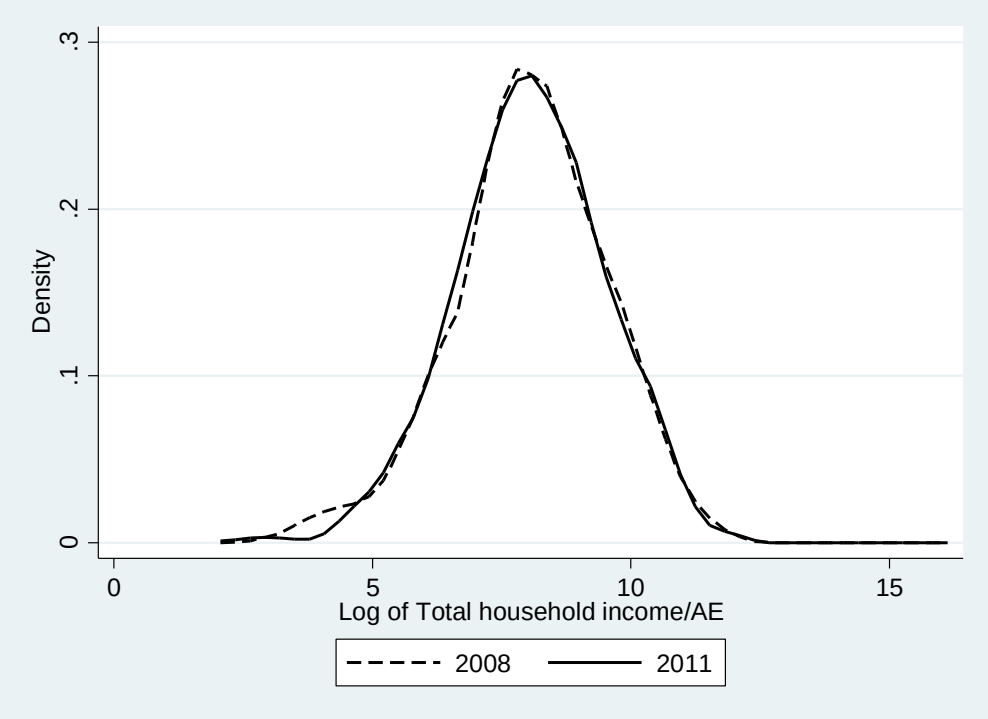


Source: Author's computation from TIA 2008 and Partial Panel 2011

Figure 6 presents trends in total income over two years. Results show little and insignificant change was observed between 2008 and 2011 in aggregate terms.

Ideally, one would want the entire income distribution to shift to the right to indicate an improvement in welfare and economic conditions of households. The distributions seem to have remained the same except the fact that the distribution of 2008 was more spread than that of 2011. Tails of both distributions did not change.

Figure 6: Distribution of Total net income/AE



Source: Author's computation from TIA 2008 and Partial Panel 2011

To better understand these dynamics, the transition matrix in Table 12 is used, showing the proportion of households in base-period income belonging to a specific income quintile end up in a final-period income group.

Table 12: Transition matrix on total net household income per AE, 2008-2011

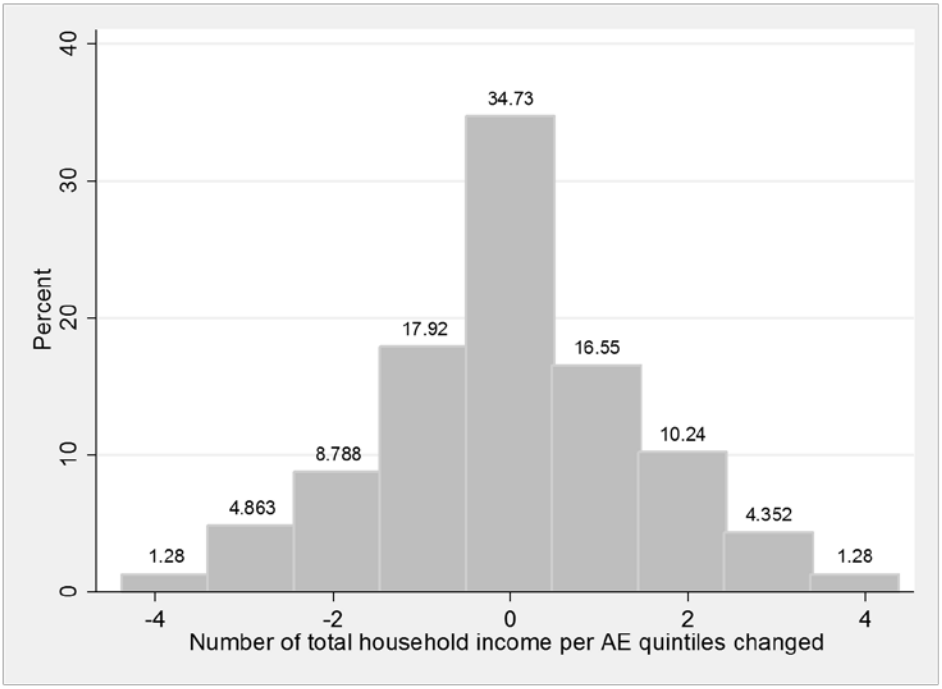
		Household total net household income per AE quintiles 2011					
		1st (Bottom)	2nd	3rd	4th	5th (Top)	Total
Total net household income per AE quintiles 2008	1st Quintile (low)	38.2	26.2	15.8	12.7	7.1	100.0
	2nd	19.1	30.3	20.7	20.0	10.0	100.0
	3rd	21.5	23.9	23.2	22.1	9.4	100.0
	4th	12.6	12.6	21.1	34.5	19.2	100.0
	5th Quintile (high)	6.0	11.1	19.1	13.7	50.0	100.0
Total		19.3	20.8	20.1	20.8	19.1	100.0

Source: Author's computation from TIA 2008 and Partial Panel 2011

When no mobility is observed, one would expect to see an identity matrix, where the diagonal elements would sum to 100 percent (equivalent to an immobility index of 1). Results show high immobility with the immobility index of 0.65. Although the total net income per AE did not change significantly over time, subtle dynamics have been observed between 2008 and 2011. Results in Table 12 show that from those that were in bottom quintile in 2008 about 7 percent of them have moved up to fifth quintile in 2011, suggesting that extremely poor households are not doomed to remain in their status quo.

Figure 7, illustrates the quintiles movement between the two survey years. Households moving backwards are those that were in lower quintile in 2008 and ended up in higher quintiles in 2011. For instance, households that moved four quintiles backwards are those that were in first quintile in 2008 and moved to the highest quintile in 2011, likewise those than moved four quintiles forward were in highest quintile in 2011 but were among the poorest in 2008. The distribution of number of quintiles is symmetric, suggesting no significant differences are observed in number of quintile movement over time as represented in Figure 6, consistent with results in Figure 5 and Figure 6.

Figure 7: Number of household net income per AE quintiles changed, 2008-2011



Source: Author's computation from TIA 2008 and Partial Panel 2011

As reported in Table 13, following the panel households over time reveals that 18 percent of the poor were unable to rise above the poverty line over 2008-2011 (persistent poverty) while about 34 percent of households observed transitory poverty. Looking at the transitory nature of poverty, it appears that more households are moving into than out of poverty estimated at 13 percent and 21 percent; respectively. With transitory poverty rate greater than the persistent poverty, safety net policies addressing the causes such high rate of entry compared to the rate of exit are key policy interventions. This aspect is discussed in more detail later in section 3.6.2.

Table 13: Transition in and out of income poverty, 2008-2011 (in percentage of households)

Poverty status in 2008	Poverty status in 2011		
	Non-Poor	Poor	Total
With local poverty lines (Estimated poverty = 36%)			
Non-poor	47.5	20.9	68.4
Poor	13.3	18.4	31.6
Total	60.7	39.3	100.0
With $1.25/day poverty line PPP (Estimated poverty = 79%)			
Non-poor	11.2	11.4	22.6
Poor	9.3	68.1	77.4
Total	20.5	79.5	100.0

Source: Author's computation from TIA 2008 and Partial Panel 2011

Table 14 presents the transition probability matrix to assess the probability of moving from one state to another. In general some 61 percent of non-poor remained non-poor and the remaining 39 percent became poor. Those poor in 2008 have about 44 percent chance of being non-poor in 2011 and 56 percent change of remaining poor in 2011. Those non-poor in 2008 had about 70 percent of remaining non-poor in 2011 and only 30 percent chance of being poor in 2011. Once again, this reveals the high immobility of households in the two survey years. This is not surprising, considering the short time period in the analysis acknowledging the lower rural income levels observed.

Table 14: Transition probability matrix, 2008-2011 (in percentage)

Poverty status in 2008	Poverty status in 2011		
	Non-Poor	Poor	Total
With local poverty lines (Estimated poverty=36%)			
Non-poor	69.5	30.5	100.0
Poor	43.7	56.3	100.0
Total	61.4	38.6	100.0
With $1.25/day poverty line(Estimated poverty = 79%)			
Non-poor	51.1	48.9	100.0
Poor	12.3	87.7	100.0
Total	21.2	78.8	100.0

Source: Author's computation from TIA 2008 and Partial Panel 2011

3.6.1.1 CHARACTERISTICS OF SAMPLED HOUSEHOLDS

The characteristics of sampled households are presented in Table 15. Results identify the major forces behind the improvement of livelihoods and reduction of poverty in rural Mozambique by comparing household characteristics across the four transition groups to identifying factors that helped families to move from one group to another. Several interesting observations can be made.

First, the *movers* are the only group that reported increases their cultivated land size while all others observed a reduction in the average cultivated land size. Therefore, policies and strategies that encourage land expansion still appear as an avenue for exiting from poverty. Similarly to land expansion, the *movers* also observed increased access to public services such as infrastructures development. On the other hand, those who became poor in 2011 reduced their cultivated land size by about 11 percent in 3 years and lower proportion had access to transportation infrastructure. The *entrants* have generally older household heads than all other groups. The *always poor* households remained mostly with smaller land size, turned mostly female-headed with decreased level of education of their heads, suggesting that heads changed over time.

Second, the *movers* increased their production in cereals, and are the only group that observed increase in the number of household members with self-employment, in all other groups the number of people with self-employment decreased between the two survey years. Similarly, the *movers* also are the only group observed large access to quality land compared to the rest. The *entrants* experienced the largest drop in the number of household members with self-

employment while increasing the proportion hiring seasonal labor and a drop on crop yields. It appears that the entrants have shifted from crop production to livestock production as noted by the significant increase over time on their tropical livestock units from 0.57 to 0.87 in 3 years.

Third, the *always non-poor* households are the group that experienced the highest increase in access to credit while the *entrants* observed the largest drop in the proportion of households with access to credit. With only about 3 percent of household in 2008 that had access to credit, this proportion more than doubled in 2011 (to 7.4 percent). The proportion of *always non-poor* households with good quality land is higher than that of entrants. Results in Table 14 show that more than one-third of households in this group reported using good quality land.

To have a deeper understanding and check the consistency on the factors that may trigger movements above the poverty line among the rural households, two comparisons were made: (1) between the *movers* and *always poor* and (2) between the entrants and always non-poor. Findings suggest that exiting poverty and entering into poverty may represent difference experiences. The forces driving poor households beyond the poverty line when compared to those that remained poor are: (i) increases in landholdings, (ii) lower education of the head, (ii) young household heads, and (iii) increased agricultural production. On the other hand, the factors that drives households into poverty include: (v) lower proportion of educated males within the household, (vi) small household size (especially active adults), (vii) lower crop production (especially Maize); (viii) limited access to credit, (xix) limited access to quality land, and (x) low or limited access to improved agricultural production technologies.

Table 15: Characteristics of households by poverty transition status, 2008-2011

	Mover		Entrant		Always poor		Always non-poor	
Characteristics	2008	2011	2008	2011	2008	2011	2008	2011
HH lives in non-remote village (%)	36.8	45.5	45.0	36.2	41.4	48.1	40.0	42.4
Total land owned/AE (ha)	0.87	1.07	0.86	0.73	0.87	0.76	0.77	0.70
Operate land size/AE (ha)	0.78	0.95	0.68	0.61	0.70	0.62	0.65	0.60
Female-headed HH (%)	30.8	29.9	18.8	17.2	20.7	24.2	12.9	13.6
Head's education (years completed)	3.0	2.7	3.1	3.2	2.5	2.2	3.3	3.4
Males in secondary school (number)	0.15	0.14	0.17	0.22	0.13	0.10	0.27	0.25
Head’s age (years)	42.3	42.1	41.8	41.7	44.6	43.8	41.8	41.8
HH size (# of members)	5.3	5.2	5.7	5.7	5.5	5.5	6.5	6.3
Number of months with food reserves	7.2	7.4	7.6	6.8	6.9	6.9	7.4	7.5
Total Net HH income (in '000 2011 MZM)	2.57	32.05	37.32	3.20	1.41	1.65	75.95	51.67
HH's Maize production (Kgs)	716.8	732.3	639.3	663.7	694.0	559.8	1016.3	920.0
Average Maize yield (Kg/ha)	883.8	761.5	984.6	878.5	766.1	718.0	1003.5	962.8
Mean Maize price (MZM/Kg)	5.19	6.70	5.51	5.62	3.76	6.29	5.50	5.09
Aggregated production (in tons of wheat equivalent units)	1.42	1.26	1.35	1.39	0.90	1.09	2.06	5.51
Widowed head (%)	8.7	13.2	8.5	5.9	9.6	5.4	5.4	6.3
People aged 15-59 years (number	2.4	2.3	2.5	2.6	2.3	2.2	2.9	2.8
HH is food insecure (%)	37.1	23.2	28.7	25.6	25.1	22.1	21.2	19.4
People with self-employment (number)	54.5	56.2	77.4	55.2	38.6	35.9	83.9	73.4
HH have access to credit (%)	2.4	1.2	2.7	3.5	4.7	2.5	2.9	7.4
HH has good land quality (%)	29.3	30.8	31.0	34.5	34.4	28.4	37.0	41.2
Total Tropical Livestock units per HH	0.94	1.00	0.57	0.87	0.52	0.41	1.32	1.14
HH used fertilizer (%)	3.5	3.6	7.9	5.4	4.3	7.1	7.2	6.1
HH used pesticide (%)	2.2	1.8	4.3	2.2	1.6	2.4	2.5	2.3
HH used manure (%)	5.1	3.6	3.6	1.7	4.5	5.8	3.9	3.9
HH used irrigation (%)	1.2	4.6	5.0	4.9	3.0	4.2	3.3	4.2
HH used improved seeds for cereals (%)	57.2	60.8	59.9	57.3	55.4	51.8	56.4	51.9
HH used improved seeds for beans (%)	30.7	29.3	28.6	24.8	24.8	25.4	29.3	32.0
HH used improved seeds for vegetables (%)	7.7	9.5	8.3	12.2	15.4	10.0	14.3	14.1

Table 15 (Cont'd)

	Mover		Entrant		Always poor		Always non-poor	
Characteristics	2008	2011	2008	2011	2008	2011	2008	2011
HH does crop rotation (%)	22.4	36.6	26.2	25.0	33.9	24.6	31.0	28.4
HH does intercropping (%)	71.3	78.0	80.9	82.3	74.1	80.0	77.8	77.0
HH does line sowing (%)	49.2	56.3	53.2	49.2	52.7	52.9	54.2	51.2
HH used permanent labor (%)	2.8	2.4	4.5	3.0	3.9	5.0	6.7	6.1
HH used seasonal labor (%)	13.0	12.3	26.1	19.3	23.5	27.6	32.4	36.5
HH used animal traction (%)	7.0	10.3	13.5	13.3	10.1	7.6	14.6	10.8
Number of observations	162	162	244	244	209	209	557	557

Source: Author's computation from TIA 2008 and Partial Panel 2011

Given the short period between the two survey years, some changes observed deserve further investigation. For instance, the drastic change in the remoteness of movers and entrants can be explained by the mobility of the households and not necessarily the improvement of infrastructure. Perhaps, those moved out of poverty sought for better accessibility in 2011, moving to villages with better access to transport and roads. With respect to education, ideally with no mobility across income distribution, one would expect that the education level of the heads would be the same. However, the results highlight, that the differences in head's education can merely result from changes in household heads over time. Significant income change was observed between the survey years, highlighting the improvement of earning capacity of households that moved out of poverty and worsening of households that became poor. The income improvement of movers can be associated with high maize price, increased cultivated land and productivity, but most importantly the increased number of members with self-employment.

Given the homogeneity of household farmers in terms of agricultural technology use in rural Mozambique, the data limitation on land quality was addressed by defining land quality as the

percentage of households with maize yield greater than 2,000 Kg/ha. The rationale is that with lower input use and near homogenous managerial skills, higher yields could significantly be driven by land quality. The results show that the higher proportion of always non-poor households has significantly good quality land (higher maize productivity) compared to those that became poor and other groups (Table 16).

It is worth noting that besides the exclusive factors discussed above, results show that same strategies have differential impact on households, suggesting the interdependence and complementarity of multiple strategies in exiting poverty (Nargis & Hossain, 2006). For instance, the movers have significantly higher proportion of female-headed compared to *always poor* but the entrants have a higher proportion of female-headed household than *always non-poor*.

Similarly, the *movers* have higher proportion of self-employed members than the *always poor*, while the entrants have lower proportion than the always non-poor. This pattern is also observed with seasonal labor and the possession of livestock. To formalize this discussion, the next presents the multivariate analysis on average partial effects on these factors.

Results in Table 16, confirm findings by Lohamo (2009) and Muyanga *et al*. (2013) that those who moved out of poverty are the only group that observed significant increase in cultivated land compared those who remained poor in the two survey periods. The movers, appears to be significantly younger than always poor, suggesting that age is an important driver in income generation to escape poverty. With respect to education, results in Table 16, show that

households that moved out of poverty have significantly higher education attainments than those that remained poor throughout while the households that remained always non-poor have significantly more males with secondary school than those that became poor, suggesting that education is an important driver to exit poverty.

The group analysis presented in Table 16 helps to elucidate the discussion presented above. The group analysis in Table 16 is restricted to two comparisons: 1) movers vs. always poor and 2) entrants vs. always non-poor. Results show that those who moved out of poverty in from 2008 to 2011 have significantly higher proportion of female-headed households, higher education attainments of the heads, younger household heads, higher agricultural production, livestock production and number of self-employed members relative to those that were always poor. On the other hand, relative to those who remained always non-poor, households that became poor in 2011 have higher proportion of female-headed households, larger number of males with secondary school education, large household size, few adult members, high proportion of food insecure households, fewer people with self-employment, limited access to credit, smaller livestock herd.

Regarding agricultural technologies, results in Table 16 reveal that the movers large proportion of households using animal traction and intercropping techniques relative to always poor households, while those that became poor in 2011 do not seem to be distinguishable from the always non-poor.

Table 16: Poverty dynamics profiles, 2008-2011

Characteristics	Mover	Entrant	Always poor	Always non-poor	Significance difference[a]	
	A	B	C	D	[B-D][b]	[A-C][c]
HH lives in non-remote village (%)	41.1	40.5	44.7	41.1		
Total land owned/AE (ha)	0.97	0.79	0.81	0.74		
Operate land size/AE (ha)	0.86	0.65	0.62	0.66		*
Female-headed HH (%)	30.4	18.0	22.5	13.2	*	*
Head's education (years completed)	2.8	3.1	2.4	3.3		*
Males in secondary school (number)	0.14	0.20	0.11	0.26	*	
Head's age (years)	42.2	41.7	44.2	41.8		+
HH size (# of members)	5.3	5.7	5.5	6.4	**	
Number of months with food reserves	7.3	7.2	6.9	7.5		
Total Net HH income (in '000 2011 MZM)	17.10	19.95	1.53	63.94	**	**
HH's Maize production (Kgs)	724.4	651.7	626.9	968.6	**	
Average Maize yield (Kg/ha)	825.8	932.4	741.0	983.8		
Mean Maize price (MZM/Kg)	5.99	5.57	4.95	5.29		
Aggregated production (in tons of wheat equivalent units)	1.34	1.37	1.00	3.77		*
Widowed head (%)	10.9	7.2	7.5	5.8		
People aged 15-59 years (number	2.3	2.5	2.3	2.8	**	
HH is food insecure (%)	30.3	27.1	23.6	20.3	**	*
People with self-employment (number)	0.6	0.7	0.4	0.8	*	**
HH have access to credit (%)	1.8	3.1	3.6	5.1	+	
HH has good land quality (%)	30.1	32.8	31.4	39.1	*	
Total Tropical Livestock units per HH	0.97	0.72	0.47	1.23	**	**
HH used fertilizer (%)	6.7	5.7	6.7	3.6		
HH used pesticide (%)	3.3	2.0	2.4	2.0		
HH used manure (%)	2.6	5.1	3.9	4.4		
HH used irrigation (%)	4.9	3.6	3.7	2.9		
HH used improved seeds for cereals	58.6	53.6	54.2	59.0		
HH used improved seeds for beans (%)	26.7	25.1	30.7	30.0		
HH used improved seeds for vegetables (%)	10.2	12.6	14.2	8.6		
HH does crop rotation (%)	25.6	29.2	29.7	29.5		
HH does intercropping (%)	81.5	77.1	77.4	74.7		+
HH does line sowing (%)	51.2	52.8	52.7	52.8		
HH used permanent labor (%)	3.8	4.5	6.4	2.6		
HH used seasonal labor (%)	22.8	25.6	34.4	12.7		
HH used animal traction (%)	13.4	8.8	12.7	8.7	+	
HH used fertilizer (%)	6.7	5.7	6.7	3.6		
Number of observations	162	244	209	557		

[a]+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$; [b]Compares those who became poor relative to those that stayed non-poor
[c]Compares those who moved-out of poverty relative to those that stayed in poverty trap
Source: Author's computation from TIA 2008 and Partial Panel 2011

3.6.2 EMPIRICAL RESULTS

3.6.2.1 CROSS-SECTION RURAL INCOME/AE PREDICTION

As pointed by Cunguara (2008), one particular drawback in using the reported income in poverty analysis is the difficulty of distinguishing transitory to chronic poverty, especially when dealing with short-time period panels. The suggested alternative is to use predicted income/AE for individual years to compute the poverty measures because the predicted income/AE are more likely to reflect a long-term earning potential than the reported income (McKay & Lawson, 2002). Table 17 presents the cross-section income/AE predictors for 2008 and 2011.

Results in Table 17 highlights the following three key findings:

First, most income determinants had significant welfare effect in 2011 than in 2008, including: a) cultivated land size/AE with positive and significant effect on the total net household income/AE in 2011. Doubling the cultivated land size/AE results in about 15 to 28 percent increase in the total income/AE; b) access to public transport services and good roads leads to about 32 percent income increase; c) an additional year of age of the head leading to a 10 percent decrease in income/AE; and d) the additional unit of livestock leading to a 6-7 percent increase in the total income in 2011; e) the use of improved seeds in 2011 increased total income/AE by 30 percent; f) Even for the significant predictors in both years, their effects were higher in 2011 relative to 2008. For instance, land quality increasing the total net household income/AE by about 35 percent in 2008 and 67 percent in 2011, similarly, an additional member with self-employment increased total income/AE by 18 percent in 2008 and 26 percent in 2011.

Table 17: Determinants of Household income/AE in 2008 and 2011, OLS and IV-GMM models

	OLS estimation		IV-estimation	
	2008	2011	2008	2011
Log of cultivated land per AE	0.096	0.154*	0.494	0.284**
	(1.51)	(2.25)	(1.42)	(3.42)
HH lives in non-remote village (1=Yes)	0.179	0.359**	0.208+	0.385**
	(1.38)	(2.99)	(1.65)	(2.96)
Male-headed HH (1=Yes)	0.131	0.266	0.073	0.409+
	(0.56)	(1.33)	(0.33)	(1.88)
Head's education (years completed)	0.029	-0.015	0.037+	-0.023
	(1.25)	(-0.63)	(1.67)	(-0.92)
Males in secondary school (number)	0.219+	-0.100	0.190	-0.006
	(1.79)	(-0.69)	(1.63)	(-0.04)
Head's age (years)	-0.011*	-0.011*	-0.009+	-0.008
	(-2.21)	(-2.41)	(-1.77)	(-1.61)
Widowed head (1=Yes)	0.020	0.575*	0.005	0.445
	(0.07)	(2.18)	(0.02)	(1.61)
People aged 15-59 years (number)	-0.169**	-0.141**	-0.071	0.075
	(-3.68)	(-2.84)	(-0.78)	(0.80)
People with self-employment (number)	0.156**	0.201**	0.178**	0.257**
	(3.09)	(2.91)	(3.16)	(3.33)
HH have access to credit (1=Yes)	-0.014	0.164	-0.013	0.434
	(-0.05)	(0.57)	(-0.04)	(1.45)
HH has good land quality (1=Yes)	0.191	0.284*	0.346+	0.657**
	(1.55)	(2.34)	(1.91)	(3.70)
HH used fertilizer (1=Yes)	0.301	0.215	0.199	0.064
	(1.37)	(0.99)	(0.81)	(0.25)
HH used improved seeds (1=Yes)	0.119	0.290*	0.067	0.302*
	(1.01)	(2.40)	(0.59)	(2.45)
HH used permanent labor (1=Yes)	0.257	-0.103	0.348	-0.153
	(0.84)	(-0.46)	(1.14)	(-0.59)
HH hired seasonal labor (1=Yes)	0.279*	0.267+		
	(2.08)	(1.96)		
HH used animal traction (1=Yes)	-0.036	0.071	-0.140	-0.010
	(-0.17)	(0.37)	(-0.68)	(-0.04)
Total Tropical Livestock units per HH	-0.001	0.051*	-0.005	0.069**
	(-0.03)	(2.38)	(-0.24)	(2.60)
Constant	7.854**	7.402**	7.800**	7.859**
	(23.60)	(20.97)	(23.05)	(17.88)
Observations	1,172	1,172	1,172	1,172
R-square	0.150	0.141	0.108	0.09

t statistics in parentheses; + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$; HH: household; District FE included
Source: Author's computation from TIA 2008 and Partial Panel 2011

Second, education and age of the head have exclusively impacted incomes in 2008. Results show that an additional year of head's education leads to an increase in total income/AE by 4 percent while an additional year of head's age leads to a decrease in total income/AE by 1 percent only.

Third, the availability of family labor, the access to self-employment activities, and hiring seasonal labor for agricultural production had affected the household income in both years, but, only when cultivated land size/AE is considered exogenous.

These three findings suggest that the favorable food prices for producers due to food price crises in 2008 may have had a lagged transmission effect, encouraging the rural households to adjust their livelihoods.

3.6.2.2 EXPLAINING THE FACTORS AFFECTING MOVING OUT AND INTO POVERTY

To better understand the pathways into or out of poverty, the *movers* and *entrants* models are estimated using *always poor* and *always non-poor* and reference groups. Essentially, households moving out of poverty are compared to those that remained always poor while those becoming poor are compared to those who were remained always non-poor.

The pathways out/into poverty are estimated in Table 18. Results show that the routes out and into poverty are more structural (productive asset and production technologies) than demographic. These results are robust to differences in poverty lines used. The key finding is that the initial cultivated land endowments have high potential of lifting people out of poverty.

The results in Table 18 show that an additional percent of initial cultivated land size increases the probability of moving out of poverty by about 0.2 percent under the current poverty lines and 0.09 percent under higher international poverty line of $1.25/day. Similarly, the initial endowments in livestock stock have shown promising in moving people out of poverty. Results show that an additional tropical livestock unit increases the chance reducing the probability of becoming poor by 2 percent compared to those stayed non-poor under the current (low) poverty lines, while it has no effect when higher poverty line ($1.25/day) is used. This finding confirms the argument that the initial asset distribution is an important in pro-poor growth.

Land quality is another important productive asset to alleviate poverty in the study area. Results in Table 18 show that accessing good quality land decreases the probability of becoming poor by about 19 percent relative to those that stayed non-poor across years when higher poverty line is used but although not statistically significant, it increases the likelihood of moving out of poverty even under low (current) poverty lines. This suggests that investing in technologies that improves land quality such as fertility management techniques are likely to have high pay-offs in the long-run under local conditions (local poverty lines).

The use of chemical fertilizer and hiring seasonal labor are associated with increased probability of exiting out of poverty. Households that used chemical fertilizer increased their change to exit out of poverty by about 13 percent, while those hiring seasonal agricultural production labor reduces the change of entering into poverty by 8 percent under the current low poverty lines and 21 percent under high poverty lines (high poverty rates).

Table 18: The effect of initial endowments on the probability to move out and into poverty

	Local poverty lines		$1.25/day poverty line	
	Mover	Entrant	Mover	Entrant
HH lives in non-remote village (1=yes)	0.016	0.011	0.037	-0.242*
	(0.22)	(0.24)	(1.48)	(-2.54)
Log of cultivated land per AE	0.209+	0.020	0.090**	-0.219
	(1.78)	(0.29)	(2.58)	(-1.54)
Male-headed HH (1=Yes)	-0.241*	-0.037	-0.092+	0.130
	(-2.42)	(-0.47)	(-1.94)	(0.98)
Head's education (years completed)	0.018	0.008	-0.003	0.010
	(1.19)	(0.88)	(-0.68)	(0.66)
Males in secondary school (number)	-0.071	-0.044	-0.067*	-0.045
	(-0.69)	(-0.99)	(-2.15)	(-0.60)
Head's age (years)	-0.001	0.001	-0.002+	0.004
	(-0.29)	(0.33)	(-1.94)	(1.44)
Widowed head (1=yes)	-0.104	0.100	-0.035	-0.086
	(-0.78)	(0.94)	(-1.15)	(-0.47)
People aged 15-59 years (number)	0.020	-0.020	-0.005	0.005
	(0.64)	(-1.16)	(-0.46)	(0.15)
People with self-employment (number)	0.001	-0.009	0.010	0.048
	(0.01)	(-0.43)	(1.01)	(1.14)
HH have access to credit (1=yes)	-0.127	0.153	-0.030	0.042
	(-0.93)	(1.24)	(-0.94)	(0.24)
HH has good land quality (1=yes)	0.016	-0.041	0.041	-0.187*
	(0.21)	(-0.92)	(1.57)	(-2.11)
HH used fertilizer (1=yes)	0.057	-0.126+	-0.002	0.177
	(0.37)	(-1.77)	(-0.04)	(1.13)
HH used improved seeds (1=yes)	-0.040	-0.018	0.010	-0.024
	(-0.53)	(-0.42)	(0.42)	(-0.27)
HH used permanent labor (1=yes)	0.023	-0.021	0.193*	0.226+
	(0.12)	(-0.25)	(2.17)	(1.71)
HH hired seasonal labor (1=yes)	0.144	-0.081+	0.035	-0.209*
	(1.54)	(-1.86)	(1.20)	(-2.38)
HH used animal traction (1=yes)	0.178	0.005	0.009	0.115
	(1.51)	(0.07)	(0.25)	(0.84)
Total Tropical Livestock units per HH	0.015	-0.020*	0.002	0.002
	(0.80)	(-2.18)	(0.65)	(0.22)
Observations	732	1,580	1,640	518
Pseudo R-square	0.179	0.069	0.138	0.186
Percent predicted correctly	98.2	94.6	57.4	99.7

Marginal effects; *t* statistics in parentheses; + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$; District FE included
Source: Author's computation from TIA 2008 and Partial Panel 2011

Surprisingly on the households' demographics, the results show male-headed households tend to

decrease the chance of moving out of poverty by about 24 percent compared to their female counterpart. This could be explained by the fact that male-heads tend to be older and as reported in Table 17, an additional year of household's age increases the change of entering into poverty. Although not statistically significant, the education of the household head shows a potential to lift people out of poverty by about 0.2 percent.

Another surprisingly result is that access to self-employment was not found to be an important poverty exiting strategy. This challenges the importance of off-farm income for poverty alleviation in rural Mozambique. Access to credit is another not important mechanism to move out of poverty. Results show that, households that accessed credit reduced their chance of exiting poverty while increasing the change of becoming poor by 13 and 15 percent; respectively. This suggests that efforts in establishing and promoting financial services in rural Mozambique can only important for poverty alleviation if they can increase household incomes through investments in productive activities.

The results discussed above are robust to the potential endogeneity of cultivated land size as presented in Table 19.

Table 19: The effect of initial endowments on the probability to move out and into poverty, IV- Probit models

Variables	Local poverty lines		$1.25/day poverty line	
	Mover	Entrant	Mover	Entrant
HH lives in non-remote village (1=Yes)	0.051	0.032	0.037	-0.573*
	(0.28)	(0.24)	(1.48)	(-2.20)
Log of cultivated land per AE	1.938**	0.811	0.090**	-2.580**
	(2.83)	(1.14)	(2.58)	(-2.58)
Male-headed HH (1=Yes)	-0.606*	-0.123	-0.092+	0.115
	(-2.38)	(-0.55)	(-1.94)	(0.31)
Head's education (years completed)	0.049	0.024	-0.003	0.011
	(1.32)	(0.95)	(-0.68)	(0.30)
Males in secondary school (number)	-0.068	-0.147	-0.067*	0.045
	(-0.28)	(-1.14)	(-2.15)	(0.22)
Head's age (years)	-0.001	0.001	-0.002+	0.011
	(-0.18)	(0.12)	(-1.94)	(1.57)
Widowed head (1=Yes)	-0.241	0.340	-0.035	-0.336
	(-0.69)	(1.21)	(-1.15)	(-0.67)
People aged 15-59 years (number)	0.197*	0.007	-0.005	-0.163
	(2.20)	(0.10)	(-0.46)	(-1.45)
People with self-employment (number)	-0.021	-0.021	0.010	0.087
	(-0.18)	(-0.33)	(1.01)	(0.90)
HH have access to credit (1=Yes)	-0.232	0.356	-0.030	-0.173
	(-0.63)	(1.11)	(-0.94)	(-0.50)
HH has good land quality (1=Yes)	0.221	-0.011	0.041	-0.789**
	(1.09)	(-0.07)	(1.57)	(-3.63)
HH used fertilizer (1=Yes)	0.004	-0.459+	-0.002	0.811+
	(0.01)	(-1.67)	(-0.04)	(1.72)
HH used improved seeds (1=Yes)	-0.080	-0.064	0.010	0.192
	(-0.43)	(-0.51)	(0.42)	(0.86)
HH used permanent labor (1=Yes)	0.317	-0.026	0.193*	0.354
	(0.76)	(-0.10)	(2.17)	(1.01)
HH hired seasonal labor (1=Yes)	0.398+	-0.221	0.035	-0.503*
	(1.79)	(-1.62)	(1.20)	(-2.31)
HH used animal traction (1=Yes)	0.294	-0.050	0.009	0.412
	(0.94)	(-0.24)	(0.25)	(1.07)
Total Tropical Livestock units per HH	0.014	-0.057*	0.002	0.019
	(0.27)	(-2.16)	(0.65)	(0.82)
Observations	732	1,580	1,640	518
Exogeneity test (Wald p-value)	0.032	0.261	0.052	0.077

Marginal effects; *t* statistics in parentheses; + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$; District FE included
Source: Author's computation from TIA 2008 and Partial Panel 2011

3.6.2.3 DETERMINANTS OF TRANSIENT AND CHRONIC POVERTY

As discussed earlier, the distinction between transitory and chronic poverty and the assessment of their determinants is of great interest for policy makers as it provides insights in what development strategies to pursue based on the prevalent type of poverty. For policy interventions, once the distinguish between chronic and transient poverty, the next step is assess whether the determinants of chronic and transient poverty are different or to evaluate whether the policies that address one are different from the other or to assess whether policy does address the transient poverty would also be effective in addressing the chronic poverty. Answering these questions is of great importance for policy makers and development practitioners and this study focuses on the first question, decomposing the total income poverty into chronic and transient poverty using the program "*Distributive Analysis Stata Package*" (DASP version 2.3), developed by Araar & Dulcos (2013) and estimate their determinants.

3.6.2.3.1 POVERTY DECOMPOSITION

Table 20 presents the decomposition for squared poverty gap index into transient and chronic poverty, both comprise total poverty. Without correcting for bias, the total poverty stands at 0.420, with transient poverty constituting 65 percent (0.273) of the total poverty. Correcting for biases brought about by using panel data of a small number of time periods, which is of -0.027, the transient poverty now accounts for as much as 66 percent (0.198) of total poverty.

In fact, the high share of transient poverty implies prevalent high cyclical income fluctuations in Northern and Central Mozambique, suggesting that much of the poor population is able to rise above the poverty line temporarily.

Table 20: Squared poverty gap index chronic and transient poverty decomposition

Item	Estimates without bias correction	% sample	Estimates with bias correction	% sample	Standard errors
Bias	-0.027	---	---	---	
Chronic	0.147	35	0.102	34	1.60
Transient	0.273	65	0.198	66	0.20
Total	0.420	100	0.420	100	0.43

Source: Author's computation from TIA 2008 and Partial Panel 2011

3.6.2.3.2 RESULTS FROM CENSORED QUANTILE REGRESSION

The research question addressed in this section is whether the determinants of chronic and transient poverty congruent. Table 20 reports the parameter estimates for the two poverty measures to answer this question. The estimated parameters investigate the effect of the initial condition (using the initial endowments as explanatory variables) on chronic and transient poverty. Essentially, this estimation procedure aims to identify whether the determinants of poverty measures are persistent or not over time. The models predict chronic poverty fairly well than transient poverty as can be seen from the pseudo-R^2 (0.11 or 0.12). This echoes earlier studies by Jalan & Ravalion (1998) in China; Panganiban (2010) in the Philippines; and Garza-Rodriguez (2010) in Brazil as argued by Jalan & Ravalion this could be due to lack of variation in the survey reflecting idiosyncratic shock to income. This argument appears to reflect the survey data of the present study where the standard deviation of transient poverty (0.20) is smaller than that of chronic poverty (1.60).

The estimates in Table 20 suggest that the determinants of chronic and transient poverty are not totally congruent; however, it seems that policies to address chronic poverty are not necessarily the same to well tackle the transient poverty. The most important variables for transient poverty are remoteness, head's age, family, fertilizer use, and livestock. All these variables are important

even when the cultivated land is considered exogenous, except the remoteness and livestock that become insignificant. All these covariates tend to decrease the transient poverty, except the remoteness which is likely to decrease it. The most important variables for the chronic poverty are the cultivated land size, access to self-employment, use of fertilizer, improved seeds and hiring seasonal labor. But, when the cultivated land size is considered endogenous, only male headship, head's education and civil status of the head (widowed head) are important for chronic poverty. All these variables tend to decrease chronic poverty except the widowed heads which tend to increase it. It is noteworthy that the important variables have opposite effect for each type of poverty. Results in Table 20 show that one percent increase in the initial cultivated land size is likely to decrease chronic poverty in about 0.4 percent under the current poverty lines.

Household's demographic characteristics: As one would expect, demographic characteristics (education, male heads, and widowed head) seem to be less important for transient than chronic poverty. Results in Table 20 indicate that only family labor and head's age are important for transient poverty. Education is an important factor for avoiding chronic poverty, perhaps due to the fact that an educated person can easily aspire to have higher income over the course of their lifetime. The effect of the size of family labor, seem to suggest that households with greater number of people that can contribute to household income can help households to cope with external shocks leading to transient poverty.

Rural services: the improvement of infrastructures for transport is important for transient poverty. Results show that promoting self-employment opportunities in rural Northern and central Mozambique is likely to decrease significantly the chronic poverty. Results show that an

additional household member with accessing or engaging in self-employment is likely to reduce the likelihood of the household being chronically poor by a sizable amount, about 19 percent.

Productive assets: Increasing cultivated land sizes decrease the chance of being chronically poor. This result is consistent with findings by Jalan & Ravalion in China, households higher cultivated land are less vulnerable to chronic poverty. An additional percentage of cultivated land decreases the likelihood of being chronically poor by about 0.4 percent.

Agricultural production and technologies: Similar to productive assets, the agricultural production and technologies are important for both chronic and transient poverty, splitting the magnitude of importance among them. The adoption of chemical fertilizers, improved seeds and hiring seasonal labor for agricultural production are more important for chronic than transient poverty. Results show that those who adopted chemical fertilizers reduced their chance of being chronically poor by 60 percent while those adopting improved seeds and hiring seasonal labor reduced their likelihood of being chronically poor by 33 percent each. The possession of livestock is more important for transient than for chronic poverty.

The most interesting finding is that, variables explaining chronic poverty are not exactly the same that explain transient poverty, suggesting that the determinants of chronic and transient poverty are not congruent; however, synergies are expected from policy interventions expected to tackle chronic poverty.

Table 21: The effect of initial endowments on transitory and chronic poverty

Variables	Quantile regression		IV-quantile regression	
Dependent variables: Log of chronic/transient poverty	Chronic (70^{th} quantile)	Transient (90^{th} quantile)	Chronic (70^{th} quantile)	Transient (90^{th} quantile)
HH lives in non-remote village (1=Yes)	0.105	0.294^{+}	-0.000	0.145
	(0.59)	(1.73)	(-0.55)	(1.27)
Log of cultivated land per AE	-0.388^{+}	0.222	-0.000	0.023
	(-1.80)	(1.23)	(-1.32)	(0.05)
Male-headed HH (1=Yes)	-0.181	-0.028	-0.000**	0.213
	(-0.85)	(-0.19)	(-2.74)	(1.12)
Head's education (years completed)	-0.003	0.019	-0.000^{+}	0.004
	(-0.10)	(0.80)	(-1.82)	(0.19)
Males in secondary school (number)	-0.094	0.074	0.000	0.160
	(-0.93)	(0.53)	(0.99)	(1.35)
Head's age (years)	0.014*	-0.007*	0.000	-0.009*
	(2.38)	(-2.11)	(0.57)	(-2.33)
Widowed head (1=Yes)	-0.067	0.032	0.188**	0.088
	(-0.16)	(0.23)	(1.69e+15)	(0.36)
People aged 15-59 years (number)	0.115	-0.119*	-0.000	-0.306**
	(1.56)	(-2.12)	(-1.30)	(-5.20)
People with self-employment (number)	-0.188**	-0.034	-0.000	0.021
	(-2.97)	(-0.64)	(-0.69)	(0.40)
HH have access to credit (1=Yes)	-0.196	-0.037	0.000	0.051
	(-0.77)	(-0.09)	(0.01)	(0.23)
HH has good land quality (1=Yes)	-0.227	0.060	-0.000	-0.024
	(-1.58)	(0.66)	(-1.20)	(-0.17)
HH used fertilizer (1=Yes)	-0.591*	-0.385*	-0.000	-0.489*
	(-2.16)	(-2.11)	(-0.57)	(-2.25)
HH used improved seeds (1=Yes)	-0.330*	0.031	-0.000	0.193
	(-2.17)	(0.28)	(-0.59)	(1.62)
HH used permanent labor (1=Yes)	-0.358	0.392	-0.000	0.362
	(-1.31)	(0.79)	(-0.53)	(1.62)
HH hired seasonal labor (1=Yes)	-0.328^{+}	0.295	-0.000	0.109
	(-1.86)	(1.01)	(-0.15)	(0.88)
HH used animal traction (1=Yes)	0.021	0.347	0.000	-0.086
	(0.09)	(1.25)	(0.91)	(-0.50)
Total Tropical Livestock units per HH	-0.028	-0.036*	0.000	-0.014
	(-1.18)	(-2.07)	(0.80)	(-0.74)
Constant	3.176**	0.328	0.000*	-0.483
	(7.67)	(1.24)	(2.27)	(-1.21)
Observations	2,344	1,768	2,344	1,768
R-square	0.114	0.047		
Pseudo R-square			0.121	0.080

Marginal effects; *t* statistics in parentheses; $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$
Source: Author's computation from TIA 2008 and Partial Panel 2011

Therefore, policies aimed at reducing chronic poverty should concentrate more on improving household characteristics such as investing in education, agricultural reform that encourage landholding expansion and alternative power sources for agricultural production, while reducing transient poverty would call for policies oriented at allowing that family is active enough to contribute to household income and support older heads to earn income to support their families.

3.6.2.4 POVERTY SIMULATIONS

In poverty dynamics studies, the main interest does not only rest on assessing the movement between classes over time but also, the potential poverty effect of certain policy interventions. Two main groups of policy interventions were simulated, including: short-term (land size and technology adoption) and long-term (education, labor market, and infrastructure). The choice of these variables is guided by two main criteria; their importance in the recent development agenda of Mozambique and availability of quality data points in the two surveys.

A total of eight policy scenarios were simulated of which six individual scenarios and two combined strategies and the results are presented in Table 21. Out of the six individual scenarios, the least feasible scenarios are those on education while the most feasible are those related technology adoption and infrastructure. In general, the impacts of the simulated scenarios are very similar. Recognizing that the policy strategies are a combination of interventions, two combinations of individual scenarios were simulated. Results in Table 21 show that policy interventions leading to agricultural and land reform conducive to in increased landholdings, improved agricultural technologies and infrastructure is likely to have significant impact in poverty reduction under both poverty lines, but differences in targeted population are observed.

Table 22: Changes in the Incidence and Severity of Rural Income Poverty by Scenario

Scenario No.	General	Description	Change in the Head count index (in %)[1]	Change in the squared poverty gap index (in %)[2]	Change in the Head count index (in %)[1]	Change in the squared poverty gap index (in %)[2]
1	Cultivated land size	Increase cultivated land size per AE in 2011 by 20%	-6.5	-4.6	-0.2	-1.6
2	Technology adoption	Shift upwards the adoption of chemical fertilizer, improved seeds and animal traction in 2011 by 10%	-4.0	-4.3	-0.3	-1.3
3	Education	All household heads with no schooling in 2011 attain educational level of 3 years	-5.7	-2.8	-0.1	-1.5
4	Education	All household heads with some schooling attain highest educational level of 5 or more years	-5.6	-7.8	-0.3	-1.3
5	Labor Market	Shift hiring seasonal labor in 2011 upwards 20%	-6.3	-7.9	-0.3	-.13
6	Infrastructure	Increase infrastructure coverage in 2011 by 10%	-5.8	-7.9	-0.3	-1.3
Combined strategies						
7	Education and labor (3+4+5)	All household heads with no schooling and those with some education in 2011 attained education level of 3 years and 5 years or more; respectively. In addition, to these changes, the proportion of households hiring seasonal labor increased by 10 percent.	-5.9	-7.9	-0.3	-1.3
8	Cultivated land size , agricultural technology, and infrastructure (1+2+6)	The increase in cultivated land size per AE by 20% was accompanied by a 10% increase in the improved agricultural technology and a 10% increase in the infrastructure coverage.	-5.4	-7.9	-0.7	-0.9

[1]Calculated as 100*(simulated poverty headcount minus poverty headcount in 2008)
[2]Calculated as 100*(simulated poverty indicator - poverty indicator in 2008)/poverty indicator in 2008
Source: Author's computation from TIA 2008 and Partial Panel 2011

Results in Table 22 show that the effect of cultivated land size and education scenarios are important for the poorest households when the high poverty rates are observed ($1.25/day poverty line) while the long-term poverty reduction interventions (scenarios 4, 5, and 6) have large effect for the less poor under lower poverty rates (local poverty lines).

3.7 KEY FINDINGS

While poverty is well documented in Mozambique, few studies have systematically used the existent panel data, assessed the routes out of poverty or made distinction between chronic and transitory poverty. This paper contributes in the poverty literature by using panel data, allowing controlling for unobserved time-invariant household characteristics, assessing factors that can help the non-poor avoid falling into poverty (pathways), make a distinction between transitory and chronic poverty while estimating the potential impacts of simulated policy interventions.

This study allowed drawing the following conclusions:

First, some 13 percent of surveyed households moved out of poverty, 21 percent became poor while 18 percent stayed poor in two periods and 48 percent remained always non-poor. Results show that moving out of poverty is positively correlated with cultivated land size, confirming the claim that the land is an important asset to fight poverty and that the initial land distribution is important for pro-poor growth.

Although these results confirm the welfare effect of cultivated land size per AE in poverty reduction found by previous studies (Tschirley & Weber, 1994; Mather *et al*. 2012), given the fact that land distribution in Northern-Central Mozambique is still highly skewed and the

average farm size in rural Mozambique is very low (65 percent of households have 0.70 ha per adult equivalent of total land owned while only 5 percent of households have more than 1.74 ha of total land owned), creating conditions that encourage increased landholdings and utilization is recommended for agricultural growth and poverty reduction. Given that changes in landholding size is very limited in rural Mozambique, the results reiterate the findings by Jayne and his colleagues on the need to guarantee initial distribution of assets including land as essential efforts for poverty reduction in developing countries. It is noteworthy that increased land sizes, require complementary assets such credit, inputs (fertilizer, seeds, etc.) and animal traction or other sources of power to operationalize land in a productive way. Therefore, intersectoral policy interventions are recommended.

Second, poverty is found to have asset, infrastructural, and demographic dimensions in rural Northern-Central Mozambique. Access to public transportation and transitable roads throughout the year, having good land quality, hiring seasonal labor, livestock stock, self-employment, and the use of improved agricultural technologies significantly reduces poverty among rural households in Mozambique.

Third, family labor availability is found to be reducing the probability of the households becoming poor. But, older heads appears to be more likely to be poor as it as the earning potentials diminishes age when no cumulated resources or savings are available while widowed heads less likely to be poor as they may be benefiting from social ties within the families.

Fourth, the following pathways out/into poverty were identified:

1. The Routes out of poverty:

Increased cultivated land sizes, large number of adult members as well as hiring seasonal labor are significantly associated with moving out of poverty. An additional hectare of cultivated land per AE is strongly associated with an increase in probability of moving out of poverty and reducing the chance of being chronically poor only when assumed exogeneity of cultivated land size. This limited effect of land size on poverty is associated with limited increase in cultivated land size per AE between the two periods. However, there is an expectation that if farmers are able to significantly increase their landholding size or alternatively access to non-farm employment opportunities, there are likely to move out of poverty.

Access to *good land quality* is associated with decrease in the probability of becoming poor by 79 percent relative to those that stayed non-poor across years, suggesting that investing in technologies that improves land quality such as fertility management techniques are likely to have high pay-offs in the long-run. These results are consistent with Okwi *et al.* (2007) who found that locations with good soil quality are associated with lower poverty in Kenyan provinces. *Livestock* stock is associated with an decrease in the probability of becoming poverty by 2-6 percent relative to those stayed poor at the same reduces probability of becoming poor by same magnitude compared to those stayed non-poor.

Surprisingly, the *education* of the household reduces the probability of escaping poverty relative to staying and poor.

Fifth, unlike most of the previous studies, another finding of this study is that the determinants of transient and chronic poverty are not completely congruent but the differences are minimal and is consistent with the most recent study in Africa by Muyanga et al. (2013). So, both demographic and asset variables play significant role in both chronic and transient poverty. Based on these results, one can conclude that transient and chronic poverty determinants are not congruent. Chronic poverty is a concern, policies intervention should concentrate more on improving household characteristics such as investing in education, agricultural reform that encourage cultivated land expansion and alternative power sources for agricultural production.

Sixth, the five key findings are. First, investing in education has an important contribution in improving well-being and increases the likelihood of moving out of poverty. Second, cultivated land size is confirmed to reduce the likelihood of permanent poverty. Third, the use of improved agricultural production technologies such as chemical fertilizers, improved seeds, and hiring agricultural labor, and increasing livestock stock contribute significantly to reduce the probability of becoming poor while increasing the probability of moving out of poverty. Forth, the transition from 2008 to 2011 may have increased the likelihood of households to become poor. Fifth, the earning capacity of households as result of availability of family labor is more relevant in increasing chances of moving out of poverty under low poverty lines while remoteness are more relevant in reducing the likelihood of becoming poor when in the presence of high poverty rates (with $1.25/day poverty lines) Self-employment is more relevant for the poorest than the less poor households by reducing the likelihood of becoming chronically poor.

The general policy recommendation of this study is to encourage the implementation of the Action Plan for the Reduction of Absolute Poverty *(*PRSP) focusing on increasing agriculture production (where 85 percent of households depend on agriculture); improving infrastructure in order to address wide spread rural poverty. The implementation of such policy interventions should bear in mind that although land is abundant in Mozambique, it is unequally distributed, with smallholders owning less land than large-scale farmers (Brück & Schindler, 2009; Marrule, 1998), suggesting incentives to expand the cultivated land of the smallholders in rural areas.

The implementation of such interventions has to bear in mind the heterogeneity of the targeted population and the prevailing poverty rates. For instance, while the expansion of cultivated land is likely to have large poverty reduction effect on the less poor who can afford to access improved inputs under high poverty rates, the long-term type of interventions (education and labor market) are likely to have higher effects in poverty reduction on the poorest under high poverty rates.

4 THE PERFORMANCE OF LAND ADMINISTRATION IN MOZAMBIQUE: THE APPLICATION OF STRUCTURE, CONDUCT, AND PERFORMANCE IN THE LOCAL PUBLIC SECTOR

4.1 INTRODUCTION

Land administration as a concept was first introduced by the UN-Economic Commission for Europe (UN-ECE) in 1996 when an ad hoc group composed by members of 58 countries established guidelines providing a definition for the term land administration as: *"the processes of determining, recording and disseminating information about the tenure, value and use of land when implementing land management policies. It is considered to include land registration, cadastral surveying and mapping, fiscal, legal and multi-purpose cadasters and land information systems" (*Steubler *et al*., 2004*).*

This definition have been used by many authors since then and other alternative definitions have been provided such as Dale & McLaughlin (1999) who defined land administration as "*the process of regulating land and property development and the use and conservation of the land; the gathering of revenues from the land through sales, leasing, and taxation; and the resolving of conflicts concerning the ownership and use of the land*".

What is common in these definition is the three key attributes that are concerned with the land administration, including: (1) juridical purpose for land registration (ownership); (2) fiscal purpose for valuation & taxation (value); and (3) regulatory purpose for planning (use of land). According to Steubler *et al*. (2004), the land administration is concerned with the social, legal, economic and technical framework within which land managers and administrators must operate.

There are perceptions that a successful land administration should be able to guarantee property rights leading to reduction in land conflicts and cost-effectiveness, socio-political stability, and governance (Steudler *et al*., 2004). These assumptions have motivated a considerable number of countries to engage on land administration reforms aiming to improve level of land governance and increase land administration efficiency.

Similarly to a considerable of African countries, Mozambique's government have been engaged in land reform policies and programs aiming to increase security of land ownership by providing power over their owned land resources, believed to be a condition to improve land investments, increase incomes, boost land markets which will lead to more effective land use.

Despite its impressive economic growth over the past decade, Mozambique remains a poor country with more than 50 percent of the population still living below poverty line (MPD, 2010) and no written land administration strategy exists. To address this issue and realizing the need and the importance for increasing the productive capacity of the population, the Government of Mozambique has initiated several parallel initiatives, including: Land Tenure Regularization (LTR), the Community Land Delimitation (CLD), Project GesTerra; and the consultative group (locally known as "*Forum Consultivo de Terra-FCT*") created in 2011 to stimulate dialogue between the government and the civil society on land administration.

The LTR initiative have been implemented by the National Directorate of Land and Forest (DNTF) since 2004 at the rate of 4 districts per year, aiming to regularize individual properties in urban and rural (especially in high density areas) areas. Given the financial and capacity

limitation to implement LTR using government funds, the Mozambique's government initiated the Land Tenure Services Project ("*Land Project*") with the aim of establishing a more efficient and secure access to land by improving the policy framework; upgrading land information systems and services; helping beneficiaries meet immediate needs for registered land rights; and better access to land for investment. The Land Project is one of the projects financed under the Compact signed in 2008 between the Millennium Challenge Corporation (MCC) and the Government of Mozambique. The project's objectives are to: (1) increase the level and value of investment on land; (2) increase access to land; (3) reduce the costs associated with acquiring land user rights; and (iv) resolve and prevent conflicts over land. The Land Project interventions were targeted to four Northern Provinces (Cabo Delgado, Niassa, Nampula and Zambezia), at all levels of administration – National, Provincial, and District / Municipal – and across a range of beneficiaries, including rural individual land holders, rural communities, urban land holders, and domestic and international investors. However, the component that can be most rigorously evaluated at the household level is the site-specific interventions targeted in selected districts and municipalities.

Motivated by recent evidences that individual titling may not be a more cost-effective way to protect land rights of women and other minority groups, given the associated costs and complexity that comes with implementing the full title initiatives, the government of Mozambique has realized the need to establish lower-cost options in the form of the community land delimitation (CLD) program aiming to improve tenure security for collectives, enhancing private sector investments (both domestic and foreign), efficiency-enhancing land transfers, small-holder agricultural productivity, and rural livelihoods more broadly (Ghebru et al., 2015).

The limited capacity of DNTF in implementing systematically this strategy was alleviated by the creation of iTC, established in 2003 by group of international donors as a means of supporting the registration of a community's land rights, with the ultimate objective of creating local accountability in protecting the interests and rights to land of the rural poor (such as women and other vulnerable groups) against the non-inclusive approaches of recent foreign interests in Mozambique land. Given the documented land related disputes in Mozambique in recent years, several interventions are either under way or in the proposal stages in order to speed up the community land delimitation process to not only secure the land rights of communities but also to spur investment in the country. Implementation of CLD is not free of challenges; it is long and requires superior effort from the community in order for it to be effective and beneficial. Recently, funding support from the MCC was channeled to support the continuation of CLD interventions in the Northern region.

With the end of the financial and capacity support from the MCC, the DNTF created Project GesTerra, designed as a continuation of MCC's project to implement both LTR and CLD, expected to contribute in the development of the Land Information Management System (LIMS), funding demarcation, and regularization.

Although through these initiatives, mechanisms to acquire new land rights for private investment were created at almost no cost to the applicant, the weak and deficient centralized land administration, the lack of transparency and a lot of opportunism where large portions of land are allocated to potential investors with little or no exhaustive community consultation, the

Government should make land administration its priority. Even with Land Policy, Land Law and regulations, the land administration in Mozambique is still facing challenges, including:

Limited dissemination and poor knowledge of Land Law after more than 15 years of existence. Recent analyses using nationally representative household survey data (TIA 2008) indicated that only 36 percent of the households in the nation are informed about the Land Law and 20 percent have specific knowledge about the Land Law. Moreover, there is a large majority with specific knowledge about the rights of women (e.g. inheritance, acquisition of formal title). This suggests that massive Land Law dissemination is likely to increase awareness about the Law and reduce asymmetric information on rights and obligations of the citizens with regards to land Law as shown by the results indicating that the majority of households are concerned in purchasing land (57 percent) due to lack of knowledge about the Land Law and only about 14 percent of the households expressed their willingness to buy land as result of knowing the Land Law.

Large regional differences in legislation knowledge are observed. Results from a small sample in Nampula and Cabo Delgado provinces (Maredia et al., 2012a; Jin et al., 2013), show that only 22 percent rural and 7 percent urban households were informed about the law, suggesting that the 1997 Land Law was poorly implemented.

High degree of informality and Lack of formal land title (DUATs). Results show that only 12 (or 13) parcels out of 4,224 (or 3,992) parcels in rural (or urban) study areas have DUATs, a large majority of parcels (94 percent or 54 percent) do not have any documents. Suggesting limited access to the land registration services (Maredia et al., 2012; Jin et al., 2013). The national statistics report that in average between 2006 and 2013 there are 639 registries per one million of

population equivalent to 2,099 registries per 100,000 square kilometers of the country's land area.

Perceived high tenure insecurity. At the national level, about 6 percent of rural households reported land conflict, where it occurs, its magnitude of loss of income and poverty is high. Where the land conflict occurs it is mostly among neighbors (65 percent) and among family members

(16 percent) and in most of the cases it is basically about errors in boundaries (62 percent) commonly with male-headed households (Maredia *et al*., 2012b). This situation is expected to continue and spread out in the communities with firms and authorities entering to the matrix. Unfortunately this is not a desirable outcome since the formal authority should play a central role in arbitrage by mediating and solving the conflicts and not as source of the conflict. Results from the Baseline studies in Nampula show that the potential for conflict in urban areas is higher than in rural (18 percent vs. 12 percent) and no more than 4 percent of the parcels have received an investment.

Limited formal registration of land related conflicts and land use rights transactions. The land conflicts and transfers are mostly reported and resolved at the community level and very few require the intermediation of formal authorities and are mostly not formally reported to the land administration units. However, the national statistics reports that in a period of seven years (2006-2013), 634 land conflicts have been reported with most being in 2007 (148 cases). The causes and types of conflicts change over time, with conflicts between 2006-2008 related to land access in the central and southern regions and in the second period (2009-2012) related to land use in both regions of the country (South, Central and Northern regions).

High demand for DUAT. The results from the baseline studies show that more than 87 percent of landholders are willing to obtain DUAT, and the perceived impacts of DUAT on most of the outcome indicators are positive: DUAT will reduce the risk of land expropriation (94 percent in urban vs. 84 percent in rural); DUAT to increase land value (94 percent in urban vs. 73 percent in rural).

Uncoordinated land related interventions. Results show that Land Law dissemination and the delimitation are not simultaneously targeting areas with highest number of land conflicts. For instance, in 2012 and 2013, the highest number of land conflicts was reported in Tete, Maputo, Gaza and Cabo Delgado, but the area community land demarcated in these provinces are small and the outreach seminars covered only two of these provinces (Tete and Gaza). The ideal intervention would be similar to that of 2006, when, Manica had both high number of land conflicts, outreach seminars and land delimitations. This call for a strategic implementation of these initiatives, making a simultaneous intervention (Land Law and demarcation) to target the most problematic areas if funding is constraining (Pitoro et al., 2014).

Limited legal assistance. The legal assistance for local communities and poor families is limited or even inexistent. To address this issue, the government has implemented through the Judical and Judicial Training Centre (CFJJ) with the mandate to train judges, prosecuters, distrital administrators, paralegals, and other relevant and interested individuals. The training of paralegals was implemented under FAO project from 2001 to 2012 on natural resources rights and management composed by two main areas: training and research on land administration. Despite this government effort, much is still to be done, including, the recognition of paralegals

as community representatives for communities in courts for conflict resolution involving community-investors.

Limited involvement of women in the decision making process. For instance, the number of bairros headed by female is minimal, the participation of women in the community council is limited, and the participation of women in the seminars for dissemination of Land Law is also limited. This suggests, investing in women's education and changing the strong social pressure within families in the most rural communities that deter women from seeking for legal assistance

Thin and imperfect land market. Although rental market in Mozambique is still in incipient phase, but it has been growing over time. Results based on the TIA 2008 indicated that in average, households rent-in about 1.0ha of land and rent-out to others a total average of 1.2 ha. For those households that reported renting-out their parcels, their average annual rental rate is 377.31 Mt/ha, with households headed by women charging higher rental rate than male-headed households (MSU, 2012). Other studies in Northern Mozambique show that 12 percent in urban areas and 8 percent parcels in rural areas were either rented-in or rented out and there is a considerable difference between the actual rental price and hypothetical rental price, suggesting a high degree of imperfection of the current land rental markets in northern Mozambique (Maredia et al., 2012a; Jin et al., 2013).

Gender differentiation in terms of land use property rights and investments. Results show that women hold no more than one-quarter of the DUATs and the SPGCs take in average 8 months more to authorize female-owned DUATs than those of men (Pitoro *et al*., 2015). Results based on TIA2008's data indicate that male-headed households tend to invest more frequently in land

than the female-headed. While female-headed households tend to invest more frequently in land authorized by the traditional leaders, government authorities and rented, the male-headed households invest more frequently in the land acquired through purchases, inherited, rented and occupied. In terms of type of investments, results indicate that about one-fifth of the households interviewed make at least one investment on land and the most common types of investments are the soil improvement and fencing.

Lengthy DUATs' application processing. The intention of the Ministry of Agriculture to achieve a performance of that DUAT application processing within 90 days is not being fulfilled. Pitoro et al. (2015) found that only about 60 percent of DUAT applications are processed within the intended time period. Therefore, investments in strengthening local capacity through policy reform, human and infrastructure may generate even greater efficiency gains. It is in this line that MCC's investments are expected to generate such gains. The national statistics show that from 2006 to 2013, 51 percent of land use rights applications were registered (equivalent to 32 percent of area.

Large land size does not necessarily imply longer land use rights processing times. Results of the recent study in Northern Mozambique show that either for DUAT applications or community land delimitations the processing period is relatively lower when land sizes are large (Pitoro *et al*., 2014). For instance, processing land use rights for land sizes of 10,000 hectares or more are 50 and 100 days shorter than for land sizes of 1,000 hectares or smaller and those between 1,000 and 10,000 hectares. This highlight the priority given to large area land regularization, perhaps because they are related to development programs and projects than smaller area land

regularizations mainly related to subsistence or low economic use values. These results imply that higher authority is much efficient in providing land use rights regularization than lower authority levels. In other words, the Council of Ministers appears to authorize land use rights much faster than provincial governors and the Minister of Agriculture. Consistent with these findings, large community land sizes are formalized quickly, perhaps due to legislative provisions that establish fast mechanisms to recognize community land compared to other uses. The community land delimitations for larger than 10,000 hectares take only about one month to be completed, while those between 1,000 and 10,000 hectares and less than 1,000 hectares takes 3 months and 2 years to have the delimitation process completed; respectively.

All these challenges suggest that the current level of land administration need reform. But for that purpose, one may want to understand what drives the current level of performance. Answering such question is challenging and complex given the multiplicity of factors and actors. However, this chapter uses the administrative data and the review of land related policy directives, strategies and annual land administration reports; to assess the relationship between the land administration structure and its performance and draw lessons on how to improve land administration in Mozambique. More specifically, this essay intends to answer the following research question: does the current land administration performance significantly associated with is structure?

4.2 LAND GOVERNANCE/ADMINISTRATION IN MOZAMBIQUE

As stated in the land law (article 3, Chapter 2), the land is the property of the State and cannot be sold or otherwise alienated, mortgaged or encumbered (Frey, 2004). According to the Land Law,

the exclusive right of the state is established by the constitution of the Republic of Mozambique (CRM) which incorporates all rights of ownership, as well as the power and the ability to determine the conditions of its use and benefit by individual or corporate persons. In the same line, Burr (2000) describes the Land Law of Mozambique as embracing customary African law in its innovative land tenure strategy, giving substantial control to local authorities in the delimitation and allocation of land use rights, the resolution of disputes, and the subsequent management of resources. Although the Land Law is seen as innovative, it introduces ambiguity in treating development initiatives which on one hand land cannot be transferred as a normal commonality, conditions to make it transferable (DUATs) are met in a complex and lengthy process.

The Government of Mozambique has embraced a more liberal and market oriented development model. However, there has been little consideration of landholdings and tenure arrangements as a potential cause of the stagnant agricultural growth even after observing decreasing landholdings, with a negative correlation with income (Walker *et al*., 2004). Recognizing that a successful land administration should be able to guarantee property rights leading to reduction in land conflicts and cost-effectiveness, socio-political stability, and governance, implementing land reform aiming to address equitable access to land tenure security for private sector enterprises as well as local communities including recognition of customary rights is crucial to support of economic growth. This argument have stirred interest in improving land governance in Mozambique through The Land Tenure Services Project (Land Project) worked on 1) improving policy, 2) upgrading the public land administration agencies (the title registry and cadaster), and 3) facilitating site-specific land access. These activities aim to address concerns widely shared

across the private sector, the Government, and civil society in order to strengthen the property rights system by clearly defined rights that are enforceable, transferable, and of appropriate duration and scope.

Currently, a broad range of actors are involved in land governance/administration in Mozambique. The land administration in Mozambique is managed in two main administration levels by the following actors (see Appendix 1 for their roles and responsibilities):

i. **National Level** : National Directorate of Geography and Cadaster (DINAGECA); National Centre for Cartography and Remote Sensing (CENACARTA), National Directorate of Land & Forestry (DNTF), Ministry for Environmental Coordination (MICOA), Ministry of Planning and Development (MPD) and Ministry of Territorial Administration (MAE), National Directory of Registry and Notary (DNRN), Training Institute for Land Administration and Mapping (INFATEC), Legal & Judicial Training Centre (CFJJ), Center for Agricultural Development (CEPAGRI), and Private Land Surveyors

ii. **Provincial Level and Below**: Provincial Geographic and Cadastral (SPGC), Districts, Communities, Community Land Initiative (iTC), Municipalities, Civil Society, and NGOs.

As noted in Appendix B, although the mandate for land administration is held by DNTF its implementation is dependent of good collaboration and information flow among the intervenient institutions. The institutional arrangements for land administration are undoubtedly complex and

fragmented and do not function well as noted by MINAG (2010). The most striking aspect in land management is information storage, availability and quality. While the municipalities are responsible for recording land use rights in their jurisdiction areas, MINAG (2001) have observed that the records are poorly filled and stored due to poor storage conditions, they are not harmonized with district level information. While in the Districts the information on land use rights is kept in digital format, in the municipalities it is mostly kept in hardcopy files with digitization process in very slow pace whatever is possible. For instance, in the municipality of Marrupa, given the limited storage capacity, the original copies were returned to the applicants whenever the applicant requested, leaving the land office with no records on file. Although a specific land-related institution has been created, the lack of resources allocated to higher-level training of land administration specialists is a major cause for concern.

4.2.1 FACTORS INFLUENCING PERFORMANCE OF LAND ADMINISTRATION IN MOZAMBIQUE

According to MINAG (2010), the performance of land administration is Mozambique is affected by several factors including institutional and organizational arrangements and capacity of delivering the land administration services. More specifically, the key factors identified by MINAG (2010) are: (i) the inadequate financial and human resource allocation for training, staffing and equipment for better deliver the administration services; (ii) a complex organizational structures challenging and effective decision making, communication, and control. Essentially, with a complex array of actors, delivering administration services requires great coordination; (iii) Inconsistent legal code related to land; (iv) limited public capacity to implement the Land Law; and (v) the need for regular amendments to the Law and its regulations to be consistent with current conditions.

Speaking about the organizational arrangements, MINAG (2010) note seven (7) issues that need to be resolved. First, the mapping services are separated from the cadastral services, while the DNTF and municipal cadastral systems are not aligned, making it difficult to create a harmonized land management system. Second, it appears that the individual municipality cadaster is not harmonized to each other resulting in limited ability for data sharing. Third, difference in registration systems is observed between DNTF and the ministry of Justice. While the DNTF and SPGC use land registrations in their land registry, the *Registo Predial* of the Ministry of Justice uses a deeds registration system. Fourth, there are two overlapping planning laws, including the Land Law 19/97 and the Territorial Planning Law 19/07. Fifth, the limited implementation of the Land Law 19/97 is plagued by a limited inter-ministerial coordination. While the Ministry of Agriculture and its land related departments (DNTF, SPGCs, SDAE) are responsible for implementing the Land Law, other Ministries and departments such as Forestry and Wildlife, Public Works and Housing, MICOA, and MICTUR (Ministry of Commerce and Tourism) implement independently their sectoral policies related to land.

4.3 DATA SOURCES

The data for this essay are drawn the administrative records from the land administration system accessed through the provincial land administration offices at the Ministry of Agriculture. This is a nationally representative administrative data from the National Directorate of Land and Forestry containing records from ten provinces and 158 Districts spamming from 1986 to 2014 with more than 44,000 DUATs nationwide (see Appendix C). These data contain information on individual DUAT, including: applicant/owner (name, nationality, gender, type of ownership-whether the right belongs to a particular person) and transaction time (date of application and

date of DUAT authorization); DUAT status (approved, cancelled); location of the parcel (province, district, locality); parcel characteristics (e.g. size, end use). This data is used to establish the relationship between the structure and performance of the land administration using the conceptual framework described below. This data is complemented by District profiles derived from the third Population Census of 2007 from the Bureau of National Statistics. This complementary data source contains demographic and other information at District level relevant for describing the study area.

4.4 CONCEPTUAL FRAMEWORK

According to Steudeler *et al*. (2004), there is no an internationally accepted methodologies to evaluate and compare the performance of land administration systems because land administration systems are in constant evolution, context specific, and reflect the stage of socio-economic development. The evolutionary pattern of land administration systems range from the traditional systems created to respond the societies' changing needs in developing countries to a more sophisticated system to respond to the development dynamic of the current world (Dale & McLaughlin, 1988). An attempt to fill this gap is a framework developed by Steudler *et al*. (2004) consisting of four evaluation elements –objectives, strategies, outcomes and review process but they could go further on the details of the indicators. Later in 2006, Land Equity International Pty prepared a report in support of the World Bank's Policy Research report on Land Policy that resulted in developing twenty indicators and seven criteria for a successful land administration system. These indicators were later applied to compare the performance of sixteen countries of Europe, Latin America, and Africa. The later although does not present an elaborated framework based on well-developed theory, it makes a clear description of the

indicators and its limitations. Unfortunately, their case studies, Mozambique is among the African countries in which the performance indicators were estimated limiting the comparison of performance indicators to thirteen countries only.

Recognizing the importance of the conclusion of the Bathurst Declaration that a sustainable development requires a sound land administration system and echoing Lavandez *et al*. (2002) for the need of more comprehensive approach in land administration system, this paper contribute in methodological approaches for the evaluation of land administration system by suggesting the application of the Structure, Conduct, and Performance (SCP) paradigm to test the "*structure performance hypothesis"* that better land administrative structure have a positive effect on the performance of the land administration. Developed in 1959 by Joe S. Bain derived from neoclassical analysis of markets and brain child of the Harvard school of thoughts and popularized during 1940-60 (Edwards *et al*., 2006), the SCP paradigm was first published by economist Edward Chamberlin and Joan Robinson as a model in industrial organization economics which offers a theoretical explanation for a firm's performance trough economic conduct and structure. The SCP framework states that an industry performance, which can be measured in terms of potential benefits to the individuals and a society as a whole, is determined by the conduct of the firms within the industry, which is depend on the structure of the market (Policonomics, 2012).

According to Edwards *et al*. (2006), there are two competing hypothesis in the SCP paradigm, including the "*structure performance hypothesis*" and "*efficiency structure hypothesis*". The "*structure performance hypothesis*" states that the degree of market concentration is inversely

related to the degree of competition because the market concentration encourages firms to collude, especially if there is a positive relationship between concentration and performance. The idea is that in more concentrated industries, firms will earn more profits than those in less concentrated industries, irrespective of efficiency. On the other hand, the "*efficiency structure hypothesis*", the performance of the firm is positively associated to its efficiency.

Translating these ideas to public sector, I draw from insights by Eberts & Gromberg (1990) and Kizito (2011) on their theoretical implications of public sector structure on public sector performance. The SCP framework for analyzing the land administration in Mozambique is depicted in Figure 8.

Essentially, this conceptual framework recognizes four main components that characterize the land administration in Mozambique: the basic conditions, structure issues, conduct issues, performance issues and public policies. Essentially, the framework distinguishes structure and conduct design issues, and their performance issues. The various components of the SCP framework for the land administration are described as follows:

Basic conditions: describe the environment in which the land administration operates including: (1) government policies, (2) some key macroeconomic characteristics (e.g. inflation rates, credit markets; infrastructure; human capital (e.g. number of trained staff by type of expertise).

Structure design issues: composed by a set of variables that relatively stable over time and affect the behavior buyers/or sellers (which in this case I refer to as clientele and the District land administration units -DLAUs). Literature argue that the way in which markets fail to follow

perfect competition conditions, depend essentially of the degree of concentration (supply/demand) and the level of product differentiation and market entry barriers (Policonomics, 2012). In the terms of the current public sector in investigation, the structure includes:

1. The land administration mandate (Aims, objectives, and clientele): Policy formulation, Attainment of efficiency in service delivery, and Clientele (individual people-local and foreigners, private companies or investors, communities; government).
2. Institutional home, organization, and coordination: Geographical coverage and range of services provided, Design of incentives, and Training and other human capacity development

Conduct design issues: represents the way DLAUs and their clientele behave, both amongst themselves, and amongst each other, including:

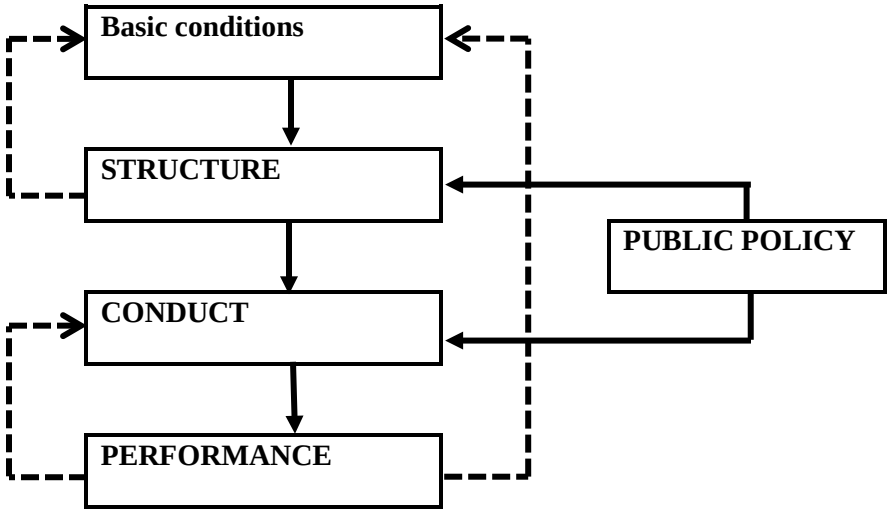
1. Services provided: Surveying, demarcation, delimitation, land certification and regularization
2. Awareness (e.g. Dissemination of Land Laws and Regulations, conflict mediation and resolution)
3. Land administration system used: Traditional Land Information Management System (LIMS) and Modern LIMS
4. Funding strategies: Government; Donor finding (e.g. iTC, MCC, etc.); and Investors

Performance (outcomes) design issues: it is measure comparing the DLAUs within land administration in efficiency terms, including measures of level of priced quantity, service quality

(Reliability, Credibility, Timeliness), sustainability and financial support (government, donors, or user support -land use taxes); and cost minimization strategy.

The framework depicted in Figure 8 suggests that the structure design issues affect the conduct which in turn affects the performance and the basic conditions shape the structure of the land administration. The conduct design issues in turn, affect the overall performance of land administration which is measured by number of land conflicts, DUAT processing time, revenue (taxes collected income received by communities). In the long-run, the performance affects conduct and basic conditions while the structure affect basic conditions.

Figure 8: Structure, Conduct, and Performance Framework



4.5 ESTIMATION STRATEGY

To meet the objective of this essay, I start by providing and discussing the land policy in Mozambique to provide the legislation context, followed by a descriptive evidence of the main challenges as part of the constructing the conceptual framework, then establish the relationship

between land administrative structure and performance; and finally draw lessons on how to improve land administration in Mozambique.

Given that the purpose of this essay is to assess empirically the relationship between the structure of the local public service and its performance, I then describe below the estimation strategy to be adopted. Establishing this relationship is conditional to estimate measures of both structure and performance given the quality of the available data.

4.5.1 MEASURING LAND ADMINISTRATION'S STRUCTURE

The market structure is commonly measured in terms of its size by firms' concentration, fragmentation, and competition (Nabieu, 2013; Belo & Isola, 2014; Bathi &Hussain, 2010). As stated by Eberts & Gromberg (1990), comparing empirically the local public sector size among DLAUs that differ in their structural arrangements for delivering public services faces three critical challenges, including: 1) the measurement of size; 2) the measurement of structure; 3) the identification of factors that differ across the units of analysis that affect the public sector size but not related to its structure.

The structure of the land administration is measured in two dimensions: the concentration and fragmentation. Ideally, fragmentation would be measured by the number of land government units in each District, and since there only one DLAU in each District, fragmentation is measured by the number of localities (locally known as "*localidade*" - a lower administrative unit within the District from which one must obtain the initial documentation to apply for DUAT. Among other administration tasks that it is responsible for, it serves as a lower level land administration unit per square kilometer.

To measure concentration, I borrow from Eberts and Gromberg (1990) who argues that the number of cities within an administrative area covered by a local public sector service provider does not accurately capture the degree of competition in public good services, instead the population- based concentration measure is preferred. Therefore, two indicators are used: the population density in each district to capture the level of competition of the clientele on the public sector services. The assumption is that high population density is positively associated with competition for public services (e.g. regularization of land use rights is high population density implies various field trips to regularize small land plots resulting in high operation costs than in less dense areas).

An additional measure of structure is the authority level involved in land administration. The Mozambique's land legislation indicates three levels of authorities involved in land administration based on land size. For land size of 1,000 hectares or less the DUATs are authorized by the provincial governors; for land size between 1,000-10,000 hectares by the Minister of Agriculture; and for land sizes of 10,000 hectares or more by the Council of Ministers. As such, this variety on the authority level involved in DUATs authorization is an important structural characteristic that affects the performance of land administration; therefore it is used to assess the effect of level of authority in the performance of land administration. The number of DUATs authorized by each level of authority in a District is used to measure the level of authority.

4.5.2 MEASURING LAND ADMINISTRATION'S PERFORMANCE

As defined by Steudler *et al*. (2004), the term "performance indicator" represents a measurement of different aspects of organizational performance, which can be measured by the profit margins, return on investment, The performance land administration is measured by two indicators, including: 1) the land use rights (DUAT) transaction times for private land titles, defined as the time period between DUAT application and issuance by District offices and 2) own-source revenue defined as the revenue generated by the local DLAUs land use taxes (not received as grant) to reflect the size of operations that can be afforded by DLAUs using the own resources. The proportion of registries mapped on the total number of applications authorized (and its land area equivalent) would be other performance indicator but, due to data limitation this measure was not included in the analysis.

4.5.3 EMPIRICAL MODEL

In order to empirically estimate the effect of land administration structure on its performance the following empirical model is estimated using Ordinary Least Squares:

$$Y_i = \alpha_0 + \alpha_1 CM_i + \alpha_2 FG + \alpha_3 AT + \alpha_4 X_i + \alpha_5 Z_i + \varepsilon_i \qquad (8)$$

where Y_i represents the performance indicators (e.g. the average "*DUAT transaction*" time) in District *i*; CM_i is a measure of concentration (measured as the number of localities per capita in each District). A significant effect on this measure may support decentralization; FG_i is a vector of measures of fragmentation or competition (measured by the population) and the intensity of application measured by the number of application per area; X_i is a vector of other characteristics of DLAU (e.g. number of sporadic DUAT applications, proportion of DUATs by uses; and the

proportion of applications by gender of the applicant); and ϵ_i is the random error term assumed to be normally distributed with mean zero and standard error of one.

To control for differences among the DLAUs, District-level demographic variables is added in the estimation equation as vector Z_i. These demographic characteristics were obtained from national regional profiles developed by the Ministry of Local Administration.

The research hypotheses tested in this study are the following:

1) *Structure performance hypothesis:* $\alpha_1 > 0, \quad \alpha_2 > 0, \quad \alpha_3 > 0$. Essentially this hypothesis intends to test whether the performance of the land administration in Mozambique is a function of its structure as measured by concentration, competition, and the authority level. If such hypothesis is valid, then investments in improving the structure will likely result in improved performance. This hypothesis is composed by three individual hypotheses below.
2) *Concentration hypothesis*: $\alpha_1 > 0, \alpha_2 = 0, \alpha_3 = 0$. This hypothesis sets that the performance of the land administration is solely dependent of the concentration of service provider units as result of the competition among the clients to be served.
3) *Fragmentation or competition hypothesis*: $\alpha_1 = 0, \alpha_2 > 0, \alpha_3 = 0$. As indicated by Eberts & Gromberg (1990), according to decentralization hypothesis, an increased fragmentation should lead to greater choice of taxpayers and thus increased competition among the local administrative government units, reducing the size of the central government public services.

4) *Power differential hypothesis*: $\alpha_1 = 0$, $\alpha_2 = 0$, $\alpha_3 > 0$. Consistent with the decentralization hypothesis, the power differential hypothesis intends to measure not only the potential for decentralization but also the effect of bureaucracy on the performance of land administration. This hypothesis sets that the higher the authority level the lower the performance with respect to processing times and the opposite with respect to revenues collection.

With District as the unit of analysis, the empirical approach begins by analyzing the entire country as whole, and then regional analysis is performed by dividing the DLAUs into two geographical (South, Central and North) and in each region. Essentially, three empirical estimations are conducted in each of them (National, Southern, and Central & Northern) to assess the regional differences in structure and performance and within each region comparison is made. Given the limited number of variables in the main data set, the empirical estimation is interpreted mostly as correlation between the structure variables and the measures of performance.

4.6 RESULTS AND DISCUSSION

4.6.1 DESCRIPTIVE RESULTS

Table 23 presents the descriptive statistics for the analysis of land administration system's performance in Mozambique. As can be observed, the initial approach was to conduct the analysis in three different regions, including: south, central, and north based on their socioeconomic and agricultural potential differences. However, when the key characteristics related to land administration system are compared across the regions, it was observed that there were no significant differences between the central and Northern regions, while a significant

difference was observed between these and the Southern region. Therefore, comparisons and analysis are conducted in two regions (Southern vs. Central & Northern).

Table 23: Descriptive statistics by region

	Region			Difference
Characteristic (N=138)	Southern	Central & Northern	National	S vs. CN
Performance measures (Average):				
Percentage of applications with no response	0.04	0.09	0.08	**
DUAT processing time (days)	534.7	215.1	293.8	**
Annual fee per hectare (MNZ)[a]	6.25E+05	4.05E+08	3.06E+08	+
Structure measures:				
Applications per Km2	0.09	0.34	0.28	+
Population density (people/km2)	163.3	131.1	139.1	
Localities per Km2	0.003	0.002	0.002	+
Parcels: <1,000ha	72.1	277.8	227.1	**
Parcels: 1,000-10,000ha	7.4	10.4	9.7	
Parcels: >10,000ha	2.6	3.3	3.1	
District characteristics (Average):				
Percentage of males	0.5	0.5	0.5	**
Percentage of out-migration	0.4	0.1	0.1	
Number of primary schools	58.2	87.1	79.9	**
Number of farms	19,042.9	28,626.6	26,248.7	**
Number of commercial units	73.4	71.3	71.8	
Public administration units	25.6	20.9	22.0	*
Health service units	8.8	7.2	7.6	+
Average number of applications by use:				
Agriculture	60.1	107.5	95.8	*
Commerce	9.7	25.1	21.3	*
Residential	15.1	176.6	136.8	*
Religion/social	2.8	8.2	6.9	*
Aquaculture	0.1	0.2	0.1	**
Public services	4.8	7.5	6.9	
Livestock	8.6	23.5	19.8	**
No data	0.1	3.8	2.9	**
Number of applications	116.2	390.2	322.7	**
Average number of applications by type of ownership:				
Individual ownership (#)	74.5	196.2	166.2	**
Company (private, state) (#)	26.2	49.1	43.5	*

Table 23 (Cont'd)

Characteristic (N=138)	Region: Southern	Region: Central & Northern	National	Difference: S vs. CN
Average number of applications by authorization date:				
Authorized before 1980 (#)	0.0	0.3	0.3	*
Authorized: 1980-1990 (#)	0.6	4.1	3.2	**
Authorized: 1990-2000 (#)	8.6	31.1	25.6	**
Authorized: 2000-2010 (#)	30.0	226.8	178.3	**
Authorized: 2010-2014 (#)	6.6	9.9	9.1	
Total Number of applications	**3,952**	**40,585**	**44,537**	
Districts	**34**	**104**	**138**	

+ p < 0.10, * p < 0.05, ** p < 0.01

[a] MZN (the local currency known as Mozambique *Metical*) in real terms. Exchange rate: 1USD=30.69MZN (projected for 2015 available at http://www.bancomoc.mz/fm_MercadosMMI.aspx?id=15, accessed on 10/20/2015).

Source: Author's computation from DNTF, 2014 and INE, 2015 data

Results in Table 23 show that the Central & Northern region (CN) is significant well-off in several characteristics. For instance, it can be noted that on average, the CN region has shorter time to process a DUAT application and has collected significantly large revenues compared to the Southern region. The Southern on the other hand, has in average significantly large number of localities per square kilometer, higher out migration rate, and large number of public administration compared to CN which are likely to contribute to increased provision of complementary services to the land administration in the region.

Results in Table 23, show that the residential and agricultural uses are the main purposes to which DUATs are used for while private ownership are the most common type of ownership of DUAT. It appears that some growth in the demand for DUAT has been observed over time in the country mostly reported in the CN region. It is worth to mention that the highest number of sporadic applications for DUAT was observed in the decade 2000-2010.

Since the key objective of this study is to assess the relationship between the structure of land administration system and its performance, Table 24 presents results of a bivariate analysis

between structure and performance measures by region, where the structure measures were compared against the distribution of performance measures (terciles in the first column). Results in Table 24 show a significant relationship between structure and performance of land administration system and highlight four key findings.

First, the application intensity (a measure of fragmentation/competition) as measured by the number of applications per square Kilometer is inversely related to DUAT processing time and positively related to revenues collection, suggesting that higher the intensity or demand for DUAT increases pressure over the land services reducing the processing time while rendering high revenue collection deriving from those massive applications. This finding is consistent with the expectation. This could be justification improvements of the land administration system in collecting revenues from DUAT applications. If one believes that shorter the processing times result in higher revenues as result, then there is an incentive to improve the system.

Second, it appears that the population density (measure of fragmentation/competition) does not have a significant effect in the performance of the land administration system in either region although it follows a similar pattern as the application intensity.

Third, the number of localities per square Kilometer (measure of concentration) follows the pattern of the intensity of applications (fragmentation/competition), suggesting that concentration increases efficiency (reduces processing time and increases revenues).

Fourth, with the authorized area of the parcel it is intended to whether the authority level involved in processing a specific DUAT has any effect on the performance of the land

administration system. Results show that in average the majority of applications for DUAT are in the land size less than 1,000 hectares followed by those in size range of 1,000-10,000 hectares and finally those with area greater than 10,000 hectares. It appears that in each land size group, the number of applications is inversely related to processing time and positively proportional to the revenue. Suggesting that in each land size group, the majority of applications are processed in the lowest time range.

As per the efficiency of the different land sizes corresponding to the authority level involved, additional analysis show that 47 percent of application with land size less than 1,000 hectares and 21 percent of applications with more than 10,000 hectares are in lowest processing time group while about 34 percent land size less than 1,000 hectares and only 13 percent of applications with more than 10,000 hectares are in highest processing time group.

Table 24: Relationship between structural measures and performance by region

Terciles performance measures (N=138)	*Performance measure I: DUAT processing time (days)*			*Performance measure II: Annual fee per ha (MZN)*		
	Region			Region		
	Southern	Central & Northern	Total	Southern	Central & Northern	Total
Applications per Km^2						
1 (Low)	0.20	0.40	0.38	0.04	0.21	0.17
2	0.14	0.32	0.31	0.02	0.04	0.03
3 (Top)	0.07	0.24	0.12	0.16	0.80	0.59
Total	0.09	0.34	0.28	0.09	0.34	0.28
Dif. (1-3)	+			+		
Dif. (2-3)				*	+	*
Population density (people/km2)						
1 (Low)	117.7	154.1	150.8	40.0	104.7	91.7
2	1131.6	85.5	126.5	148.0	60.1	79.1
3 (Top)	98.3	260.8	142.2	253.6	231.8	238.9
Total	163.3	131.1	139.1	163.3	131.1	139.1
Dif. (1-3)						
Dif. (2-3)					+	+
Localities per Km^2						
1 (Low)	0.006	0.003	0.003	0.002	0.003	0.002
2	0.002	0.002	0.002	0.004	0.002	0.002
3 (Top)	0.003	0.002	0.003	0.004	0.002	0.003
Total	0.003	0.002	0.002	0.003	0.002	0.002
Dif. (1-3)	*			*		
Dif. (2-3)			*		+	
Parcels: <1,000ha						
1 (Low)	206.8	223.3	221.9	68.8	212.8	181.8
2	63.0	348.3	337.8	15.1	107.3	89.3
3 (Top)	53.5	140.0	76.3	104.9	543.2	400.3
Total	72.1	277.8	227.1	72.1	277.8	227.1
Dif. (1-3)	*		**			
Dif. (2-3)			*	**	*	*
Parcels: 1,000-10,000ha						
1 (Low)	25.5	6.9	8.5	5.2	7.1	6.7
2	12.5	12.8	12.7	0.8	4.8	4.0
3 (Top)	4.4	12.9	6.6	12.5	20.5	17.9
Total	7.4	10.4	9.7	7.4	10.4	9.7
Dif. (1-3)	**			+	**	**
Dif. (2-3)		*		**	**	**

Table 24 (Cont'd)

Terciles performance measures (N=138)	*Performance measure I: DUAT processing time (days)*			*Performance measure II: Annual fee per ha (MZN)*		
	Region			Region		
	Southern	Central & Northern	Total	Southern	Central & Northern	Total
Parcels: >10,000ha						
1 (Low)	8.3	2.6	3.1	0.7	1.5	1.3
2	10.5	3.7	4.0	0.5	3.4	2.8
3 (Top)	1.2	4.1	1.9	5.0	5.6	5.4
Total	2.6	3.3	3.1	2.6	3.3	3.1
Dif. (1-3)	**			*	**	**
Dif. (2-3)	**		*	**		*

+ p < 0.10, * p < 0.05, ** p < 0.01
Source: Author's computation from DNTF, 2014 and INE, 2015 data

These results suggest that the lower authority is more efficient in processing DUATs than the higher authority. However, within the higher authority level, higher proportion of application is processed quickly. This can be confirmed from results in Appendix D which show lower processing times for parcels with size lower than 1,000 hectares (authorized by the Provincial Governor) than those authorized by the Council of Ministers (greater than 10,000 hectares).

4.6.2 EMPIRICAL RESULTS

Before delving into the discussion of the empirical results, it is worth presenting the estimation strategy adopted. As indicated in Table 25, Table 26 and Table 27, four models were estimated for each performance measure (dependent variable). The first model considers only the structure measures as regressors. Given that the administrative data has significant number of observations with missing data on the performance indicators, the second model adds to the first model a variable to capture the effect of missing data. The third model is an extended model including other covariates in addition to the structure measures but excluding the missing data variable. The fourth model, it is a full model with including structure measures, other covariates, and the missing data variable. The data set used consists of 138 District Land Units aggregated from the

original administrative data on land administration covering more than 44,000 DUAT applications nationwide.

4.6.2.1 NATIONAL

Although, the results in Table 25 do not support the structure performance hypothesis, the fragmentation and power differential hypothesis are supported. Results indicate that an additional locality per square kilometer leads to reduction in the number of days to authorize a DUAT application, suggesting that decentralization of services from District capital to localities or lower administrative level may lead to a performance gain. On the other hand, an additional DUAT application of more than 10,000 ha, authorized by the Council of Ministers, leads to a significantly higher gain in revenue collected compared to that revenue collected for smaller areas. Care must be exercised in interpreting this result as it may just reflect the revenue collection which is proportional to area and not necessarily the performance of council of Ministers in authorizing DUAT applications per se.

Results at the national level confirm the descriptive statistics on the differential performance across the regions. Results show that, controlling for other factors, the Central and Northern region has significantly lower DUAT processing times and revenues compared to the Southern region. These significant differences suggest that regional differences in the drivers of performance of land administration system in each region and regional analysis are provided In Table 26 and Table 27 for Southern and Central and Northern regions; respectively.

Table 25: Determinants of land administration performance in Mozambique, 1986-2014

Variables	*Performance measure I: DUAT processing time (days)in Logs*				*Performance measure II: Total annual fee (MZN)in Logs*			
	Model1	Model2	Model3	Model4	Model5	Model6	Model7	Moel8
Structure measures:								
Applications per km2	0.050	0.009	0.042	0.005	-0.198	0.084	0.327	0.334
	(0.49)	(0.09)	(0.43)	(0.06)	(-0.24)	(0.10)	(0.50)	(0.49)
Localities per km2	-46.239*	-43.251*	-38.979*	-37.474*	-5.746	-19.489	-42.873	-43.017
	(-2.53)	(-2.39)	(-2.20)	(-2.14)	(-0.04)	(-0.13)	(-0.36)	(-0.36)
Population density (people/km2)	0.000	0.000	0.000	0.000	0.002	0.001	0.001	0.001
	(0.01)	(0.14)	(0.46)	(0.64)	(0.87)	(0.72)	(1.01)	(0.99)
Parcels: <1000 ha (#)	-0.000	-0.001*	0.000	-0.000	0.003*	0.009	0.001	0.001
	(-0.92)	(-2.28)	(0.61)	(-1.13)	(2.15)	(1.58)	(0.48)	(0.19)
Parcels: 1,000 -10,000ha (#)	0.006	0.004	-0.003	-0.004	0.128**	0.123**	0.041	0.041
	(1.00)	(0.63)	(-0.49)	(-0.62)	(2.82)	(2.69)	(0.89)	(0.88)
Parcels: >10,000ha (#)	-0.010	-0.011	-0.012	-0.020	0.231*	0.217^{+}	0.250*	0.250*
	(-0.69)	(-0.81)	(-0.84)	(-1.37)	(1.99)	(1.87)	(2.55)	(2.53)
Region (a):								
Central & Northern	-1.146**	-1.116**	-0.971**	-0.961**	-2.179^{+}	-2.174^{+}	-4.818**	-4.818**
	(-7.45)	(-7.33)	(-5.95)	(-5.97)	(-1.76)	(-1.76)	(-4.41)	(-4.39)
Main Uses of DUATs:								
Industry (#)			0.004	0.009			-0.182**	-0.184*
			(0.43)	(0.88)			(-2.63)	(-2.40)
Livestock (#)			0.005^{+}	0.003			0.077**	0.077**
			(1.74)	(1.22)			(4.31)	(4.28)
Aquaculture (#)			0.108	0.153			-0.838	-0.837
			(1.00)	(1.42)			(-1.16)	(-1.16)
Ownership:								
Individual ownership (#)			-0.001*	-0.001**			-0.001	-0.001
			(-2.31)	(-2.82)			(-0.32)	(-0.26)
Community owned (#)			0.013**	0.013**			-0.095**	-0.095**
			(3.00)	(2.93)			(-3.18)	(-3.11)

Table 25 (Cont'd)

Variables	Model1	Model2	Model3	Model4	Model5	Model6	Model7	Moel8
Missing data:								
Dependent variable (#)		0.001*		0.001*		-0.005		-0.000
		(2.14)		(2.14)		(-1.04)		(-0.04)
Constant	6.284**	6.216**	6.493**	6.360**	6.571**	6.811**	2.035	2.045
	(41.86)	(41.06)	(24.36)	(23.57)	(5.44)	(5.54)	(1.14)	(1.13)
Observations	133	133	133	133	133	133	133	133
R-square	0.334	0.357	0.455	0.476	0.243	0.250	0.571	0.571

t statistics in parentheses; $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$; (a) reference is Southern region
Source: Author's computation from DNTF, 2014 and INE, 2015 data

4.6.2.2 SOUTHERN REGION

The results in Table 26 support the structure performance hypothesis by the following reasons: First, as expected, the number of localities per square Kilometer and the number of applications per square Kilometer have a negative and statistically significant effect on the full model for the DUAT processing times. However, for revenues, the results do not fully support the structure performance hypothesis, but only the concentration and fragmentation/competition hypothesis.

Second, as indicated above, the authority power difference hypothesis is only supported in the DUATs' processing time models where the higher authority level have significantly lower processing times compared to the lower authority level which show to have not significant effect although with negative sign. These results support the hypothesized power differential effect in land administration in rural Southern Mozambique.

Third, the number of localities per square kilometer is significant on days for processing DUATs. This suggests that given the relative concentration of land administration services (District capitals) densely populated Districts will need to decentralize services to localities to allow DNTF to alleviate the pressure and demand for land administration services. Finally, parcel uses were found to be affecting the performance of land administration. Results in Table 26 show that DUATs used for livestock and aquaculture, increase and decrease processing time; respectively. This can be explained by the fact that livestock production require large areas (about 785 hectares in average in the Southern region see Appendix E) and represent about 5 percent while although large areas are requested for aquaculture it represents only 0.04 percent of applications, corresponding to only 12 applications countrywide.

Table 26: Determinants of land administration performance in Southern Mozambique

Variables	*Performance measure I: DUAT processing time (days)in Logs*				*Performance measure II: Total annual fee (MZN)in Logs*			
	Model1	Model2	Model3	Model4	Model5	Model6	Model7	Moel8
Structure measures:								
Applications per km^2	0.238	-0.463	-0.837	-1.637**	4.870	19.367**	0.628	14.203+
	(0.40)	(-0.72)	(-1.44)	(-2.99)	(0.66)	(3.04)	(0.07)	(2.01)
Population density (people/km^2)	-0.000	0.000	-0.000	-0.000	0.002	-0.001	0.001	-0.001
	(-0.00)	(0.59)	(-0.82)	(-0.07)	(0.76)	(-0.29)	(0.48)	(-0.59)
Localities per km^2	-60.789+	-26.825	-24.386	15.983	450.498	-262.448	638.928	-68.542
	(-1.75)	(-0.75)	(-0.80)	(0.56)	(1.05)	(-0.74)	(1.43)	(-0.19)
Parcels: <1000 ha (#)	-0.004*	-0.006**	-0.004*	-0.007**	0.012	0.060**	0.010	0.058**
	(-2.20)	(-3.13)	(-2.58)	(-4.32)	(0.52)	(2.99)	(0.44)	(2.89)
Parcels: 1,000 -10,000ha (#)	0.003	-0.006	-0.020	-0.030+	-0.235	-0.062	-0.336	-0.171
	(0.15)	(-0.31)	(-1.13)	(-2.01)	(-0.97)	(-0.33)	(-1.31)	(-0.88)
Parcels: >10,000ha (#)	-0.061+	-0.044	-0.083**	-0.064*	0.815+	0.476	0.737+	0.391
	(-1.87)	(-1.42)	(-2.99)	(-2.64)	(2.02)	(1.54)	(1.81)	(1.24)
Main use of DUATs:								
Livestock (#)			0.041**	0.042**			0.190	0.190
			(3.70)	(4.49)			(1.16)	(1.56)
Aquaculture (#)			-0.487+	-0.392+			0.654	-1.411
			(-1.94)	(-1.82)			(0.18)	(-0.50)
Missing data:								
Dependent variable (#)		0.005*		0.006**		-0.103**		-0.100**
		(2.19)		(3.26)		(-4.63)		(-4.47)
Constant	6.751**	6.419**	6.645**	6.256**	5.096**	12.191**	4.385*	11.444**
	(46.68)	(31.59)	(53.85)	(39.51)	(2.85)	(5.99)	(2.41)	(5.49)
Province fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	33	33	33	33	33	33	33	33
R-square	0.614	0.676	0.756	0.834	0.292	0.618	0.364	0.660

t statistics in parentheses; + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Source: Author's computation from DNTF, 2014 and INE, 2015 data

4.6.2.3 CENTRAL AND NORTHERN REGIONS

Contrary to the Southern region, results in Central and Northern region only support power differential with respect to total revenue. Results in Table 27 a positive and significant effect hierarchal power effect with an addiction application of parcels with area between 1,000 and 10,000 hectares (authorized by the Ministry of Agriculture) increasing the revenues by only 10 percent, while an additional DUAT application of area greater than 10,000 hectares (to be authorized by the Council of Ministers) increasing the revenues by about 40 percent.

As observed in the Southern region, the use of DUAT has effect on the performance. Results show a 39 percent decrease in revenues for an additional DUAT application for industrial purposes while only 7 percent increase is observed with an additional DUAT application for livestock production purposes. Although with lower magnitude, the DUAT's ownership was found to be another significant driver of performance. Results in Table 27 show that, an additional application with single ownership decreases processing times by 0.1 percent while additional community land (delimitation) increases the processing time by 1.3 percent. This can be explained by the fact that single owned DUATs are usually of small areas (mainly for residential and agriculture) while the community owned land certification follows a more complex procedure compared to private titling. A recent study on the community land delimitation (Pitoro, 2014), identified eleven main challenges for implementing community land delimitations in Mozambique, including: time limitation to complete delimitation, weak social preparation to the communities, insufficient funding for community land delimitation (estimated at US$US8,000 per community), limited capacity of NGOs in assisting communities with larger areas; lack of clarity by the State concerning the development priorities and access to land,

limited legal assistance and limited Land Law dissemination and other relevant information among others. All these challenges concur to a lengthy community land certification as depicted in the Appendix E.

4.6.2.4 MISSING DATA

As described above, the administrative data used in this study is severely plagued by missing data points which may affect the estimation results. The representativeness of data used is presented in the Appendix F. To address this problem, a variable with number of missing data points on each performance indicator was included in the model to test the null hypothesis that missing data have no effect on the estimation results, suggesting that the missing data is a random factor and not systematic. Indeed, results show that the missing data problem is of concern in the Southern than in the Central and Northern region. As indicated in Table 25, an additional case of the missing data have the potential to the processing time by about 0.6 percent and reduce the revenues estimates by about 11 percent. Essentially, when the missing data are taken into consideration, the parameter estimates of interest increase by up to 75 percent in the processing time models, while in the revenues model the effect become significant, except the case of parcels with land size greater than 10,000 hectares which become insignificant. These results suggest that using administrative data with significant missing data points, ignoring the missing data problem can be result in erroneous estimates.

Table 27: Determinants of land administration performance in Central and Northern Mozambique

Variables	*Performance measure I: DUAT processing time (days)in Logs*				*Performance measure II: Total annual fee (MZN)in Logs*			
	Model1	Model2	Model3	Model4	Model5	Model6	Model7	Moel8
Structure measures:								
Applications per km2	0.035	0.004	0.009	-0.027	-0.000	0.188	0.100	0.139
	(0.30)	(0.04)	(0.08)	(-0.24)	(-0.00)	(0.19)	(0.14)	(0.19)
Localities per km2	-33.711^{+}	-31.994	-31.620	-30.712	-44.734	-50.628	-68.860	-68.918
	(-1.66)	(-1.59)	(-1.62)	(-1.60)	(-0.28)	(-0.31)	(-0.56)	(-0.56)
Population density (people/km2)	-0.000	0.000	0.000	0.000	0.001	0.001	0.002	0.002
	(-0.04)	(0.03)	(0.50)	(0.66)	(0.35)	(0.24)	(1.10)	(1.04)
Parcels: <1000 ha (#)	-0.000	-0.001^{+}	0.000	-0.000	0.003^{+}	0.006	0.001	0.001
	(-0.68)	(-1.75)	(0.91)	(-0.76)	(1.80)	(1.05)	(0.35)	(0.29)
Parcels: 1,000 -10,000ha (#)	0.011^{+}	0.009	0.004	0.003	0.145**	0.142**	0.095^{+}	0.095^{+}
	(1.76)	(1.46)	(0.55)	(0.39)	(2.97)	(2.89)	(1.93)	(1.92)
Parcels: >10,000ha (#)	0.002	-0.000	-0.005	-0.015	0.200	0.191	0.338**	0.340**
	(0.12)	(-0.02)	(-0.32)	(-0.89)	(1.57)	(1.49)	(3.30)	(3.28)
Main uses of DUATs:								
Industry (#)			0.002	0.008			-0.322**	-0.329**
			(0.15)	(0.63)			(-4.33)	(-3.95)
Livestock (#)			0.002	0.001			0.065**	0.065**
			(0.81)	(0.39)			(3.53)	(3.52)
Aquaculture (#)			0.093	0.141			-0.759	-0.752
			(0.79)	(1.19)			(-1.03)	(-1.02)
Ownership:								
Individual ownership (#)			-0.001*	-0.001*			0.002	0.002
			(-2.03)	(-2.54)			(0.54)	(0.56)
Community owned (#)			0.013**	0.013**			-0.090**	-0.088**
			(2.85)	(2.78)			(-3.05)	(-2.94)

Table 27 (Cont'd)

Variables	*Performance measure I: DUAT processing time (days)in Logs*				*Performance measure II: Total annual fee (MZN)in Logs*			
	Model1	Model2	Model3	Model4	Model5	Model6	Model7	Moel8
Missing data:								
Dependent. Variable (#)		0.001		0.001^{+}		-0.003		-0.001
		(1.66)		(1.94)		(-0.59)		(-0.19)
Constant	5.016**	4.990**	5.292**	5.151**	4.504**	4.654**	-4.155*	-4.093*
	(43.35)	(43.12)	(17.11)	(16.45)	(4.88)	(4.84)	(-2.15)	(-2.08)
Province fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	100	100	100	100	100	100	100	100
R-square	0.078	0.104	0.253	0.285	0.259	0.262	0.632	0.632

t statistics in parentheses; $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Source: Author's computation from DNTF, 2014 and INE, 2015 data

4.7 KEY FINDINGS

Using a combination of administrative and census data, this paper tested the structure performance hypothesis in the public sector using the structure, conduct, and performance approach. Although with significant data limitation, the results of the study allow to conclude that:

First, the performance of the land administration system in Mozambique faces several challenges, including the organizational arrangements and limited capacity for service delivery. Results show that even with few land related conflicts in the rural Mozambique, it takes approximately 300 days (about 10 months) to register land use rights and about 33 percent of the registered land use rights took less than 3 months. This level of performance is lower compared to less than one day reported elsewhere in the region including the neighboring South Africa as reported by (Burns et al., 2006).

Second, reliable information on land use rights is scarce; the available information show the land use rights registration is lengthy and complex process and the coverage is very low. Results show that out of the 44,537 land use rights applications records in the land administration system, about 70 percent have been awarded DUATs, representing about 0.8 percent of the total number of parcels countrywide. Even if the 185,311 blanket registration under the MCC[13] intervention is

[13] According to Millennium Challenge Corporation, the compact target satisfied by December 2013 was a total of 185,311 LTR DUATs delivered to the beneficiaries of which 144,522 were delivered to urban beneficiaries (available at https://www.mcc.gov/where-we-work/program/mozambique-compact accessed on January 6, 2016)

included, the coverage does not exceed 5 percent of national number of parcels reported by INE (2010)[14].

Third, the performance of land administration system in Mozambique is a function of its structure and this relationship varies across regions. While the Southern region full supports the structure performance hypothesis, the Central and Northern region supports only the concentration and fragmentation hypothesis.

Fourth, a great performance level is achieved by higher authority level which commands few applications but of a significant economic importance, while the lower authority level which deals with the majority of the applications is still lagging behind. This suggests that improvements in the capacity (financial, human, and physical) of the land administration units both at provincial and district should be emphasized, given the fact these handle the majority of land rights applications.

Fifth, to minimize these differences, the decentralization of land administration services is a mechanism that is likely to improve the performance of the sector especially in densely populated Districts associated with the fact that the clients face several barriers to reach the service provider units. Recognizing that the localities are lower administrative geographic areas with specific mandates under the territorial administration body, decentralization of land administrative services to this level may possess some challenges such as infrastructural, human

[14] INE (2010) reports a total of 3,827,754 parcels countrywide.

and financial capacity, but the decentralization process is likely to result in performance gains if such constraints are addressed.

Sixth, the DUAT applications used for livestock production have potential to improve the performance of land administration system in Mozambique, deserving a deeper understand on what make such application to be such efficient.

Seventh, the estimation results are sensitive to the presence of missing data. This shows how challenging can be using administrative data for rigorous empirical results, but also calls for improvements in how information on land use rights is recorded in the national system. Therefore, a significant improvement of data recording in the provincial data base is encouraged. A significant investment was made by the Millennium Challenge Corporation in Central and Northern Mozambique, which a continued effort in similar investments is required.

Results in chapters 2 and 3 have shown how important land expansion is in poverty reduction. However, land expansion is likely to be prevented if a sound land administration system is put in place. Results from chapter 4 find that call for decentralization and improvements in the capacity of delivering land administration services to the population. It is important to note that, even if one would want to expand his/her cultivated land it will require strong institutions and functional markets to encourage farmers to acquire register and expand land.

The key recommendations from this study focus in two strategic areas of concern of the land administration system, namely the institutional and technical arrangements. On the instructional

arrangements, the recommendations include to join mapping services and the cadastral services together in other to make the flow of information a smooth process. With respect to the technical arrangements, MINAG (2010) have observed that there is a general lack of financial, technical, and human capital similarly to other African countries. The recommendation is engage in public-private partnerships in order to minimize such limitations because the land administration system in Mozambique is under-resourced with few registered professional surveyors to cover large extensions of land.

As noted earlier, one of the challenges faced by the land administration system in Mozambique is the limited capacity to deliver land administration services. When considering decentralization as a potential alternative for the lower performance, the human resources become crucial. Therefore, for an effective decentralization, qualified survey and registry staff must be available and a developed system of property rights must exist. As noted by Pitoro et al. (2013), an effective record and regulation of land use rights is not possible without a well-trained cadre of professionals; including land surveyors, cartographers, land information systems and cadaster specialists, real estate appraisers, and land use planners and managers. For this reason, MCC has invested in the Land Administration and Cartography Training Institute (INFATEC) founded in 2006.

The current environment in curriculum development and infrastructure (girl's dormitory and supplies, and subsequently on enrollments and graduation rates of INFATEC within the limited context of its current 3-year certificate program of MCC investments was studied by Michigan State University (Pitoro et al., 2013) and concluded that given the short-term period of MCC

intervention and phase in of its new curriculum, the investments have not yet translated into expected outcomes. In fact, the analysis shows no significant change on enrollments and graduation rates before and after the intervention. However, the proportion of graduated females has increased. If this trend continues, more women will be graduating than men, reversing the male-dominant graduation trend which is beneficial to the recommended decentralization of land services to lower administrative level.

Given the INFATEC's institutional, human resources, and financial long-term vision, it is expected that this trend will continues, however, to maintain a sustainable growth on land administrators and officers and to meet the perceived professional demand in a transitioning economy, it is a societal and institutional interest to establish a solid graduate-level institution focusing on the training of professional and certified surveyors, cartographers and land information system (cadaster) specialist, possibly with future program expansion to regional centers.

More specifically, the training should target basic tools and techniques such as surveying, cartography, geographic information (cadaster) system skills, and basic land administration proficiencies. Conditional on the ability of INFATEC to attract more funding from donors, especially for the training of its instructional staff and the upgrading of its training facilities as well as seeking synergetic partnerships with other institutions such as CENACARTA, DNTF and private sector entities (national, regional or international), focus would be on certificate programs in "Topography", "Cadaster and Land Administration" and "Cartography and

Information Systems" to meet the perceived labor market demand in the public and private sectors.

4.7.1 LIMITATIONS

Although part of data limitation has been addressed through inclusion of missing data variable, other relevant information is not considered in the data set including, the human (e.g. staff's education, skills, etc.) and capital resources (e.g. equipment, etc.), the land conflicts, transfers, mapping, number of community land delimitations, etc. Although not the focus of this paper, it is believed that there is a negative correlation between community land certification, Land Law dissemination and the number of land related conflicts[15].

Due to data limitation, the performance is measure by only two indicators (the processing time and revenue). For a comprehensive evaluation of the effect of structure on performance, more performance indicators would be estimated given the data availability as those described by Burns & Dalrymple (2006) such as:

1. Percentage of total parcels registered
2. Percentage of transfers that are registered
3. *Annual registered transfers as percentage of registered parcels*
4. Annual registered mortgage as percentage of registered parcels
5. *Ratio of annual registry running costs/registered parcels*
6. *Registration staff days/registration*

[15] Empirical analysis by Pitoro (2014) found that a 1 percent increase in delimitated area of community land decreases the number of land related conflicts in 22 percent controlling for year, province and Land Law dissemination seminars.

7. Total staff days/registration
8. Time to produce certified copy of title (a version used in this paper)
9. Time to complete registration of transfer
10. Total ongoing land related court cases as percentage of total registered parcels
11. Average time to resolve ongoing court cases
12. Number of registries per 1 million population
13. Number of registries per 100,000 square Kilometer in country land area
14. Average working days to pay for average transaction cost
15. Transaction cost as percentage of property value
16. Unit cost of systematic title
17. Level of government where the registration is undertaken
18. *Ratio revenue/expenditure* (a version used in this paper)

Recognizing that estimating all these performance indicators possess is subject to data availability (Burn & Dalrymple, 2006), suggest that at least four of these indicators (3, 5, 6, and 18) would be sufficient to assess the efficiency of land administration system as they are chosen on the breath of internal system efficiency and minimal data collection recommended.

5 CONCLUSIONS AND RECOMMENDATIONS

The main conclusions of this study are as follows:

Despite the limited change in incomes and cultivated land size, the study finds a significant effect of cultivated land size on income and poverty. The study concludes that changes in the cultivated land size have significant effect in increasing total household incomes while reducing the gap between poverty line and household incomes (severity of poverty) with higher income effect being observed among the land poor households.

Given that there is an inverse relationship between household labor availability and cultivated land; attention should be paid in implementing policy strategies to expand the cultivated land. For instance, results indicated that the land poor households have significantly higher labor than those less land poor households.

With large areas of land underutilized, the majority of people engaged in rural agriculture, mainly at subsistence level, limited knowledge of market prices, inputs, low productivity, and small farm sizes that are unable to produce in large volumes; the most effective and sustainable way to reduce poverty is through raising the productivity of private resource that the rural poor, small-scale and subsistence households depend upon for their livelihoods. Essentially, the potential livelihood strategy in response to the conditions above and the stagnant landholdings growth could be by shifting the available and underutilized labor into off-farm activities. If off-farm activities result in higher returns per labor than in farm activities, household would expect gains in income by gradually '*pulling*' labor away from agriculture (Reardon, 2011). Results in

show the potential of moving from farm to off-farm sub-sector. Although the farm labor productivity is about 28 percent higher (at about 9,000 MZN/adult) than that of off-farm activities it has decreased in the faster rate (1.2 MZN/adult per year) than that of off-farm (0.18 MZN/adult per year), suggesting that in the next four years at the same decreasing rate, the off-farm activities will generate higher returns than farm activities at 4.85 MZN/adult and 4.08MZN/adult; respectively. However, ironically, most often these households facing barriers to entry into off-farm activities including relatively low financial, human, and social capital may be '*pushed*' into low-return farm activities, resulting in lower household welfare.

Poverty was found to have asset, infrastructural, and demographic dimensions in rural Northern-Central Mozambique. Access to public transportation and transitable roads throughout the year, having good land quality, livestock stock, self-employment, and the use of improved agricultural technologies such as chemical fertilizers, improved seeds, and hiring seasonal labor significantly reduces poverty among rural households in Mozambique.

The composition of the household (the percentage of members in working age), access to public transports and good roads, agricultural technology has significant welfare effect, especially among the poorest households. Demographic and gender differential welfare effect was found in this study. Male-headed households and households headed by widows and education of the head have high potential to increase income among the less land poor households than the land poor ones. On the other hand, older household's heads have negative effect on income, especially among the land poor households.

Despite the limited change in incomes and the cultivated land size between the two survey years,

short-term dynamics have been observed. About 61 percent of non-poor in 2008 remained non-poor in 2011 while 39 percent became poor. The poor had higher chance of changing status to non-poor (44 percent) compared to changing from non-poor to poor (30 percent), suggesting the poor is not necessarily doomed to be poor. Results show that moving out of poverty is positively correlated with landholdings, confirming the claim that the land is an important asset to fight poverty and that the initial land distribution is important for pro-poor growth. Households that moved out of poverty are the only group that observed significant increase in their cultivated land size between the two survey periods, confirming earlier findings by Lohamo (2009).

Family labor availability is found to be increasing the probability of the households escaping poverty. But, older heads appears to be more likely to be poor as it as the earning potentials diminishes age when no cumulated resources or savings are available while widowed heads less likely to be poor as they may be benefiting from social ties within the families.

Consistent with most of the previous studies, another finding of this study is that the determinants of chronic and transient poverty are not congruent, suggesting that the chronic and transient have different causes. Therefore, different interventions should be deployed to target each type of poverty. However, multiple effects are expected from interventions aiming to promote agricultural growth and labor market as both demographic and asset variables play significant role in both chronic and transient poverty.

Although the majority of poverty is transient, fighting chronic should be a priority given the fact that chronic poverty because as argued by Garza-Rodriguez et al. (2010), more unfair the chronic poverty is more unfair and damaging than transient poverty, because a chronically poor person have been in such state for long period of time which can lead to a damaging social fabric of the society which may lead to political instability. More specifically, long-term interventions such as education and self-employment are recommended to tackle chronic poverty due to the fact that an educated person can easily aspire to have higher income over the course of their lifetime. On the other hand, with promotion of rural non-farm economy, households with large size of family labor are likely to take advantage of large number of people that can contribute to household income helping the households to cope with external shocks leading to transient poverty. For transient poverty, policies intervention should concentrate more on agricultural reform that encourage landholding expansion and alternative power sources for agricultural production.

Policy strategies to improve the use of improved agricultural technologies deserve attention given the heterogeneity among the rural households. Large proportion of households hiring seasonal labor for crop production are those at the lower end of cultivated land distribution and those more family labor available, this suggest that the opportunity cost of family labor is higher, and so, these households are taking advantage of labor markets that may have surplus labor at lower cost or reflects the fact that rural Mozambique presently has relatively poorly developed rural labor markets (labor cost not at efficient level) which can further deteriorate if households maintain the unutilized family labor idle. This fact may be highlighting the imperfect nature of labor market in rural Northern-Central Mozambique. As found in earlier studies (Mather *et al*., 2012), the use of chemical inputs in crop production remains low.

The use of animal traction is still low about 11 percent use animal traction and decreasing over time. On average, only 7 percent of smallholders used inorganic fertilizer during this time period (2008 and 2011) and there is no sign of an increase. The use of improved seed for the main staple foods is slightly higher than other inputs but decreasing over time between the two survey years. Contrary to labor hiring, higher proportion of households using inorganic fertilizer, pesticides, and improved seeds is in the higher end of cultivated land distribution and the proportion is increasing over time.

With results confirming the possibility of "*Sunday farmers*" as the off-farm income shares are highest for bottom land quintile and declines as landholdings rises. Care should be exercised to the landless or near landless households the focus should be on promoting the rural non-farm economy for their survival as suggested by (Haggblade *et al*. 2010) given that the do not seem to confirm the conventional wisdom about Asia on a negative relationship between the off-farm income share and total household income since the off-farm share is higher in the bottom quintiles and lower in the top quintile. In average, the share of off-farm income declined significantly from 40 percent in the bottom income quintile to 35 percent in the top quintile confirming earlier findings (Jayne *et al*., 2003; Reardon *et al.*, 1997).

Results in show that the households in top quintile are moving out from ("*pushed out*") nonfarm activities, while the opposite occurs with households in the bottom quintile ("*pulled into*"). These results highlight two livelihood strategies adopted by the rural smallholders: i) the landless moving out of farming, the land expansion could follow two patterns: through encouraging seasonal labor hiring for the land poor households and ii) the households in the top landholdings

quintile remaining in the farming or exiting at lower pace. This may suggest relatively unsaturated non-farm activities in Northern and Central Mozambique. Therefore, there is a need to create enabling environment for higher-returning non-farm activities, especially for the households in the bottom quintile, and enabling agricultural production environment for households in the top quintile. Therefore, the strategies for land expansion should focus on encouraging improved input use for the less poor households with demonstrated purchasing power.

The general policy recommendation of this study is to encourage the implementation of the Action Plan for the Reduction of Absolute Poverty *(*PRSP) focusing on agricultural growth through increasing agriculture production (where 85 percent of households depend on agriculture) and improving infrastructure in order to address wide spread rural poverty. The implementation of such policy interventions should bear in mind that although land is abundant in Mozambique, it is unequally distributed, with smallholders owning less land than large-scale farmers (Brück & Schindler, 2009; Marrule, 1998), suggesting incentives to expand land sizes of the smallholders in rural areas.

The implementation of such interventions has to bear in mind the heterogeneity of the targeted population and the prevailing poverty rates. For instance, while the expansion of cultivated land is likely to have large poverty reduction effect on the less poor who can afford to access improved inputs under high poverty rates, the long-term type of interventions (education and labor market) are likely to have higher effects in poverty reduction on the poorest under high poverty rates.

Acknowledging that a sustainable agricultural growth requires a sound land administration system as it leads to reduction of land related conflicts, improve governance and socio-political stability, improving the performance of the land administration system becomes an important policy intervention. Results show that the performance of land administration system in Mozambique is a function of its structure and this relationship varies across regions. While the Southern region full supports the structure performance hypothesis, the Central and Northern region supports only the concentration and fragmentation hypothesis.

The fragmentation hypothesis is supported at the national level, suggesting that the performance of the land administration system is expected to improve by decentralizing public services to lower level, allowing the households accessing these services, reducing the transaction costs, especially in remote areas. Besides organizational challenges, the land administration system is poor record keeping. Therefore, a significant improvement of data recording in the provincial data base is encouraged.

With respect to the land administration system, the key recommendations from this study focus in two strategic areas of concern of the land administration system, namely the institutional and technical arrangements. On the instructional arrangements, the recommendations include to join mapping services and the cadastral services together in other to make the flow of information a smooth process. With respect to the technical arrangements, MINAG (2010) have observed that there is a general lack of financial, technical, and human capital similarly to other African countries. The recommendation is engage in public-private partnerships in order to minimize

such limitations because the land administration system in Mozambique is under-resourced with few registered professional surveyors to cover large extensions of land.

5.1 IMPLICATIONS FOR FUTURE RESEARCH

Recognizing that agricultural growth is important component in Mozambique's economy, the results of this study lead to additional queries in agricultural and economic development as follows:

First, given that this study uses only two-period panel data reflecting short-term effects, a long-run dynamic analysis on the relationship between operated land size and rural income and poverty. Recognizing that panel data sets are rare and costly to collect, pseudo-panel data set techniques can be used to conducting long-term dynamic analysis.

Second, given the high inequality of land distribution (with risk of landlessness) and the potential income gain from hiring labor, and recognizing that the large land acquisition is current phenomenon in Developing world including Mozambique, assessing the effect of large land acquisitions on labor market and earning would provide insights on income diversification of land poor households.

Third, in the light of the evidence of limited land expansion due to underdeveloped input/output markets, limited use of alternative power sources (e.g. animal traction) and lower financial capacity of the rural households and the limited intensification due high input/output ratio

(Benfica *et al*., 2014), understanding how the agrarian and land reforms can help to relax those bottlenecks to promote agricultural growth is recommended.

The poverty analysis conducted in this study is based on the dynamics of households over time and not across generations which is likely to missing some insights on the magnitude of poverty. Therefore, a further disaggregation of chronic poverty to investigate poverty transmission between generations is recommended for better understanding what strategies are effective in reducing poverty. As stated by Takashi & Otsuka (2007), mitigation of chronic poverty of parents has multiplicative effects. Given that landholdings were found to be determinants of chronic poverty, one would be interested in investigating the role of the intergenerational land transmission on intergeneration poverty.

APPENDICES

Appendix A:

Local poverty lines

Table 28: Local poverty lines for the rural regions in the study area

Region	Poverty lines 2008/09			Poverty lines 2007/08			Poverty lines 2010/11		
	Food	Non-food	Total	Food	Non-food	Total	Food	Non-food	Total
Nampula, rural	11.1	3.2	14.3	10.5	3.0	13.5	13.5	3.9	17.4
Nampula, urban	12.5	4.2	16.7	11.8	4.0	15.7	15.2	5.1	20.3
Sofala and Zambezia, rural	11.4	3	14.4	10.7	2.8	13.6	13.9	3.6	17.5
Sofala and Zambezia, urban	13.7	5.4	19.1	12.9	5.1	18.0	16.7	6.6	23.2
Manica and Tete, rural	15.2	4.2	19.4	14.3	4.0	18.3	18.5	5.1	23.6
Manica and Tete, urban	15.6	5.9	21.5	14.7	5.6	20.2	19.0	7.2	26.1
National average (population weighted)	13.6	4.8	18.4						

Source: MPD (2010)
Poverty lines for 2007/08 and 2010/11 are authors calculations based on IPC base=2010 (INE, 2015)

Appendix B:

Institutions, Roles and responsibilities

Table 29: Key institutions and their roles and responsibilities at national, provincial and below levels

#	Institution	Key Responsibilities
	National Level	
1	National Directorate of Geography and Cadastre (DINAGECA)	1. Established in the 1920s with responsibility of land administration until 2004. 2. At that time, it was responsible for the production of topographic maps as well as the development and maintenance of the National Land Cadastre. 3. In 2004 it was split up into National Centre for Cartography and Remote Sensing (CENACARTA) and National Directorate for Lands (DINAT)
2	National Centre for Cartography and Remote Sensing (CENACARTA)	1. Formed in 1980s, in 2004 CENACARTA took over responsibility for the task of topographic mapping and DINGECA was reorganized as the National Directorate for Lands (DINAT) and merged with the National Directory of Forestry and Wildlife in 2006 under MINAG to form the National Directorate of Land and Forestry – DNTF. 2. Captures data for use throughout the country. 3. Coordinates and implements remote sensing at the national level, handling, processing and distributing images and geodetic data obtained via satellite. 4. Provides base maps, imagery and spatial information with respect to natural resources, public rights of way and conservation areas.
	National Directorate of Land & Forestry (DNTF)	1. The agency with overall responsibility for land administration and for overseeing the management of forest and wildlife resources. 2. Supervise the executing agencies in the districts and provinces, but not the 43 or so municipalities 3. Responsible for maintaining a national register of land use and land user rights 4. However, does not, allocate DUATs but serve as channel requests
3	Ministry for Environmental Coordination (MICOA)	1. Has the mandate to coordinate, supervise and monitor environmental management in terms of the 1997 Environment Law to ensure that an environmental impact assessment (EIA) is conducted of every investment that might have a significant environmental impact on people. 2. Oversees territorial planning, formulating the regulations and guidelines and issues advice to districts and municipalities.
4	Ministry of Planning and Development (MPD) and MAE (Ministry of Territorial Administration)	1. Through the DNPDR, support district economic and land use planning, involving the production of spatial plans in relation to public investment needs in infrastructure, education and health sectors. 2. The MPD is involved in the preparation of district development plans and foreign investors are guided by the Centre of Investment Promotion (CPI), under MPD.
5	National Directory of Registry and Notary (DNRN)	1. Keeps records of rights to immoveable properties (i.e. buildings) on rural and urban land.
6	Training Institute for Land Administration and Mapping (INFATEC)	1. Originally established in 1980 to provide basic training in land survey and cartography 2. Currently responsible for providing education of middle level technical specialists in the area of land administration, geographic information systems, cadastre, cartography, geodesy and topography 3. Provide graduates for employment with DNTF, provincial SPGCs, municipalities, public utility companies and NGOs
7	Legal & Judicial Training Centre (CFJJ)	1. Provides training programmes for judges, officials and paralegal personnel on the Land Law 19/97 and on related conflict and dispute resolution procedures
8	Center for Agricultural Development (CEPAGRI)	1. Formally established in 2006, supports government's evaluations of land title requests by producing informed technical opinions on the financial and technical feasibility of agricultural projects submitted related to land requests.
9	Private Land Surveyors	1. Legally recognized and encouraged to carry out land parcels demarcations and topographic surveys for cadastral purposes.

Table 29 (Cont'd)

#	Institution	Key Responsibilities
	National Level	
	Provincial Level and Below	
10	Provincial Geographic and Cadastral (SPGC)	1. Attend to applications for DUATs (*processos*) received from the districts which includes making field checks on applications, submitting them to provincial directorates (e.g. Tourism, Agriculture) for comment and to the provincial Governor for approval; 2. Conduct audits (e.g. to follow up adherence to investment conditions attached to provisional DUATs, prior to issue of definitive DUATs) 3. Keep the land records for the province: this includes maintaining the electronic and analogue cadastre. 4. Communicate with SDAEs and the DTNF and liaising with the Municipalities 5. Demarcate land parcels, delimiting community boundaries in partnership with NGOs and witnessing consultations, etc. 6. Resolve disputes. 7. Collect land-related revenues
11	Districts	1. Provided by the Law on Local Organs of the State of 2003 that district governments to prepare and implement economic development plans. 2. Earlier, the cadastral technician was placed at the District Economic Activities (SDAE), as a first point of contact for land rights' holders. 3. Since 2009, the government aims is to place a cadastral officer who also has responsibility for physical planning at the District Service for Planning and Infrastructure 4. By November 2010, a total of only 60 district cadastral offices had been established in 128 districts
12	Communities	1. Defined by The Land Law 19/97 to be self-defined and can be traditional clans with chiefs, or extended families, or a group of neighbours. They can have their land delimited and have the resulting sketch map registered in the land registry, after which a certificate (*certidão*) is issued. 2. Manage the land within their area and can use 'customary' procedures
13	Community Land Initiative (iTC)	1. Funding programme established in 2003 by a coalition of donors (Netherlands, Ireland, United Kingdom, Denmark, Sweden and Switzerland). Replicated in 2009 in northern region with funding by the millennium Challenge Corporation. 2. Support services for communal land delimitation 3. Assist in recording of Community Land Rights 4. Support communal Land Administration and Management
14	Municipalities	1. Approve urban development plans, structure plans and plans and rules for local planning and housing according to the law on physical planning (Stated in the law 20/1997). 2. Levy fees for the issuance of land titles to applicants and may also levy a tax of 0.7% per annum of the capital value of buildings. 3. Have cadastral offices (*gabinete técnico*) not part of DNTF cadastral system 4. Store paper records of land holdings within the municipal registry (*tombo*) 5. Keeps its own cadastral, financial management systems for billing and collection of revenue
15	Civil Society	1. Participate in the consultation process to represent civil society in developing legislations including the Land Law 19/97.
16	NGOs	1. Play an important part in the implementation of the law and in devising and testing initiatives relating to the delimitation of community lands (e.g. ORAM) 2. Built technical capacity for support to rural communities in the protection of their land rights and for undertaking lobbying and advocacy in favor of the rural poor.

Source: MINAG, 2010

Appendix C:

Distribution of DUAT application by region

Table 30: Number of DUAT applications by province

Province	Applications	%	Region[a]
NIASSA	1,490	3.35	
CABO DELGADO	1,040	2.34	
NAMPULA	3,690	8.29	
ZAMBEZIA	4,375	9.82	Central &
TETE	2,461	5.53	Northern
MANICA	1,232	2.77	16,984
SOFALA	2,696	6.05	
INHAMBANE	7,088	15.91	
GAZA	3,947	8.86	Southern
MAPUTO	16,518	37.09	27,553
Total	44,537	100	

Source: National Statistics of land use rights by DNTF, 2014

[a]The average district area is 5,464.8 Km^2 (Southern=4,590.2 Km^2 and 5,753.5 Km^2)

Appendix D:

DUAT processing times by type of application by region

Table 31: Average DUAT processing times (days) by region

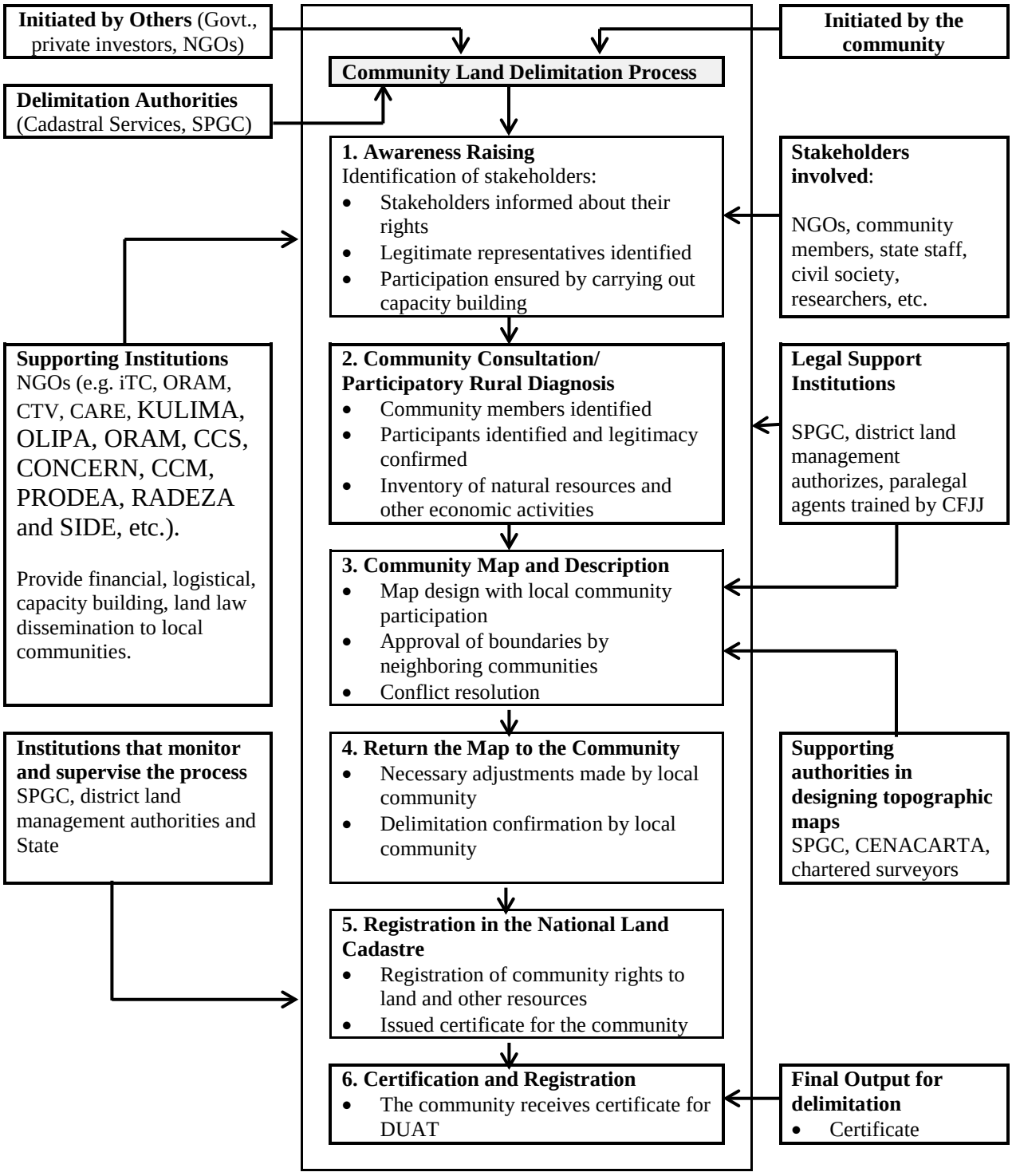
Ownership	Region: Southern	Region: Central & Northern	Total	Frequency (%)
Overall	338	638	418	
Ownership:				(a=66.4)
male	319	584	390	21.59
Female	221	519	285	4.64
Collective	262	864	595	7.38
Citizenship:				(b=5.48)
National	338	648	416	89.51
Foreign	310	781	561	5.01
Type of ownership:				(c=43.81)
Private/individual	318	626	437	42.59
Company	277	671	483	9.45
Religious/social	246	993	946	0.93
Community	402	1074	1,327	1.05
Association	620	296	359	2.15
Co-ownership		116	116	0.03
Land size:				(d=10.92)
<1,000ha	327	601	397	87.22
1,000 -10,000ha	589	681	686	1.68
>10,000ha	513	735	586	0.18
Authorization period:				
before 1980	871		871	0.1
1980-1990	358	197	313	1.2
1990-2000	654	859	769	10.8
2000-2010	312	640	384	84.0
2010-2014	61	381	227	4.0
Main use of the parcel				(e=0.77)
Agriculture	618	1,038	723	23.86
Commerce	410	515	482	6.72
Residential	205	403	244	51.8
Religion/social	443	246	302	2.39
Industry	627	1,609	818	1.02
Tourism	288	896	390	4.68
Livestock	483	923	706	5.09
Aquaculture	215	3,394	612	0.03
Public services	215	282	225	2.58
Community/Association	117	2,057	481	0.07
Forest plantation	357	2,543	342	0.51
Wildlife	160	356	1,000	0.02
Other	35	3,519	1,196	0.46

Source: Author's computation from DNTF, 2014
N=23,110
(xxx) Indicates percentages with no data

Appendix E:

Community Land Delimitation Process

Figure 9: Procedures for the Community Land Administration in Mozambique



Source: Ghebru et al. (2015)

Appendix F:

Data representativeness

Table 32: Proportion of registered DUATs with complete information by region

		Region		
Item	Statistics	Southern	Central & Northern	Total
Total observations	N	27,553	16,984	44,537
	% row	62	38	100
Valid data by key variable				
Uses	N	27,245	16,896	44,141
	% row	62	38	100
Gender	N	7,087	12,645	19,732
	% row	36	64	100
Fees	N	7,090	7,281	14,371
	% row	49	51	100
Mapping	N	20,465	12,869	33,334
	% row	61	39	100
Application date	N			
	% row	27,451	16,070	43,521
Authorization date	N	63	37	100
	% row	26,181	10,668	36,849
Authorized applications	N	71	29	100
	% row	19,619	11,714	31,333
Time (for all applications)	N	63	37	100
	% row	19,606	6,963	26,569
DNTF usable data (authorized only)	N	74	26	100
	% row	18,211	4,899	23,110
District-level data		79	21	100
INE (Projected from Census 2007)	N			
	% row	35	108	143
DNTF (aggregated from above)	N	24	76	100
	% row	33	105	138
Overall used data		24	76	100
% DNTF	Mean	66	2	52
% Districts (DNTF/DNTF)a	Mean	94	97	97
Representativeness (%)	Mean	62	26	50

Source: National Statistics of land use rights by DNTF, 2014 and INE, 2015
Districts excluded include Maputo city (Southern), Namacurra, Namarroi, Nicoadala and Pebane (Central), no information on DUATs.

REFERENCES

REFERENCES

Aaberge, R., & Mogstad, M. (2007). On the Definition and Measurement of Chronic Poverty. Institute for the Study of Labor IZA Discussion Paper N.2659

Achia, T., Wangombe, A., &Khadioli, N. (2010). A Logistic Regression Model to Identify Key Determinants of Poverty Using Demographic and Health Survey Data. *European Journal of Social Sciences – Volume 13, Number 1 (2010)*

Adhikari, C. & Bjorndal, T. (2014). Economic Relationship between Access to Land and Rural Poverty in Nepal. Applied Economics Journal Vol. 21 No. 1 (June 2014): 20-41.

Adhikari, C. B. & Chatfield, P. (2008). *The Role of Land Reform in Reducing Poverty Across Nepal*. Paper Presented at the Third Annual Himalayan Policy Research Conference Nepal Study Centre, Wisconsin, Madison, USA.

Alderman, H. (1992). Incomes and in Ghana. *CFNPP Working Paper Nº 26. Ithaca, NY*.

Araar, A. & Duclos,J. (2013). USER MANUAL-DASP version 2.3. *DASP*: Distributive Analysis Stata Package. *Université Laval:* PEP, CIRPÉE and World Bank. June 2013.

Atkinson, A. B. (1991). Comparing Poverty rates Internationally: Lessons from recent Studies in Developed Countries. *World Bank Economic Review, 5(1): 3-21.*

Bandeira, P. and Sumpsi, J. 2009. *Access to land and rural poverty in developing countries: Theory and evidence from Guatemala.* Universidad Politecnica de Madrid. 12 January 2009 (Online at http://mpra.ub.uni-muenchen.de/13365/ accessed on 10/29/2014 at 10:03pm).

Benfica, R., Boughton, D., Mouzinho, B. & Uaiene, R. (2014). Food Crop Marketing and Agricultural Productivity in a High Price Environment: Evidence and Implications for Mozambique. Research Paper 76E. May 2014.

Bigsten, A., Kebede, B., Abebe, A. & Taddesse, M. (2003). Growth and Poverty Reduction in Ethiopia: Evidence from Household Panel Surveys. World Development 31 (1): 87-106

Boughton, D., Mather, D., Tschirley, D., Walker, T., Cunguara, B., & Payongayong, E. (2006). Changes in rural household income patterns in Mozambique 1996–2002 and implications for Agriculture's contribution to poverty reduction. *MINAG Working Paper No.61E. Maputo: Ministry of Agriculture.*

Boughton, D., Mather, D., Tschirley, D., Walker, T., & Payongayong, E. (2005). Pro-Poor Rural Economic Growth for Post-Civil War Recovery: Myth or Reality in Mozambique? *Accepted as a poster paper for the 26th International Association of Agricultural Economics Meeting, Brisbane, August 2006.*

Burgess, R. (2001). Land Welfare: Theory and Evidence from China. Working Paper. Department of Economics and STICERD. *London School of Economics, London.*

Brück, T., & Schindler, K. (2009). Smallholder Land Access in Post-War Northern Mozambique. *The Limits of State-Led Land Reform*, *37*(8), 1379–1389. http://doi.org/10.1016/j.worlddev.2008.08.016

Burr, K. 2000. The evolution of the International Law of Alienability: the 1997 Land Law of Mozambique as a case study (unpublished).

Cameron, A & Trivedi, P. (2010). Microeconometrics Using Stata, Revised Edition. . Stata Press Publication, College Station, Texas.

Carter, M. & Barrett, C. (2006). The Economics of Poverty Traps and Persistent Poverty: An Asset-Based Approach. *Journal of Development Studies 42 (2): 178–199.*

Cunguara, B. (2008). Pathways Out of Poverty in Rural Mozambique. M.Sc. Thesis Submitted to Michigan State University.

Dale, P. & McLaughlin, J. (1988). *Land Information Management*. Claredon Press, Oxford; Oxford University NEW YORK, ISBN 0-19-858405-9, 266 p.

Dang, H., Lanjouw, P., Luoto, J., & McKenzie, D. (2014). Using repeated cross-section to explore movements into and out of poverty. Journal of Development economics 107 (2014): 112-128.

Datt, G.; Simler, K., Mukherjee, S., & Dava, S. (2000). Determinants of Poverty in Mozambique: 1996-97. Food Consumption and Nutrition Division Discussion Paper no. 78. *International Food Policy Research Institute, Washington, DC.*

Dercon, S., Gilligan, D., Hoddinott, J. & Woldehanna, T. (2009). The Impact of Agricultural Extension and Roads on Poverty and Consumption Growth in Fifteen Ethiopian Villages. *American Journal of Agricultural Economics 91 (4): 1007-1021*.

Deaton, A. (1997). The Analysis of Household Surveys. Washington, D.C.: World Bank.

Deininger, K. 2003. Land Policies for Growth and Poverty Reduction. A World Bank Policy Research Report. *Oxford and New York: World Bank and Oxford University Press.*

Donovan, C. & Mather, D. (2007), Impacts of Prime Age Adult Mortality on Rural Household Income, Assets, and Poverty in Mozambique: Analysis with the TIA Panel Data Set. *No 55254, Food Security Collaborative Policy Briefs, Michigan State University, Department of Agricultural, Food, and Resource Economics.*

DNTF (National Directorate of Land and Forest) (2014). National Statistics on Land Use Rights of Mozambique

Duclos, Jean-Yves , Abdelkrim Araar, and John Giles. 2006. Chronic and Transient Poverty: Measurement and Estimation, with Evidence from China. CIRPEE Working Paper No. 06-11. Downloadable from SSRN: http://ssrn.com/abstract=895181

Eberts, R. & Gromberg, T. (1990). Structure, Conduct, and Performance in the Local Public Sector. *National Tax Journal 43 (2): 165-173*.

Edwards, S., Allen, A., & Shaik, S. (2006). Market Structure Conduct Performance (SCP) Hypothesis Revisited using Stochastic Frontier Efficiency Analysis. *Selected Paper prepared for presentation at the American Agricultural Economics Association, Annual Meeting, Long Beach, California, July 23-26, 2006.*

FAO (Food and Agriculture Organization of the United Nations). (2008). FAO Methodology for the measurement of food deprivation: updating the minimum dietary energy requirements. Rome: FAO Statistics Division.

Finan, F.; Sadoulet, E.; & de Janvry, A. (2005). Measuring the poverty potential of land in Mexico. *Journal of Development Economics 77 (2005): 27-51*.

Foster, J., Greer, J, & Thorbecke, E. (1984). Notes and Comments: A Class of Decomponsable Poverty Measures. Econometrica 52 (3) (May 1984).

Frey, A. 2004. Land Law Legislation. MozLegal.

Garret, J. & Ruel, M. (1999). Are Determinants of Rural and Urban and Nutritional Status Different? Some Insights from Mozambique. *World Development Vol. 27 (11):1955-1975.*

Geda, A., Jong, N.; Kimenyi, M. S., & Mwabu, G. (2005). Determinants of Poverty in Kenya: A Household Level Analysis. *Department of Economics Working Paper Series No. 2005–44, University of Connecticut, Storrs, Connecticut* (http://www.econ.uconn.edu/working/2005-44.pdf).

Garza-Rodriguez, J., Gonzalez-Martinez, M., Quiroga-Lozano, M., Solis-Santoyo, L. & Yarto-Weber, G. (2010). Chronic and transient poverty in Mexico: 2002-2005. Economics Bulletin, 30(4): 3188-3200.

Ghebru, H., Pitoro, R. & Woldeyohannes, S. (2015). Customary tenure and innovative measures of safeguarding land rights in Africa: The community land initiative (iniciativa de terras comunitárias) in Mozambique. IFPRI Discussion Paper 1484. Washington, D.C.: International Food Policy Research Institute (IFPRI). (Available at: http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/129826)

Government of Mozambique (PARPA), (2001).The National Action Plan for the Reduction of Absolute Poverty, 2001-2005. Final draft approved by the Council of Ministers, April 2001, Maputo. Accessible at http://siteresources.worldbank.org/INTPRS1/Resources/Country-Papers-and-JSAs/Mozambique_PRSP.pdf (Accessed on 8/3/2015).

Grootaert, C. (1997). Social Capital: The Missing Link? In World Bank, *Expanding the Measure of Wealth: Indicators of Environmentally Sustainable Development.* Washington, D.C.

Gugerty, M.& Timmer. P. (1999). Growth, Inequality and Poverty Alleviation: Implications for Development Assistance. *Washington, D.C.: USAID. Mimeo.*

Haggblade, S., P.B.R. Hazell, and T. Reardon. 2010. The Rural Nonfarm Economy: Prospects for Growth and Poverty Reduction. *World Development*. October.

Harper, C., Marcus, R., & Moore, K. (2003). Enduring poverty and the conditions of childhood: lifecourse and intergenerational poverty transmissions. World Development 31 (3): 535-554.

Hulme, D. & Shepherd, A. (2003). Conceptualizing Chronic Poverty. World Development 31 (3): 402-423.

IFPRI, 2013. 2013 Global Hunger Index. The Challenge of Hunger: Building Resilience to Achieve Food and Nutrition Security.

IMF (International Monetary Fund). 2011. Republic of Mozambique: Poverty Reduction Strategy Paper. .Country Report No. 11/132. June 2011. Accessible at https://www.imf.org/external/pubs/ft/scr/2011/cr11132.pdf (Accessed on 8/3/2015).

IMF (International Monetary Fund). 2007. Republic of Mozambique: Poverty Reduction Strategy Paper. IMF Country Report No. 07/37. January 2007. Accessible at http://www.imf.org/external/pubs/ft/scr/2007/cr0737.pdf (Accessed on 8/3/2015).

INE (Instituto Nacional de Estatisticas). (2015). Estatisticas Territoriais Distritais. Available at http://www.ine.gov.mz/estatisticas/estatisticas-territorias-distritais (accessed on 9/29/2015)

Jalan, J. & Ravallion, M. (1998). Determinant of Transient and Chronic Poverty. Evidence from Rural China. World Bank. Policy Research Working Paper Series No. 1936. Washington DC.

Jayne, T. S., Chapoto, A., Sitko, N., Nkonde, C., Muyanga, M., & Chamberlin, J. (2014). Is the Scramble for Land in Africa Foreclosing a Smallholder Agricultural Expansion Strategy? *Journal of International Affairs*, *67*(2), 35–53.

Jayne, T., Yamano, T., Weber, M., Tschirley, D., Benfica, R., Chapoto, A., & Zulu, B. (2003). Smallholder income and land distribution in Africa: implications for poverty reduction strategies. *Food Policy, 28(3): 253-275.*

Kizito, A. (2011). The Structure, Conduct, and Performance of Agricultural Market Information Systems in Sub-Saharan Africa. Submitted to Michigan State University in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy. Agricultural, Food, And Resource Economics.

Lanjouw, P., & Ravalion, M. 1995. Poverty and Household Size. *Economic Journal, 105 (433): 1317 1333.*

Lohano, Hari Ram (2009). Poverty dynamics in rural Sindh, Pakistan. Chronic Poverty Research Centre. Working Paper November 2009 No. 157. ISBN: 978-1-906433-59-8.

Lopez, R. and Vales, A. 2000. Fighting Rural Poverty in Latin America: New Evidence of Effects of Education, Demographics and Access to Land. *Economic Development and Cultural Change 49 (1): 197-211*

Mabiso, A., Cunguara, B., & Benfica, R. (2014). Food (In)security and its drivers: insights from trends and opportunities in rural Mozambique. (6):649–670.

Mather, D., Benfica, B, Chamberlin, J., & Pitoro, R. (2012). Population Density and Smallholder Landholdings, Agricultural Intensification, and Household Welfare in Rural Mozambique. *(unpublished*)

Mather, D. (2012). Determinants of Crop Income in Rural Mozambique, 2002-2005. *RP 71E. January 2012.*

Maredia, M., Pitoro, R., Songqing, J., Payongayong, E., & Schultink, G. (2012a). Impact Evaluation of site-specific Activities under the Land Tenure Services Project: Report of the Baseline Survey Conducted in Two Urban Areas in Northern Mozambique. *Report Submitted by Michigan State University to Millennium Challenge Corporation. October 4, 2012*.

Maredia, M., Pitoro, R., Songqing, J., Payongayong, E., & Schultink, G. (2012b). Impact Evaluation of the Policy Monitoring and Capacity Building Activities of the Land Tenure Services Project in Mozambique: Baseline Report Based on the *TIA* 2008 Survey Data. *Report Submitted by Michigan State University to Millennium Challenge Corporation. October 4, 2012.*

Marule, H. F. 1998. Land-Poor in a “Land-Abundant" Setting: Unravelling a Paradox in Mozambique, *National Directorate of Economics Research Paper Series*, Maputo, Ministry of Agriculture.

Maxwell, D & Wiebe, K. (1998). Land Tenure and ; A Review of Concepts, Evidence, and Methods. *Research Paper No.129. January 1998. Land Tenure Center. University of Wisconsin, Madison.*

McCulloch, N. & Baulch, B. (1997). *Distinguishing the Chronically from the Transitory Poor: Evidence from Rural Pakistan*. IDS Working Paper 97.

McKay, A. & Lawson, D. (2002). *Chronic Poverty: A Review of Current Quantitative Evidence Chronic Poverty*. Research Centre Working Paper No 15.

MPD (Ministry of Planning and Development). (2010). Poverty and Well-being in Mozambique: The Thrid National Assessment**.** *National Directorate of Studies and Policy Analysis. October, 2010*

MINAG (Ministry of Agriculture of Mozambique). 2010. Provision of Long and Short Term Consultancy and Technical Assistance Services to the MCA (Mozambique) Land Component. *First Draft.* Institutional Review and Design and Work Plans for Capacity Building. November 2010.

MINAG (Ministry of Agriculture of Mozambique). (2010). Strategic Plan for Agricultural Development: PDSA 2010-2019. For an integrated, prosperous, competitive and sustainable agriculture sector. Ministry of Agriculture. October, 2010.

Mohammad, N. (1992). Historical Dimensions of Agriculture. Ashok Kamar Mittal Concept Publishing Company. ISBN 81-7022-400-4. New Delhi 110059, India.

Muyanga, M., Jayne, T. S., & Burke, W. J. (2013). Pathways into and out of Poverty: A Study of Rural Household Wealth Dynamics in Kenya. *The Journal of Development Studies*, *49*(10), 1358–1374. http://doi.org/10.1080/00220388.2013.812197

Muyanga, M., Ayieko, M., & Bundi, M. (2007). Transient and Chronic Rural Household Poverty: Evidence from Kenya. PMMA Working Paper No. 2007-20..

Mukherjee, S. & Benson, T. (2003). The Determinants of Poverty in Malawi, 1998. *World Development, 31 (2): 339-358*.

Muller, Christophe (2002). Censored Quantile Regressions of Chronic and Transient Seasonal Poverty in Rwanda. Centre for Research in Economic Development and International Trade, School of Economics, University of Nottingham, University Park, Nottingham NG2 2RD.

Nargis, N., & Hossain, M. (2006). Income dynamics and pathways out of rural poverty in Bangladesh, 1988–2004. *Agricultural Economics*, *35*, 425–435. http://doi.org/10.1111/j.1574-0862.2006.00188.x

Okwi, P. , Ndeng'e, G., Kristjanson, P., Arunga, M. , Notenbaert, A.,; Omolo, A., Henninger, N. , Benson, T., Kariuki, P. & Owuor, J. (2007). *The National Academic of Sciences of the USA, 104 (43): 16769-16774.*

Okurut, F., Odwee, J. A., & Adebaua, A. (2002) Determinants of Regional Poverty in Uganda. *African Economic Research Consortium Research Paper No. 122*

Panganiban, M. (2010).Transient, Chronic, and Intergenerational Poverty: Evidence from the Cebu Longitudinal Health and Nutrition Survey. A thesis submitted to the University of the Philippines School of Economics in partial fulfillment of the requirements for the degree of Master of Arts in Economics

Pitoro, R., Jin, S., Maredia, M, Schultink, G., & Payongayong, E. (2015). Baseline Report for the National Land Administration Interventions in Districts and Municipalities in Northern Mozambique under MCA-Mozambique's Land Tenure Services Project. Report Submitted by Michigan State University to Millennium Challenge Corporation for Comments – November 22, 2014 (unpublished).

Policonomics (2012). Structure, consudtc, performance paradigm. Economics made simple.

Reardon, T., Kelly, V., Crawford, E., Diagana, B., Dione, J., Savadogo, K. & Boughton, D. (1997). Promoting Sustainable Intensification and Productivity Growth in Sahel Agriculture after Macroeconomic Policy Reform. *Food Policy*, 22 (4): 317-328.

Ribas. P & Machado, A. (2007). Distinguishing Chronic poverty from Transient poverty in Brazil. Developing model from Pseudo-Panel Data. International Poverty Centre. Working Paper No. 36, April, 2007.

Roth, Michael. 2010. Land Tenure, Property Rights, and Food Security. Emerging Implications for USG Policies and Programming. *Property Rights and Resource Governance. USAID Issue Brief. Briefing Paper # 1. April 2010.*

Sen, A. (1981). Poverty and famines: an essay on entitlement and deprivation. Oxford: Oxford University Press.

Shapito, A., Gage, D., & Rinehardt, B. (2009). Mozambique –Country Proposal Addressing Global Food Insecurity. Fall 2009 Capstone Workshop.

Steudler, D., Rajabifard, A., & Williamson, I. (2004). Evaluation of land administration systems. *Land Use Policy 21 (2004) 371–380.*

Strauss, J. 1983. Determinants of Food Consumption in Rural Sierra Leone: Application of Quadratic Expenditure System to Consumption-Leisure component of Household-Firm Model. Journal of Development economics (11): 327-354.

Tschirley, D., & Weber, M. T. (1994). Strategies under extremely adverse conditions: the determinants of household income and consumption in rural Mozambique. *World Development 42 (2), 159–173*.

Udry, C. (2010). The Economics of Agriculture in Africa: Notes Toward a Research Program. Draft Paper

UNDP. (2014). 2014 Humand Development Statistical Tables. Available at http//:hdr.undp.org/data Accessed on January 17, 2015.

USAID (2014). Request for Quotation No. SOL-656-000009-PARTI Evaluation. Mozambique

Valente, C. (2009). The Food In(security Impact of Land Redistribution in South Africa: Microeconometric Evidence from National Data. *World development 37 (9): 1540-1533*.

Walker, T., Tschirley, D., Low, J., Tanque, M., Boughton, D., Payongayong, E., &Weber, M. (2004). Determinants of Rural Income in Mozambique in 2001-2002. *Research Report No 57 E. May 2004 (CDIE Reference number PN-ADH-865).*

Wodom, Q. (2000). Micro-determinants of Consumption, Poverty, Growth, and Inequality in Bangladesh. *Applied Economics, 32: 1337-1352.*

WFP, 2012. Country Programme Mozambique 200286 (2012-2015). Available at http//:wfp.org/eb, Accessed on January 17, 2015.

Wooldridge, J. (2002). Econometric Analysis of Cross Section and Panel Data. Cambridge, MA: MIT Press.

World Bank, (2008). World Development Indicators: Poverty data a supplement to World Development Indicators 2008. The World Bank. ISBN: 978-0-8213-7386.6.

World Bank, (2014). World Development Indicators: Agricultural Production and Productivity. (Available at http://data.worldbank.org, accessed on 17 November 2014).

Yaqub, S. (2000). Poverty Dynamics in Developing Countries. Sussex, England: Institute of Development Studies.