Income diversification patterns in rural Sub-Saharan Africa

Reassessing the evidence

Benjamin Davis

(FAO)

Stefania Di Giuseppe and Alberto Zezza

(World Bank)

30 May 2014

PRELIMINARY - DO NOT QUOTE WITHOUT PERMISSION

I. Introduction

"East Asian countries grew rapidly by replicating, in a much shorter time frame, what today's advanced countries did following the Industrial Revolution. They turned their farmers into manufacturing workers, diversified their economies, and exported a range of increasingly sophisticated goods. Little of this process is taking place in Africa. … Optimists say that the good news about African structural transformation has not yet shown up in macroeconomic data." This quote from Dani Rodrik's blog (Rodrik, 2013) is one example of a concern that is being read and heard frequently since the data on sustained GDP growth in several African countries have changed the rhetoric about the region, and stories about the "hopeless continent" (Economist, 2000) have been replaced by those about the "African Lions" (McKinsey Global Institute, 2010).

One of the most well-established stylized facts of the development literature is that, in the process of structural economic transformation that accompanies economic development, the farm sector as a share of the country's GDP will decline as a country's GDP grows (Chenery and Syrquin, 1975). The question is therefore whether Sub-Saharan African countries are following a similar path as other countries that have embarked on sustained period of growth before them. According to the IMF (2012) structural transformation has been taking place in Africa, but at a slow pace.

While most of this debate has focused on the macro-economy, some of it has focused on the agricultural and rural economy. According to IFPRI (2012), the most important challenges to be addressed if Africa is to sustain current growth in the future are the modernization of smallholders agriculture, and the promotion of enterprise creation to raise the number of jobs created outside agriculture, and their productivity.

In rural areas, a shrinking agricultural sector and expanding rural non-farm (RNF) activities, as well as a changing definition of rural itself, should be viewed as likely features of economic development. Growth in RNF activities cannot be seen in isolation from agriculture, as both are linked through investment, production, and consumption throughout the rural economy, and both form part of complex livelihood strategies adopted by rural households. While agriculture declines in relative terms as a result of structural transformations, its output and productivity increase in the process. The improvement of incentives for agriculture in the past decade, via the improvement of the policy environment and better terms of trade, provide a more conducive environment for higher agricultural growth and an opportunity for the much awaited structural transformation to finally start (Binswanger-Mkhize, McCalla, and Patel 210).

FAO (1998) characterizes three broad ‘‘stages” of transformation of the rural economy. In the first stage production and consumption linkages between the farm and non-farm sectors are strong and rural–urban links relatively weak. During this stage, non-farm activities tend to be located upstream or downstream from agriculture. In the second stage a lower share of households are directly dependent on agriculture and there are greater links between rural and urban areas. Services take off more strongly, while labor-intensive manufacturing in rural areas finds increasing competition from more capital-intensive urban enterprises and imported goods. These trends mature in the third stage, with stronger links with the urban sector, and migration, employment and income increasingly generated in sectors with little or no relation to agriculture.

In this context, the challenge for policy makers is how to assure that the growth of RNF activities can be best harnessed to the advantage of poor rural households and how to identify the mechanisms to best exploit synergies across agricultural and non-agricultural sectors. The growing consensus is that although agriculture continues to play a central role in rural development, the promotion of complementary engines of rural growth is of paramount importance. Yet, the poverty and inequality implications of promoting RNF activities are not straightforward. They depend on the access of the poor to RNF activities, on the potential returns to RNF activities, and on the share of RNF activities in total income. Just as for agriculture, the ability of poor individuals and/or households to participate in potentially more lucrative RNF activities may be limited given the barriers to entry in terms of liquidity or human capital constraints. When this is the case, a vicious circle may be established whereby poor households get relegated to low-return RNF activities that serve more as coping strategies than as a way out of poverty. Promotion of RNF activities may then leave poor households behind and exacerbate rural income inequality.

A rather large body of literature has developed over the last 20 years investigating the extent and determinants of rural household income diversification, the importance and features of rural non-farm income and employment, and the determinants of households’ participation in and returns to different income generating activities (FAO, 1998; Barrett et al. 2001; Lanjouw and Lanjouw, 2001; Haggblade et al., 2007; Winters et al., 2009; Davis et al. 2010; Winter et al., 2010). The 2007 World Development Report on agriculture and the 2011 IFAD Rural Poverty Report also devoted much attention to these themes. A major conclusion of these studies is that rural household income diversification is the norm rather than the exception, and that while endowments (physical, human, natural capital) and wealth play a role in driving engagement in different economic activities, some degree of diversification off the farm is common at all levels of welfare.

In order to facilitate cross-country comparisons on the composition of household income, the FAO’s Rural Income Generating Activities project has built comparable incomes aggregates from a database of around 40 national household surveys with good quality income data from 22 countries from all developing regions.

The initial exploration of the RIGA database, performed in 2007 in part as background to the World Development Report on Agriculture for Development (Winters et al., 2009; Davis et al., 2010; Winters et al., 2010) highlighted a number of regularities concerning household’s patterns of income diversification in developing countries, while also hinting towards a specificity of the Sub-Saharan African countries included in that database. The African countries included in that database stood out as the only ones for which specialization in farming, as opposed to holding a diversified income portfolio, was the norm.

That analysis was however based on data for only 4 countries in Sub-Saharan Africa (Madagascar, Malawi, Nigeria, Ghana). This paper sets out to expand on and update that work bringing into the analysis more recent data form some of the same countries, and data on an additional 5 countries (Ethiopia, Kenya, Niger, Tanzania, Uganda) to test whether adding more countries and more recent survey years confirm the existence of such an African specificity. This new set of countries accounts

for 51 percent[1] of the Sub-Saharan African (SSA) population in 2012, as opposed to 26 percent in initial RIGA sample. While caution is still warranted in treating this sample as representative of SSA as a whole, its coverage is arguably much more complete.

Another way in which this paper expands on the existing literature is by looking explicitly at how spatial, location issues are at play in determining rural income diversification patterns in Africa. To do that, we take advantage of one of the key the innovative features of the Living Standard Measurement Study - Integrated Surveys on Agriculture (LSMS-ISA) datasets[2] that have recently become available for Ethiopia, Kenya, Niger, Nigeria, Tanzania, and Uganda, namely their being fully geo-referenced. While quite a bit has been written in the last couple of decades on the role of geography in development, most of the studies are cross-country comparisons based on macro-data. Some micro-based studies do exist, but they deal mostly with issues of convergence or divergence in inequality or welfare across regions within a country. Very few studies look at how differences in the structure of household incomes vary with geography within countries, and we are aware of none that does that by also introducing a cross-country comparative dimension. Furthermore, very few of these micro studies focus on African countries.

There are a number of reasons why location matters for the choice of economic activities households (and firms) engage in. We follow Deichmann et al. (2008) in identifying two main strands of literature that are helpful in framing the arguments around location and income diversification. The first is the rural farm/non-farm employment (and income) literature, a good part of which has focused on the linkages between the two 'sectors'. One key empirical regularity of this literature is that at very low levels of development, non-farm activities tend to be closely related to agriculture. When agricultural growth starts taking off (e.g. due to technical change), so does the non-farm economy, thanks to the backward and forward linkages from agriculture. In a sense, agricultural activities are a driver of non-agricultural activities, and one of the measures of successful agricultural development is the relative decrease in farm employment and income shares as the non-farm sector gains 'speed'.

Such growth patterns are likely not to be location neutral, as the intrinsic potential for agricultural growth (e.g. climatic and land conditions) or the presence of an effective demand for agricultural products (whether export or domestic urban markets) are not attributes that are allocated randomly across space. Over-time endogenous sectoral growth biases may play a role, as infrastructure and other investments conducive to both farm and non-farm growth may tend to locate where growth is occurring, leading to increased spatial disparities in growth patterns. This is why some of this discussion has taken place in the context of the literature on the policy challenges of dealing with 'laggard' regions within a country. Growth in a region, however, can also serve to generate demand for goods and labor from other regions, and a tax base to provide public infrastructure to other parts of the country, so that both regional convergence or divergence paths are possible depending on how both exogenous physical characteristics and endogenous policy decisions play out in practice.

In Latin America this has attracted considerable attention for instance in the context of the debate on the 'territorial approach' to rural development (De Ferranti et al., 2005). This has put the emphasis on how sectoral policies are always bound to have differential impacts across space, so that explicitly incorporating spatial issues into policy design can help counter possible territorial distortions in development patterns.

The second key strand of literature is the new economic geography debate. Much of this debate has focused on the extent to which it is geography, as opposed to institutions, that explains differential development outcomes, and has taken place at the level of cross country, time-series studies (Krugman; Gallup et al.; Sachs). Some of it has tried to look at the same issues using micro-economic data. One main tenet of that debate is that even if soil quality and climate where the same

[1] Once we are able to include Ethiopia.

[2] See www.worldbank.org/lsms-isa for more information on the LSMS-ISA program of the World Bank, and for full access to the data and documentation.

everywhere, there would still be reasons why location would matters for economic activity. We again follow Deichmann et al. in identifying two opposing tendencies which come into play in this context. On the one hand dispersion of economic activities would happen as firms would tend to locate in areas with lower wages, and the production of non-tradable goods and services would locate close to demand is. Activities connected to non-mobile inputs (such as agricultural land) are by definition going to be spread over space to some extent. On the other hand, agglomeration would push businesses to locate close to consumers, or to the source of raw material, so that activities depending on mobile inputs but with higher transport costs for their outputs would tend to have the highest gains from concentrating in particular locations. Dis-economies related to congestion would to some extent counteract the benefits of agglomeration pushing some businesses to locate away from cities.

The early theory behind this debate is associated with the work of Von Thünen in the early 1800s (Von Thünen, 1966). According to Von Thünen's theory cities are a main driver of the location of economic activities, which would tend to locate concentrically around urban centers so that different specialization patterns are found as one moves further away from cities. Fafchamps and Shilpi (2003 and 2005) investigate how specialization patterns relate to location using micro-data for Nepal and a framework largely consistent with Von Thünen's.

Combining these two sets of arguments it becomes clear that both exogenous physical location issues, as well as the interaction between sectors (and factor markets), and endogenous issues related to policies (infrastructural as well as sectoral policies) come into play in complex ways that make it less than straightforward to predict the spatial location of economic activities in rural areas.

The analysis of these questions is complicated by the number of additional dimensions that are relevant to unpacking the simplistic farm/non-farm differentiation. Both farm and non-farm activities, for instance, can be differentiated between high- and low-return ones (Lanjouw; Lanjouw and Feder), and between tradable and non-tradable ones (with the two at times, but not necessarily, overlapping). Foster and Rosenzweig (2004) for instance show how it is only the non-tradeable non-farm activities that receive a push by agricultural productivity growth in rural India. Non farm-tradeables, on the contrary, tend other things equal to locate where agricultural productivity growth is lower, possibly due to the effect of higher wages induced by agricultural growth.

Another level of complexity is related to the existence of non-linearities in the relationships that determine location of economic activities across space. Fafchamps and Shilpi (2003) find for instance that in Nepal agricultural wage employment is concentrated in rural areas close enough to cities to specialize in high-value horticulture, but not so close as to be taken over by unskilled 'urban' wage labor opportunities. Non-linearities may also be relevant when the role of city size is found to matter for engagement in non-farm activities (Fafchamps and Shilpi, 2003) of for povery reduction (Christiaensen et al. 2013). Also, specialization may need specific levels of market size to kick-in and it isn't necessarily in direct association with just any level or feature of urbanization (Fafchamps and Shilpi, 2004). Last but not least, the different dimensions (e.g. agricultural potential and distance) do interact in determining locational advantage, occupational choices and returns to economics activities. Yamano and Kijima (2010) for Uganda and Deichman et al. (2008) for Bangladesh both hint at ways in which the role of agricultural potential in determining household productive choice changes between more or less connected areas – a finding that is also consistent with the work by Foster and Rosenzweig (2004) on India.

This discussion leads to the intersection of this debate on non-farm income diversification with the recent debate on the role of small rural towns as opposed to that of large cities if determining different development outcomes in both the urban and rural spaces. As pointed out by Christaensen (2013), against the African backdrop of increasingly fast urbanization, biased towards megacities, it is important to understand how different patterns of urbanization are associated, or drive, development outcomes. On the one hand the development of larger cities may come with a number

of gains from agglomeration and specialization. On the other, urban growth based on a larger number of smaller towns may result in greater connectivity between the urban and rural space, and hence greater benefits to rural welfare associated with urbanization. Christiaensen et al. (2013) using data for Kagera (Tanzania) complemented with cross-country analysis using data from 51 countries, suggest that it is the growth in small towns that is likely to generate most rural poverty reduction.

One of the reasons why there has been so little empirical investigation of these issues in Africa (and why most it is based on macro data and aggregate cross-country regressions) is the lack of suitable data to undertake this type of analysis. In this paper we take advantage of the geo-referencing of households, and of the focus on agricultural activities that are two of the defining features of the LSMS-ISA datasets to explore these issues using microeconomic analysis, but also aiming at uncovering difference and regularities across countries in Sub-Saharan Africa.

The paper continues as follows. In Section 2, we present and describe the construction of the RIGA database. In Section 3, we analyze the participation of rural households in income generating activities and the share of income from each activity in household income, over all households and by expenditure quintile. We then move from the level of rural space to that of the rural household, examining patterns of diversification and specialization in rural income generating activities, again over all households, and by expenditure quintile. We also use measures of stochastic dominance to characterize the relationship between types of income and income generating strategies and welfare. In Section 4, we examine the role of location in income generation strategies in a multivariate framework, and we conclude in Section V.

II. The Data

The RIGA database

The RIGA database is constructed from a pool of several dozen Living Standards Measurement Study (LSMS) and from other multi-purpose household surveys made available by the World Bank through a joint project with the FAO.[3] The original choice of countries for the RIGA database was guided by a desire to include IDA (International Development Association) countries with higher levels of poverty and to ensure geographic coverage across the four principal developing regions—Asia, Africa, Eastern Europe, and Latin America—as well as adequate quality and sufficient comparability in codification and nomenclatures of the respective surveys. Additional countries were added to the RIGA database as part of the effort to prepare background papers for the 2012 WDR on jobs. With the advent of the LSMS-ISA project, an agreement was reached to bring in these Sub Saharan African countries to the RIGA database as the country data become available. Together, 40 sets of household survey data from 21 countries (Table 1) were utilized for this paper. Each survey is representative for both urban and rural areas; only the rural sample was used for this paper.[4] While clearly not representative of all developing countries, or all of Sub Saharan Africa, the list does cover a significant range of countries, regions, and levels of development and has proven useful in providing insight into the income generating activities of rural households in the developing world.[5]

[3] Information on the RIGA database can be found at: http://www.fao.org/economic/riga/en/.

[4] Each country has their own definition of rurality, and government definitions not comparable across countries may play some part in explaining cross-country differences. While recognizing that variation in country-specific definitions of rural may explain observed differences in income composition, the available survey data do not allow for straightforward construction of an alternative measure across all countries. We thus use the government definition of what constitutes rurality. Further, rurality is identified via household domicile, not the location of the job-- a number of labor activities identified as rural may actually be located in nearby urban areas.

[5] Details of the construction of the income aggregates can be found in Carletto, et al (2007).

Table 1. Countries included in the analysis

	Country	Name of survey	Year collected	Number of observation			Per Capita GDP,
				Total	Rural	Urban	PPP Constant 2005,
African Countries	Ghana	Ghana Living Standard Survey Round	1992	4552	2913	1639	949
	Ghana	Ghana Living Standard Survey Round	1998	5998	3799	2199	1051
	Ghana	Ghana Living Standard Survey Round	2005	8687	5069	3618	1222
	Kenya	Integrated household budget survey	2005	13,212	8,487	4,725	1340
	Madagascar	Enquete Permanente Aupres des Menages	1993-1994	4,504	2,652	1,852	895
	Malawi	Integrated Household Survey	2004-2005	11280	9840	1440	640
	Malawi	Integrated Household Survey	2010-2011	12,271	10,038	2,233	785
	Nigeria	Living Standard Survey	2004	17,425	13,634	3,791	1707
	Nigeria	Living Standard Survey	2010	4,682	3,182	1,500	2120
	Niger	National Survey on Household Living Conditions and Agriculture	2011	3,968	2,430	1,538	535
	Uganda	The Uganda National Household Survey	2005-2006	7,424	5,714	1,710	966
	Uganda	The Uganda National Household Survey	2009-2006	2,975	2,206	769	1130
	Tanzania	National Panel Survey	2009	3,265	2,063	1,202	1240
Non African Countries	Albania 2002	Living Standards Measurement Study	2002	3 599	1 640	1 959	4710
	Albania 2005	Living Standards Measurement Study	2005	3 640	1 640	2 000	5463
	Bangladesh 2000	Household Income-Expenditure Survey	2000	7 440	5 040	2 400	901
	Bangladesh 2005	Household Income-Expenditure Survey	2005	10 080	6 400	3 680	1068
	Bolivia 2005	Encuesta de Hogares	2005	4 086	1 751	2 335	3758
	Bulgaria 1995	Integrated Household Survey	1995	2 468	824	1 664	6930
	Bulgaria 2001	Integrated Household Survey	2001	2 633	877	1 756	7348
	Ecuador 1995	Estudio de Condiciones de Vida	1995	5 810	2 532	3 278	5658
	Ecuador 1998	Estudio de Condiciones de Vida	1998	5 801	2 535	3 266	5862
	Guatemala 2000	Encuesta de Condiciones de Vida	2000	7 276	3 852	3 424	3966
	Guatemala 2006	Encuesta de Condiciones de Vida	2006	13 693	7 878	5 808	4178
	Indonesia 1993	Family Life Survey- Wave 1	1993	7 216	3 786	3 430	2487
	Indonesia 2000	Family Life Survey- Wave 3	2000	10 435	5 410	5 025	2724
	Nepal 1996	Living Standards Survey I	1996	3 370	2 655	715	829
	Nepal 2003	Living Standards Survey III	2003	5 071	3 655	1 416	926
	Nicaragua 1998	Encuesta de Medición de Niveles de Vida	1998	4 236	1 963	2 273	1961
	Nicaragua 2001	Encuesta de Medición de Niveles de Vida	2001	4 191	1 839	2 352	2145
	Nicaragua 2005	Encuesta de Medición de Niveles de Vida	2005	6 864	3 400	3 464	2311
	Pakistan 1991	Integrated Household Survey	1991	4 792	2 396	2 396	1719
	Pakistan 2001	Integrated Household Survey	2001	15 927	9 978	5 949	1923
	Panama 1997	Encuesta de Niveles de Vida	1997	4 945	2 496	2 449	7554
	Panama 2003	Encuesta de Niveles de Vida	2003	6 363	2 945	3 418	8267
	Tajikistan 2003	Living Standards Survey	2003	4 156	2 640	1 520	1283
	Tajikistan 2007	Living Standards Survey	2007	4 860	3 150	1 710	1656
	Vietnam 1992	Living Standards Survey	1992	4 800	3 840	960	997
	Vietnam 1998	Living Standards Survey	1997-1998	6 002	4 272	1 730	1448
	Vietnam 2002	Living Standards Survey	2002	29 380	22 621	6 909	1780

Following Davis et al (2010), income is allocated into seven basic categories: (1) crop production; (2) livestock production; (3) agricultural wage employment, (4) non-agricultural wage employment; (5) non-agricultural self-employment; (6) transfer; and (7) other.[6] Non-agricultural wage employment and non-agricultural self-employment income have been further disaggregated by industry using standard industrial codes—though we do not take advantage of this disaggregation in this study.

The seven categories of income are aggregated into higher level groupings depending on the type of analysis. One grouping distinguishes between agricultural (crop, livestock, and agricultural wage income) and non-agricultural activities (non-agricultural wage, non-agricultural self-employment, transfer, and other income), and in a second, crop and livestock income are referred to as on-farm activities, non-agricultural wage and self-employment income as non-farm activities, and agricultural wage employment, transfer, and other income are left as separate categories. Finally, we also use the concept of off-farm activities, which includes all non-agricultural activities plus agricultural wage labor.

Income shares can be analyzed as the mean of income shares or as the share of mean income. In the first instance, income shares are calculated for each household, and then the mean of the household shares of each income category. In the second case, income shares are calculated as the share of a given source of income over a given group of households.

[6] Other covers a variety of non-labor sources of income, such as rental income or interest from savings.

The two measures have different meanings. The mean of shares more accurately reflects a household-level diversification strategy, regardless of the magnitude of income. The share of means reflects the importance of a given income source in the aggregate income of rural households in general or for any given group of households. The two measures will give similar results if the distribution of the shares of a given source of income is constant over the income distribution, which is clearly not always the case. If, for example, those households with the highest share of crop income are also the households with the highest quantity of crop income, then the share of agricultural income in total income (over a given group of households) using the share of means will be greater than the share using the mean of shares. Since the household is our basic unit of analysis, we use the mean of shares throughout this paper.

In analyzing spatially the patterns of income diversification in our sample of LSMS-ISA datasets, we use a set of geo-referenced variables from external datasets that can be linked to household-level data via their GPS attributes (Murray, 2013). These variables are available for a subset of the Sub Saharan African countries in the dataset: Malawi, Tanzania, Uganda, Niger and Nigeria. In this draft of the paper, we apply the geo-referenced variables to all the LSMS-ISA countries except for Nigeria. In particular, we focus on two variables. First, we use an aridity index as proxy for agricultural potential. The aridity Index is defined as the ration between mean annual precipitation and mean annual potential evapo-transpiration so that a higher valued of the index identifies wetter areas[7]. This is a purely physical, exogenous indicator that reflects long-term conditions in a locality. We maintain this is superior for this use to alternatives that embed the profitability or value of agricultural production in a given area, as those incorporate contingent factors such as prices and terms of trade. In this application we value the fact that the aridity index be truly exogenous.

Second, we proxy market access, distance and agglomeration effects with variables that measure the Euclidean ('crow -fly') distance to cities of 20, 100 , 500 and 1 million inhabitants.[8] We choose this measure due to a concern with the potential endogeneity of travel time measures—roads and travel infrastructure may be built in response to agricultural production or potential (Fafchamps and Shilpi, 2005; Deichmann, et al, 2008)). The Euclidean distance is independent of travel infrastructure, but provides a good measure of the spatial dispersion of households with regards to urban populations.

III. Describing income diversification in Sub Saharan Africa

The diversification of income sources in rural Sub Saharan Africa

We look first at household participation in, and the share of income from, rural income generating activities (participation rates can be found in Table 2, while shares can be found in Table 3). First and foremost, rural households in the African countries of our sample are primarily engaged in agriculture, and as we see in Figure 1, a majority of rural households are involved in agriculture, with some form of on farm activity, even at higher levels of GDP. While for some households the importance of this participation is relatively minor, since it includes consumption of a few animals or patio crop production, agriculture continues to play a fundamental role in the rural household economic portfolio. In this and the figures that follow, we have added a separate trend line for the African countries in the sample.

[7] CGIAR, 2014.
[8] References to source of variable to be added.

Figure 1.

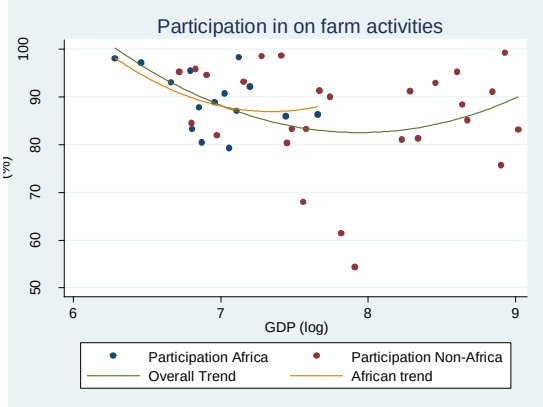


Figure 2.

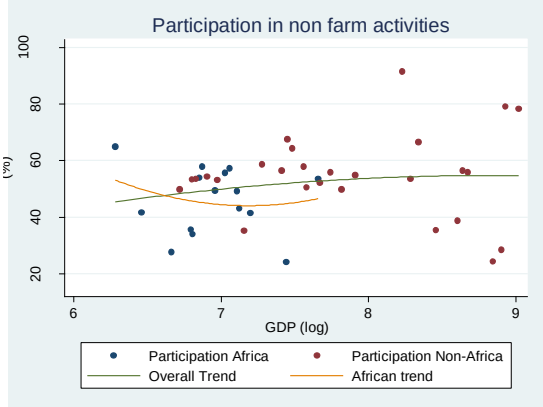


Figure 3.

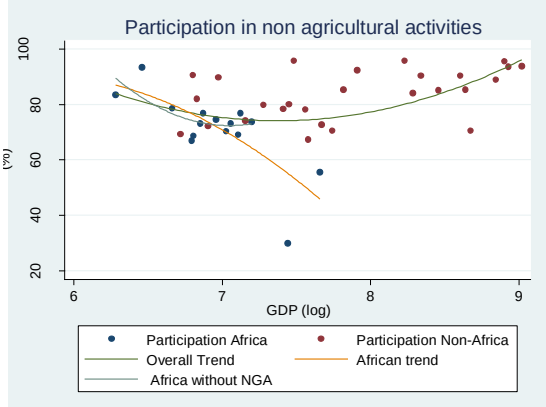
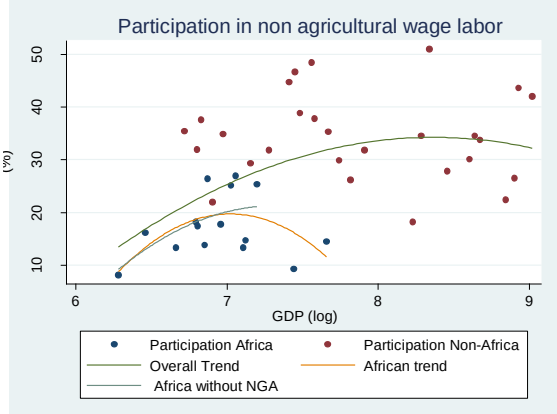


Figure 4.



Rural households are also diversified (Figure 2); an important share of rural households across GDP levels participate in non farm (non agricultural wage labor and self employment). When including transfers and other sources of income, the large majority of rural households across GDP levels have some form of non agricultural income. Participation in non agricultural wage labor, on the other hand, shows a clear increase by levels of GDP (Figure 4), with the African countries in our sample (show in blue or darker hue) showing relatively lower participation rates then other countries at the same level of GDP. Further, in both Figures 3 and 4, we have added a third trend line, for the African countries without Nigeria, given that country's much lower participation in non agricultural activities.

In terms of shares of income, as expected, overall, the share of non agricultural income among rural households increases with increasing levels of GDP per capita (Figure 5). Agricultural sources of income are particularly important for the countries from Sub Saharan Africa-all earn more than 50 percent of their income from agricultural sources, reaching approximately 80 percent in a number of countries. Similarly, on farm income accounts for more than 50 percent of all but one country. The decreasing importance of on farm (crop and livestock) sources of income over GDP can be seen in Figure 6. With increasing levels of GDP, on farm sources of income are replaced by the increasing importance of non agricultural wage income (Figure 7) and public and private transfers (Figure 8).

Figure 5.

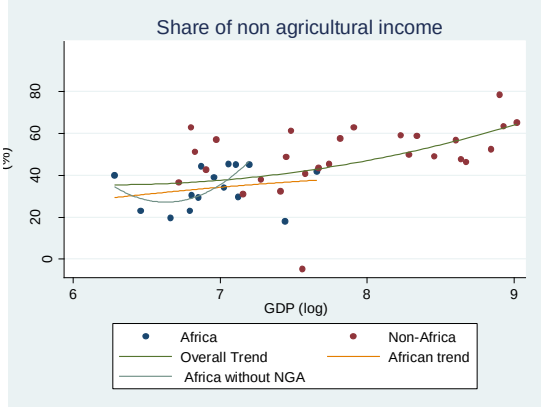


Figure 6.

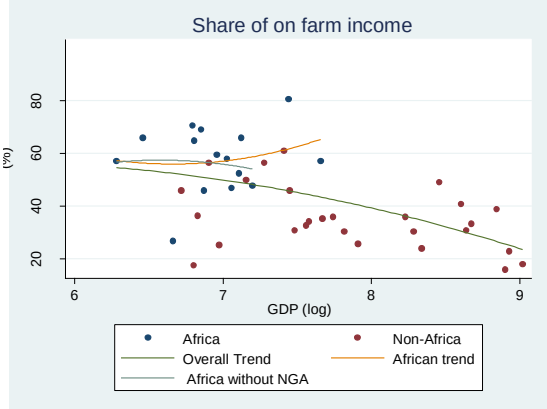


Figure 7.

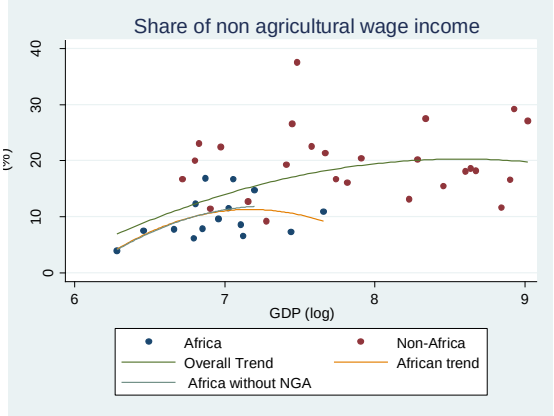
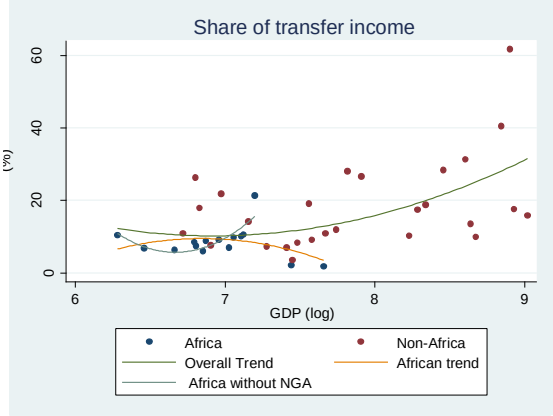


Figure 8.



The countries in our African sample show a tendency towards on farm sources of income—they have higher shares of on farm income, and lower shares on non agricultural wage income, compared to countries of other regions, including those at similar levels of GDP. Speculation as to whether Africa will follow a different path depends in part on whether Nigeria represents the exception or the rule, as can be seen by the trend line for the African countries without Nigeria in Figures 5-8. In either case, the African countries generally have less income from agricultural wage labor (Figure 9). Moreover, African and non African countries appear to be dissimilar in terms of participation in, and shares of income from, non agricultural self employment (Figures 10 and 11), by GDP.

Figure 9.

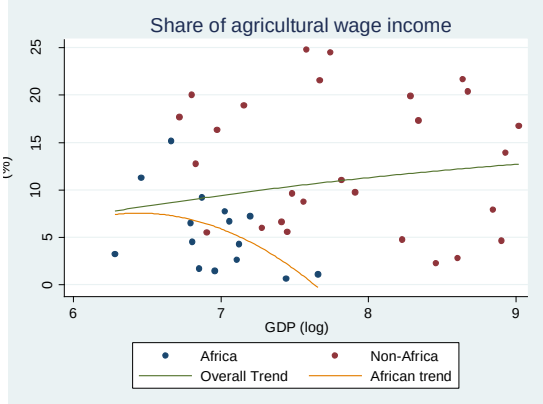


Figure 10.

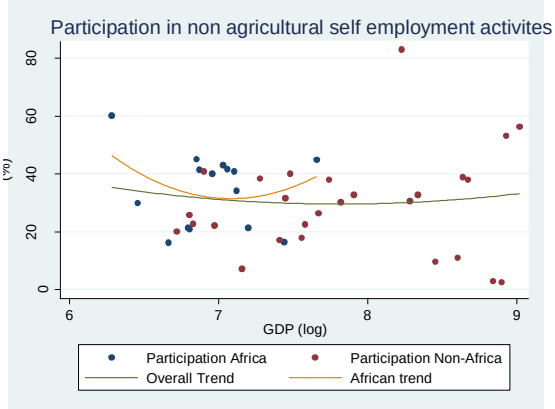
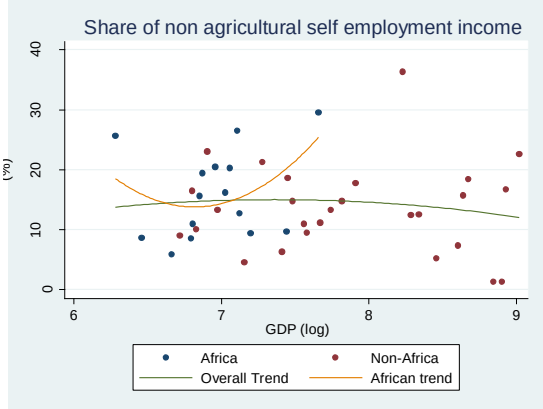


Figure 11.



The diversification of income sources by wealth status

The previous section illustrated the diversified nature of the rural economies in all the countries of our sample, including those of Sub Saharan Africa. There is also likely to be significant variation in the returns to the different activities. The available literature shows that that, for both agricultural and non-agricultural income generating activities, there is often a high productivity/high return sub-sector, confined mostly among privileged, better-endowed groups in high potential areas. These high return activities usually have significant barriers to entry or accumulation in terms of land, human capital, and other productive assets. These entry barriers activities may prevent more marginalized households from taking advantage of the opportunities offered by the more dynamic segments of the rural economy. The importance of entry barriers may derive from a combination of household inability to make investments in key assets and the relative scarcity of economic activities with low capital requirements in rural areas (Reardon, Taylor, Stamoulis, Lanjouw, & Balisacan, 2000).

In contrast a low productivity segment usually serves as a source of residual income or subsistence food production and as a refuge for the rural poor. This covers activities such as subsistence agriculture, seasonal agricultural wage labor, and various forms of off farm self-employment. These typically informal activities may provide a last resort to food security, helping to reduce the severity of deprivation and avoid more irreversible processes of destitution.[9]

High and low return activities within farm and nonfarm sectors may feed into each other. For those with few assets, seasonal, and insufficient income from subsistence agriculture, and lack of access to liquidity or credit, poorly remunerated off-farm activities may be the only available option. Households that are able to overcome financial or asset constraints may diversify or specialize in agricultural and non-agricultural activities, depending not only on access to specific assets but also on household demographic characteristics and the functioning of local labor and credit markets. The observed dualism also often appears to be drawn along gender lines, with women more likely to participate in the least remunerated agricultural and non-agricultural activities. Given the existence of both low and high return rural income generating activities, with varying barriers to access, previous empirical studies have shown a wide variety of results in terms of the relationship of rural income generating activities, and in particular RNF activities, to poverty (FAO, 1998; Lanjouw, 1999; Elbers and Lanjouw, 2001; Adams, 2001 and 2002; Isgut, 2004; de Janvry, Sadoulet, and Zhu, 2005; Lanjouw and Shariff, 2002)

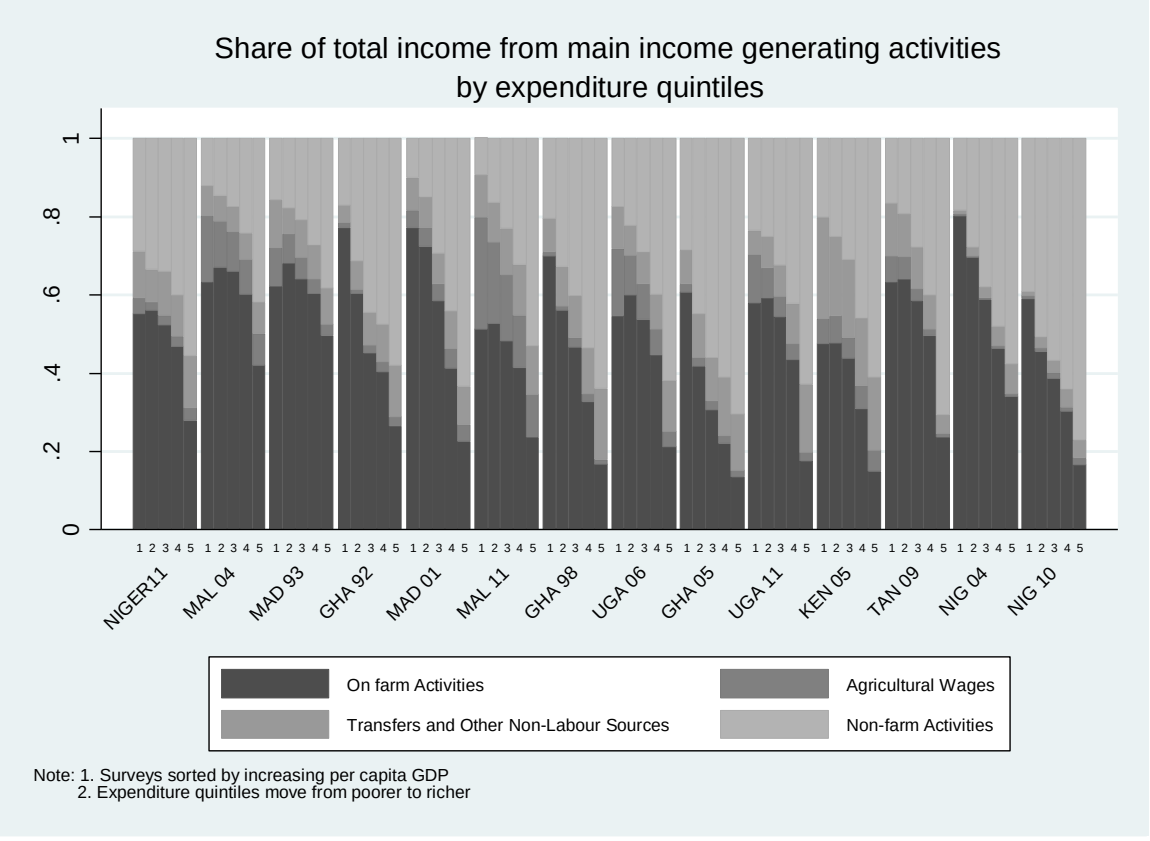
The country case study literature suggests that household participating in higher-return RNF activities are wealthier and have more upward income mobility (Barrett et al. 2001; Bezu et al, 2012;

[9] See Lanjouw and Lanjouw (2001) and Lanjouw and Feder (2001) for a general discussion relevant to non-farm activities and Fafchamps and Shilpi (2003) for Nepal and Azzari, Carletto, Davis, Fatchi, and Vigneri (2006) for Malawi, for example, regarding the role of agricultural wage labor.

Bezu and Barrett, 2012, among others), a relationship that holds up in cross country studies and across increasing levels of development (Davis, et al, 2010; Winters, et al, 2010). Recent literature focuses on the dynamics of household participation in RNF activities. Bezu and Barrett (2012) find that households able to accumulate capital, increase adult labour or increase access to credit and savings were more able to access high-return RNF activities. Chawanote and Barrett (2013) find the existence of an "occupational ladder" in rural Thailand in which transitions into the RNF economy lead to increased income, and transitions into farming with reduced income.

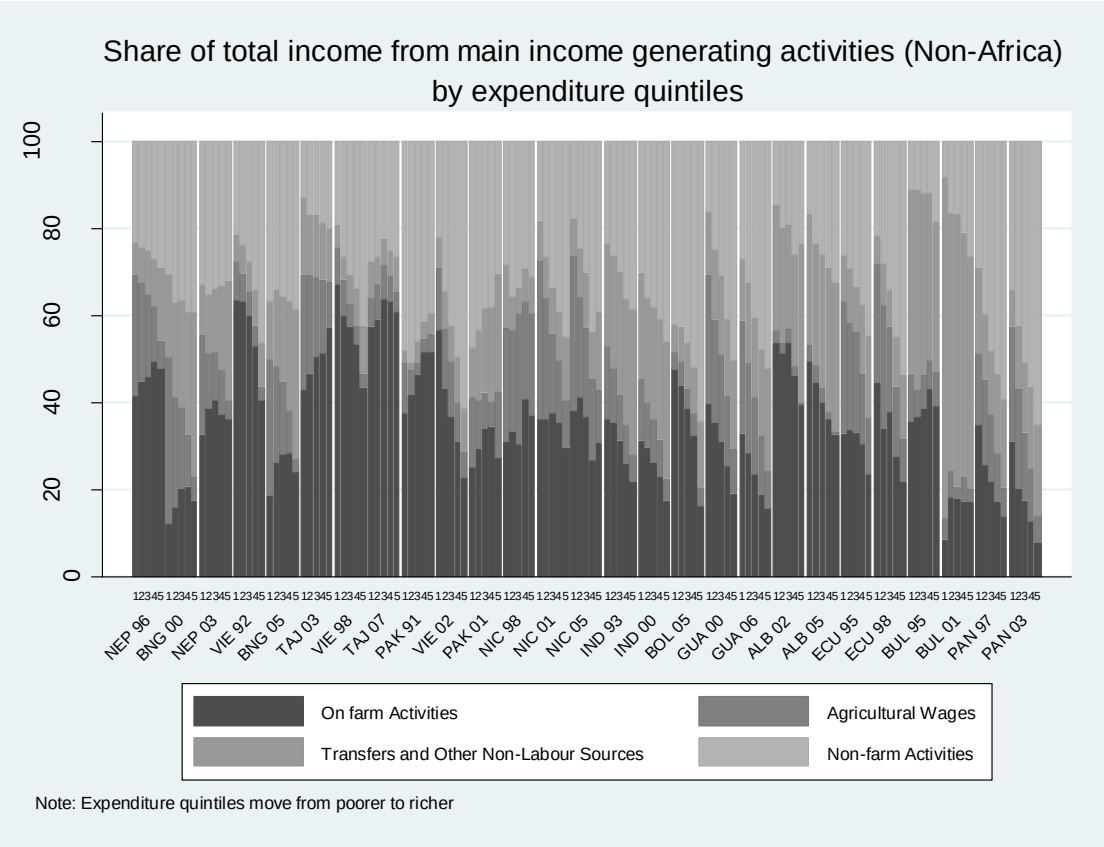
To explore the relationship across countries between rural income generating activities and wealth, for each country we examine activities by expenditure quintile. Figure 12a charts income shares by expenditure quintile for all countries in the African sample. Focusing on on-farm activities, the darkest color, we see a sharp decrease in the share of on-farm income with increasing levels of wealth, dropping from around 50 percent of income in the poorest quintile in most countries, to less than 20 percent in the wealthiest quintile. The drop in on farm sources of income is made up by the increasing importance of off farm (non agricultural wage and self employment) sources of income for wealthier rural households. The clear trend evident from the countries in the African sample is not as clear in the non African countries in Figure 12b. Here Bangladesh, Bulgaria, Nepal, Pakistan and Tajikistan show the opposite trend; the share of on farm activities increases with wealth.

Figure 12a



Note: 1. Surveys sorted by increasing per capita GDP
2. Expenditure quintiles move from poorer to richer

Figure 12b



On the other hand, participation in, and shares of income from, agricultural wage labor show for the most part a negative correlation with the level of expenditure, for both African and non African countries. With the exception of those countries that have negligible agricultural labor wage markets, poorer rural households tend to have a higher rate of participation in agricultural wage employment. Similarly, the share of income from agricultural wage labor is more important for poorer households in these countries, and the relationship holds regardless of the level of development.

Diversification and specialization

The results presented thus far suggest that rural households employ a wide range of income generating activities—though perhaps rural households in the African countries in our sample are more dependent on agriculture then rural households in other countries. The question remains, however, whether households specialize in activities—with diversity in activities across households in the rural space—or, whether households themselves diversify income generating activities. We examine the degree of specialization and diversification by defining a household as specialized if it receives more than 75 percent of its income from a single source and diversified if no single source is greater than that amount.[10,11]

[10] Other definitions of diversification and specialization are possible. Davis et al (2010) used 100% and 50% of income from a single source as alternative thresholds in order to examine robustness. They find that the extent of diversification is affected by the choice of the threshold, which drops to around 10% or less in all cases when using the 50% definition of specialization, climbing to around 90% with the 100% definition. The broad patterns by country and by level of welfare, however, did not change with choice of the threshold. Alternative groupings of income categories are also possible, such as joining together agricultural and non agricultural

Figure 13.

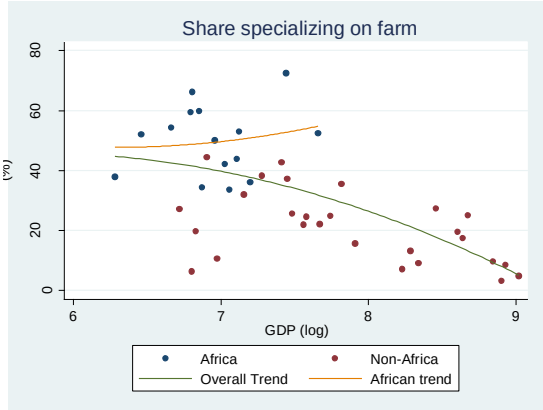


Figure 14.

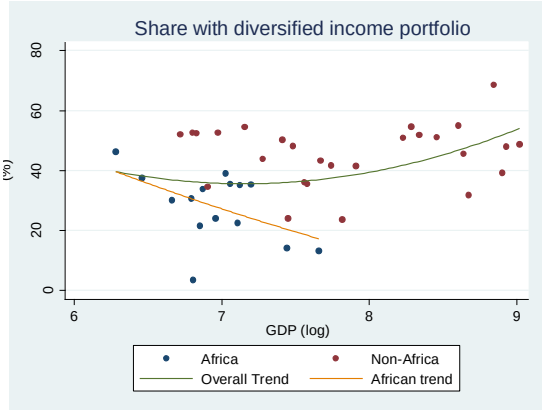


Figure 15.

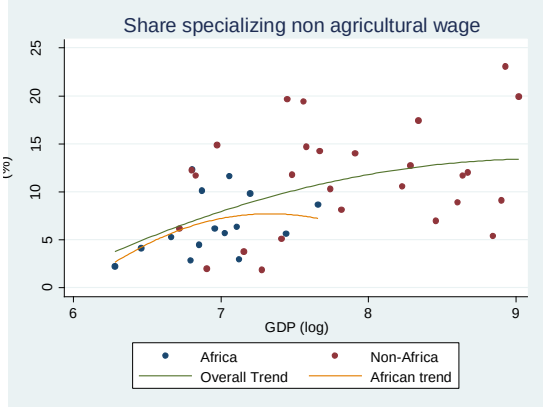
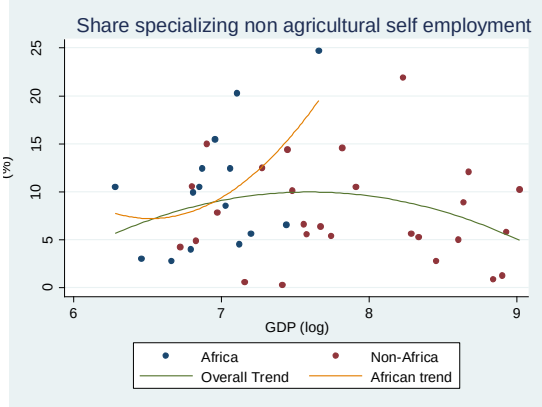


Figure 16.



Among rural households in the countries of our African sample, specialization in on farm activities continues to be the norm. Among all countries, with the exception of Niger, the largest share of households specialize in on farm activities, as can be seen in Table 4 (African countries in bold). This result is quite different from the non African households in our sample of countries, among which only two specialize in on farm activities, and among whom diversification is the norm. The relative differences between the African and non African countries with increasing levels of per capita GDP can be seen in Figures 13 and 14. Rural households in the African country are clustered above the trend line in the former graph, and below the trend line in the latter. Again, speculation on future trends for Africa depends on one whether considers Nigeria—with high levels of on farm specialization, and low levels of diversification—is the exception or the rule. Though even in the case of Nigeria, over time the share of on farm specialization has decreased.

When rural households in non African countries do specialize, in a majority of cases this specialization is in on farm activities, although the percentages become lower the higher the per capita GDP. At higher GDP levels specialization in non-agricultural wage becomes more important

wage labor, or non agricultural wage labor and non agricultural self-employment, which would increase the share of household specializing in these new categories.

[11] Note that we are constrained from delving into the details of diversification due to how household survey data are often collected. The apparent diversification may derive from aggregation across seasons (with seasonal specialization by households) or across individuals (with specialization by individual household members).

(Figure 15), for both African and non African countries. No distinct association between GDP levels and specialization in agricultural wage or self employment is apparent for non African countries, while for African countries the share appears to increase (Figure 16).

Table 4. Percent of rural household with diversified and specialized income generating activities

Country and year	Per Capita GDP, PPP Constant 2005, USD	Principal Household Income Source (>=75% of Total Income)						
		Diverse Income Portfolio	Ag Wage	Non Ag Wage	Self Emp	Transfers	Other	Farm
Niger 2010/2011	535	46%	0%	2%	10%	3%	0%	38%
Malawi 2004	640	37%	3%	4%	3%	1%	0%	52%
Malawi 20011	785	30%	7%	5%	3%	1%	0%	55%
Nepal 1996	829	52%	7%	6%	4%	3%	0%	27%
Madagascar 1993	895	31%	1%	3%	4%	1%	0%	59%
Bangladesh 2000	901	52%	11%	12%	11%	6%	2%	6%
Nepal 2003	926	53%	4%	12%	5%	7%	0%	19%
Ghana 1992	949	22%	1%	4%	10%	3%	0%	60%
Uganda 2005/2006	966	35%	6%	7%	8%	3%	0%	41%
Vietnam 1992	997	35%	3%	2%	15%	1%	0%	44%
Ghana 1998	1051	24%	1%	6%	15%	3%	0%	50%
Bangladesh 2005	1068	53%	9%	15%	8%	4%	2%	10%
Uganda 2009/2010	1130	39%	3%	5%	8%	2%	0%	43%
Ghnana 2005	1222	23%	2%	6%	20%	5%	0%	44%
Tanzania 2009	1240	35%	1%	3%	5%	4%	0%	53%
Tajikistan 2003	1283	54%	5%	4%	1%	5%	0%	32%
Kenya 2005	1340	35%	4%	10%	6%	9%	1%	36%
Vietnam 1998	1448	44%	2%	2%	13%	1%	0%	38%
Tajikistan 2007	1656	50%	1%	5%	0%	1%	0%	43%
Nigeria 2004	1707	14%	0%	6%	7%	1%	0%	72%
Pakistan 1991	1719	24%	3%	20%	14%	1%	0%	37%
Vietnam 2002	1780	48%	2%	12%	10%	2%	0%	25%
Pakistan 2001	1923	36%	5%	19%	7%	9%	2%	22%
Nicaragua 1998	1961	35%	16%	15%	6%	3%	0%	25%
Nigeria 2010	2120	13%	0%	9%	25%	0%	1%	52%
Nicaragua 2001	2145	44%	13%	14%	6%	1%	0%	22%
Nicaragua 2005	2311	42%	13%	10%	5%	4%	0%	25%
Indonesia 1993	2487	24%	5%	8%	15%	11%	1%	35%
Indonesia 2000	2724	42%	6%	14%	10%	11%	1%	16%
Bolivia 2005	3758	51%	4%	11%	22%	5%	1%	7%
Guatemala 2000	3966	55%	9%	13%	6%	5%	0%	13%
Guatemala 2006	4178	52%	9%	17%	5%	7%	0%	9%
Albania 2002	4710	51%	1%	7%	3%	11%	0%	27%
Albania 2005	5463	55%	1%	9%	5%	10%	1%	19%
Ecuador 1995	5658	46%	13%	12%	9%	2%	1%	17%
Ecuador 1998	5862	30%	12%	11%	12%	6%	4%	24%
Bulgaria 1995	6930	50%	7%	15%	2%	21%	0%	5%
Bulgaria 2001	7348	41%	2%	9%	1%	43%	0%	3%
Panama 1997	7554	48%	8%	23%	6%	6%	1%	8%
Panama 2003	8267	49%	10%	20%	10%	7%	0%	5%

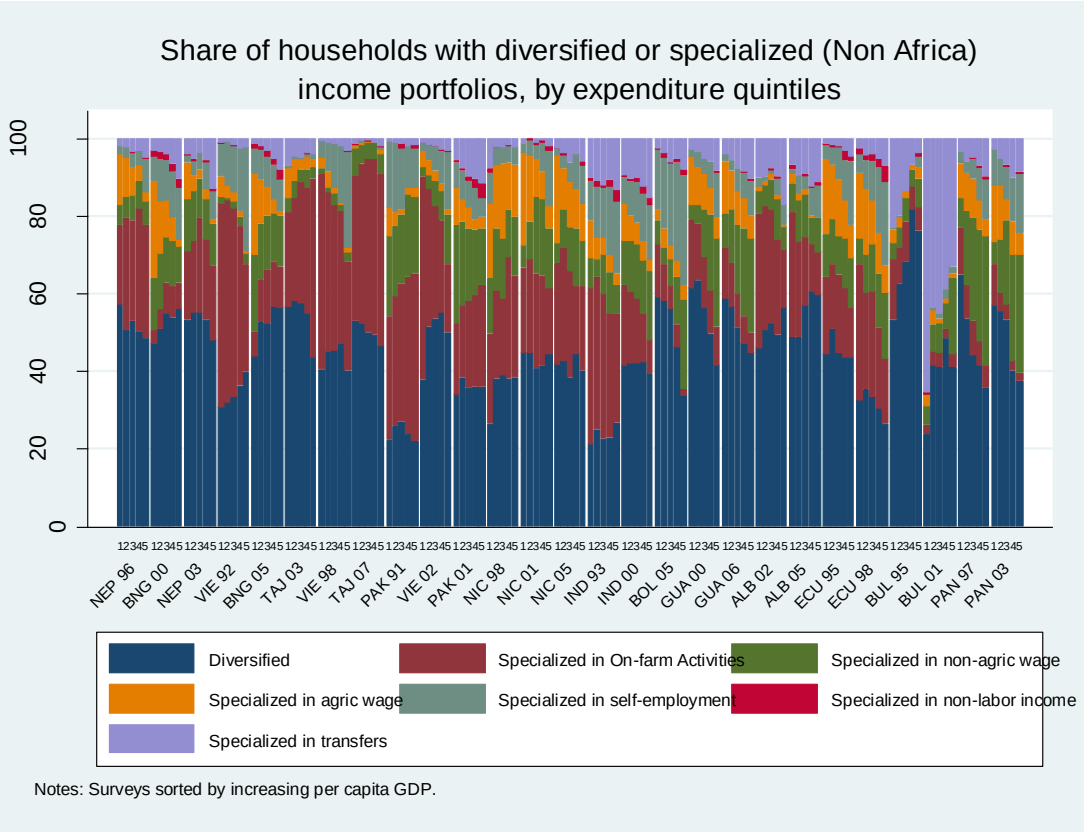
A rural household may have multiple activities for a variety of reasons: as a response to market failures, such as in credit markets, and thus earning cash to finance agricultural activities, or

insurance markets, and thus spreading risks among different activities; failure of any one activity to provide enough income; or different skills and attributes of individual household members. Diversification into rural nonfarm activities can thus reflect activities in either high or low-return sectors. Rural nonfarm activities may or may not be countercyclical with agriculture, both within and between years, and particularly if not highly correlated with agriculture, they can serve as a consumption smoothing or risk insurance mechanism. Thus, the results raise the question of whether diversification is a strategy for households to manage risk and overcome market failures, or whether it represents specialization within the household in which some members participate in certain activities because they have a comparative advantage in those activities. If the latter is the case and it tends to be the young who are in off-farm activities, diversification may simply reflect a transition period as the household moves out of farm activities.

The empirical relationship between diversification and wealth is thus not straightforward. A reduction in diversification as household wealth increases could be a sign that those at lower income levels are using diversification to overcome market imperfections. Alternatively, a reduction in diversification as household wealth decreases could be a sign of an inability to overcome barriers to entry in a second activity thus indicating that poorer households are limited from further specialization. An increase in diversification as household wealth increases could be a sign of using profitability in one activity to overcome threshold barriers to entry in another activity, or complementary use of assets between activities.

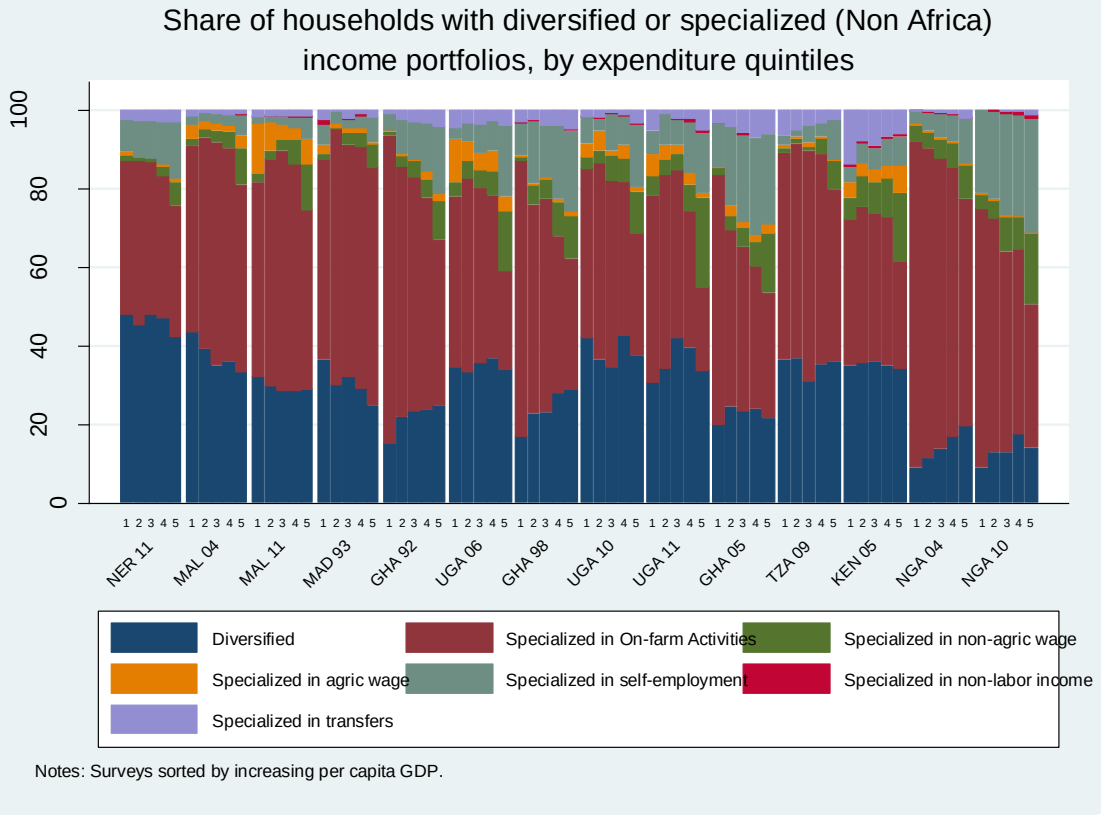
The inability to conceptually sign *a priori* the correlation between diversification and household wealth status emerges from the data. Figures 17, 18 and 19 explore the relationship between diversification, specialization and household expenditure for the countries in our African sample. The share of rural households with a diversified portfolio of income generating strategies shows few consistent patterns by wealth status in our sample countries, in both our African and non African countries (Figures 17a and 17b). A clear pattern emerges, however, among the African countries, in terms of the share of households specializing in on farm activities. Here, the share of households in most countries decreases with increasing wealth. Conversely, the share of households specializing in self employment activities and non agricultural wage labor increases with wealth, at least for those countries where there activities are pronounced, such as Nigeria, Ghana, Malawi and Uganda.

Figure 17a



Notes: Surveys sorted by increasing per capita GDP.

Figure 17b



Notes: Surveys sorted by increasing per capita GDP.

Figure 18.

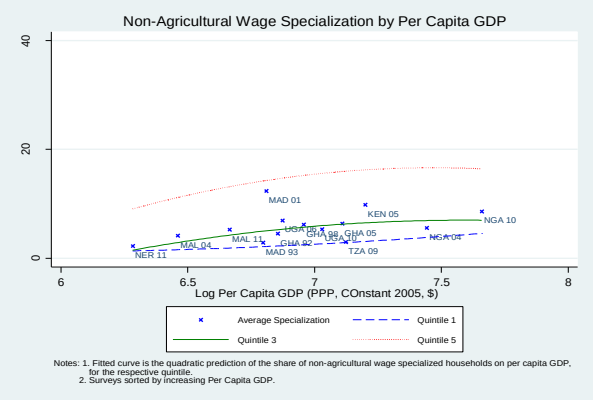
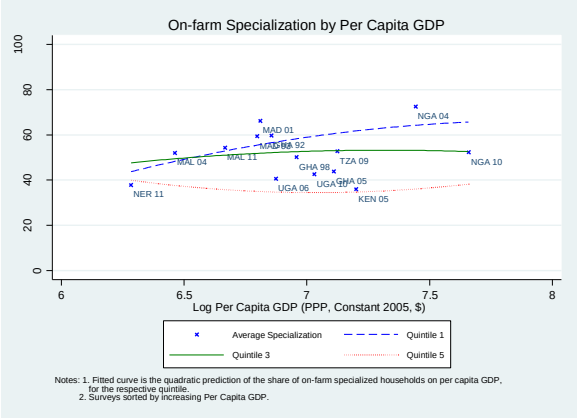


Figure 19.



Stochastic dominance analysis

To take a more systematic approach to characterizing the association between sources of income, specialization and welfare, we use measures of stochastic dominance. For each of four of the African countries, covering six datasets—Malawi (2011), Niger (2011), Tanzania (2009 and 2010) and Uganda (2010 and 2011)—we first compared sources of income. We then look at income diversification and specialization income generation strategies by both total household income and by per capita expenditure. We include the latter as expenditure is considered the gold standard in terms of measuring household level welfare. In each case we calculated pairwise tests of stochastic dominance (see in the Annex for an example),[12] and we rank sources of income (or income diversification/specialization) by dominance. We do not include transfer and other income in order to improve the clarity of the presentation. A summary of the analysis can be found in Table 5.

[12] Specify procedure used.

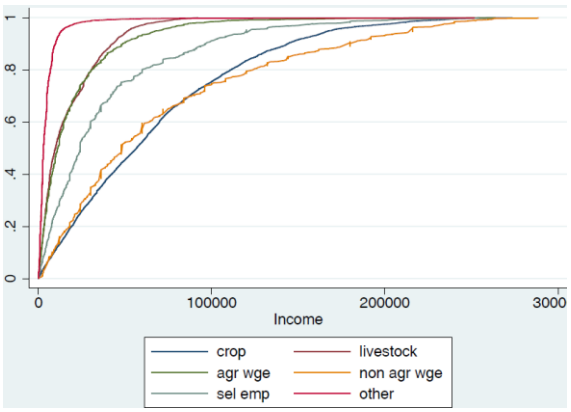
Table 5. Summary of stochastic dominance rankings, by country/dataset

	By income source	By income diversification/ specialization (total hh income)	By income diversification/ specialization (pc exp)
Malawi 2011	1. Non ag wage—crop 2. Self employ 3. agr wage 4. livestock	1. Non ag wage 2. Self employ 3. Farm—Diverse 4. Agr wage	1. Non ag wage—Self employ 2. Farm (low lev)—Diverse (high lev) 3. Ag wage
Tanzania 2009	1. Crop 2. Non ag wage— Self employ 3. Livestock—agr wage	1. Non ag wage—self employ 2. Diverse 3. Farm 4. Agr wage	1. Non ag wage—Self employ 2. Farm—Diverse 3. Ag wage
Tanzania 2010	1. Crop 2. Non ag wage 3. Self employ 4. Livestock 5. Agr wage	1. Diverse—self employ—farm—non ag wage 2. Agr wage	1. Non ag wage—Self employ 2. Farm—Diverse 3. Ag wage
Uganda 2010	1. Crop 2. Non ag wage 3. Self employ 4. Livestock—ag wage	1. Diverse—non ag wage—self employ 2. Farm 3. Agr wage	1. Non ag wage—Self employ 2. Farm—Diverse 3. Ag wage
Uganda 2011	1. Non ag wage 2. Crop—self employ 3. Ag wage—livestock	1. Non ag wage—Diverse—self employ 2. Farm 3. Agr wage	1. Non ag wage—Self employ 2. Diverse 3. Farm 4. Ag wage
Niger 2011	1. Non ag wage—crop 2. Self employ 3. Livestock—agr wage	1. Non ag wage 2. Diverse—self employ—ag wage 3. Farm	1. Non ag wage—Self employ—Ag wage 2. Farm—Diverse

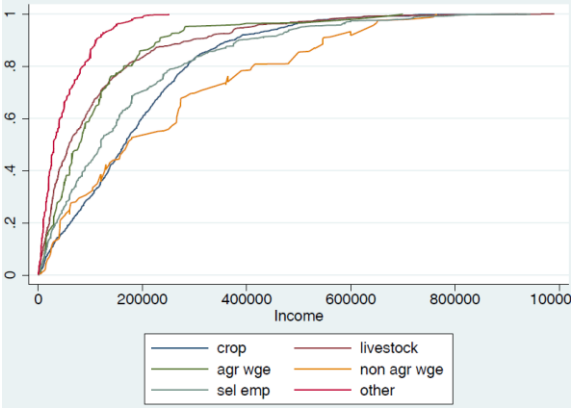
Turning first to sources of income, Figure 20 provides graphs of the cumulative income distribution in each country, and in Table 5 we find the ranking. A consistent, thought somewhat surprising, pattern emerges across the four countries. Crop and non agricultural wage income tend to stochastically dominant the other sources of income, followed by self employment, with livestock and agricultural wage employment associated with lower levels of income. The consistent strong showing of crop income is surprising until one considers that almost all households, rich and poor, have crop income. What becomes important is the relative mix of income generating strategies.

Figure 20. Cumulative income distributions, by source of income.

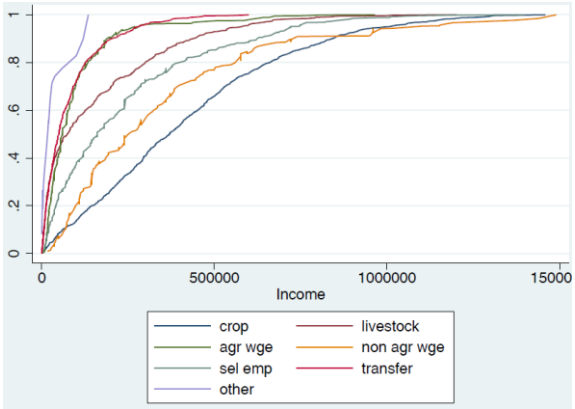
Malawi 2011



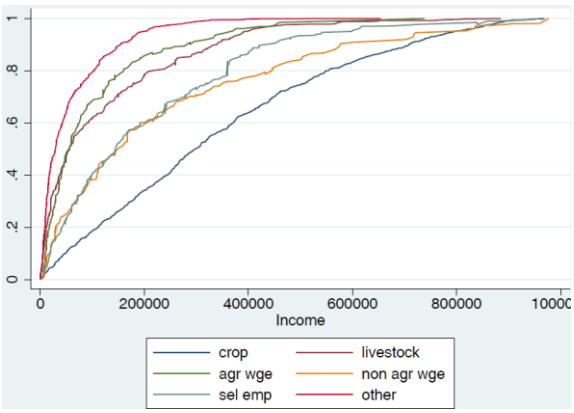
Niger 2011



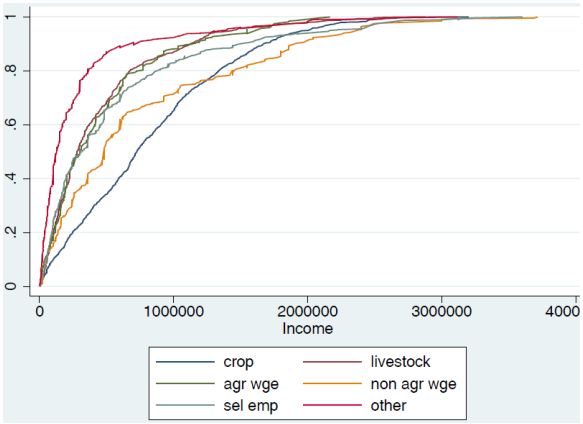
Tanzania 2009



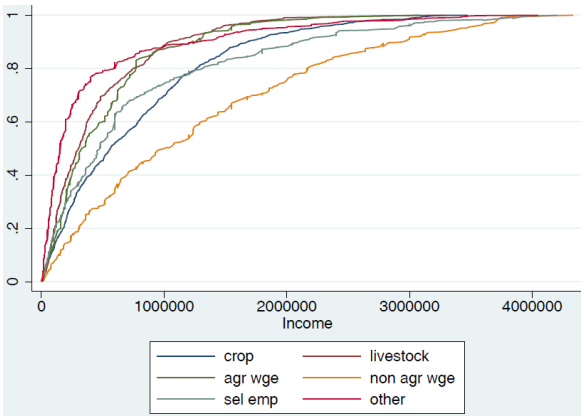
Tanzania 2010



Uganda 2010



Uganda 2011



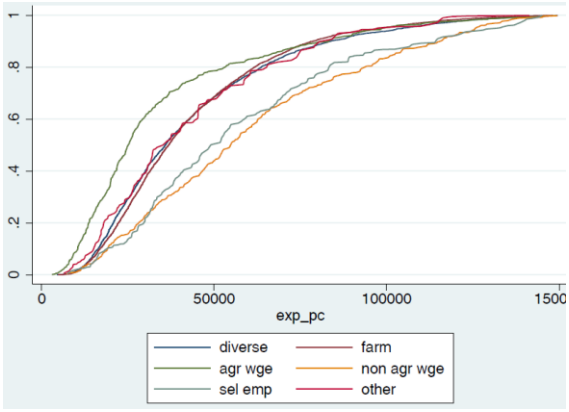
Focusing on household income diversification and specialization in income generating strategies, by both total household income and per capita expenditure, a complementary story emerges, as seen in Figure 21 and again in Table 5. Across all countries, specialization in off farm activities—non agricultural wage income and self employment—stochastically dominates other household income generating strategies, in terms of both total household income and per capita expenditure. These are followed by on farm specialization and diversified strategies, then agricultural wage labor which is clearly associated with the lowest levels of welfare.[13] This pattern is clearest in the case of the

[13] The one exception is specialization in agricultural wage labor in Niger, which includes less than one percent of households, but with high incomes.

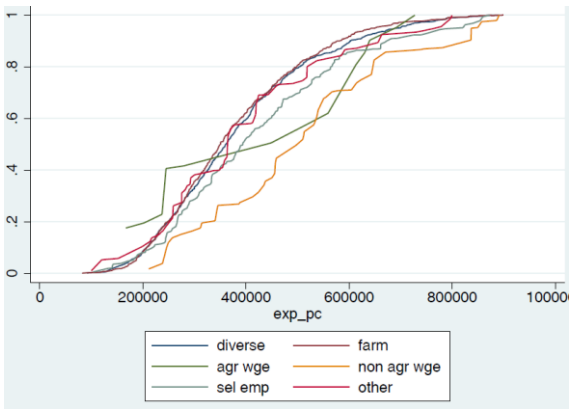
distribution of per capita expenditure; with household total income, in some cases (such as Uganda) diversification is not stochastically dominated by specialization in non agricultural wage and self employment.

Figure 21. Cumulative per capita expenditure distributions, by income generating strategy.

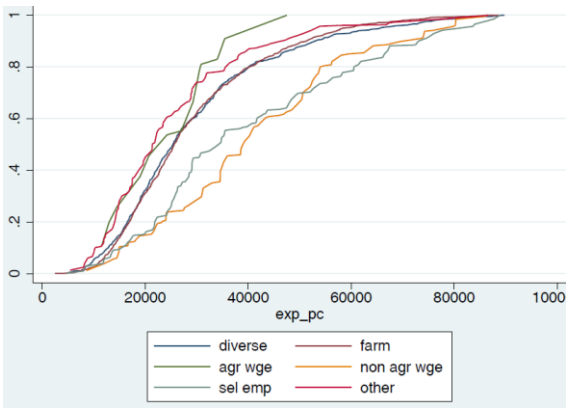
Malawi 2011



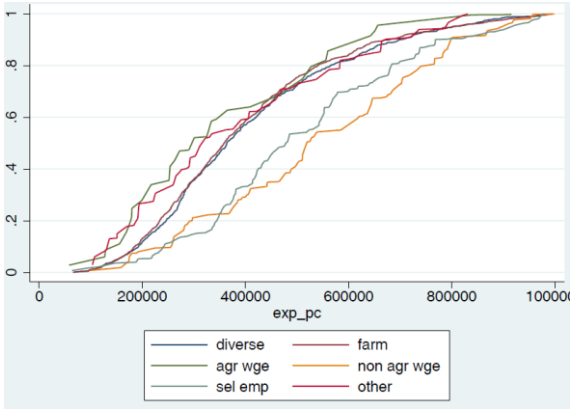
Niger 2011



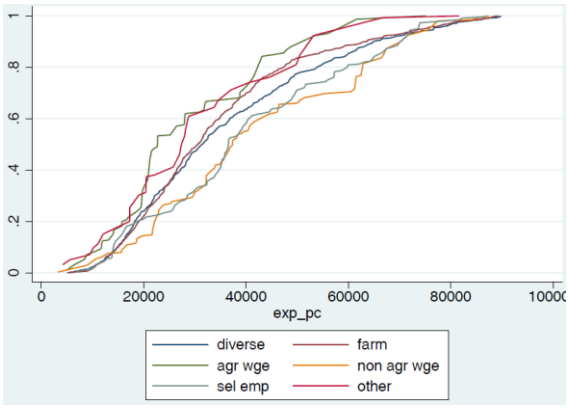
Tanzania 2009



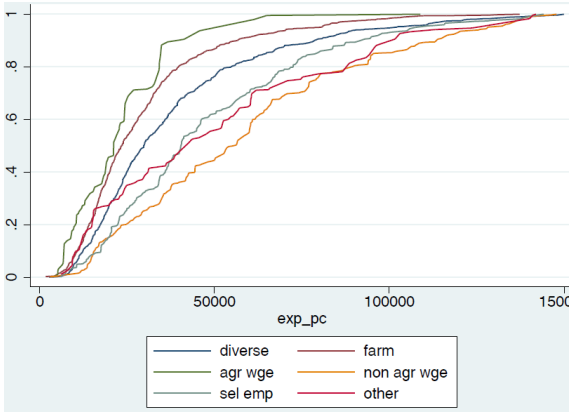
Tanzania 2010



Uganda 2010



Uganda 2011



Overall, bringing together the results from the two three of stochastic dominance analyses, a clear picture emerges. Specialization in non agricultural income generating activities stochastically dominates farm based strategies in all countries. Crop income, however, is still important for welfare, and even at higher levels of household income (or wealth) crop activities continue to play an important complementary—though secondary—role in income generation.

IV. Modelling location and income diversification in LSMS-ISA countries

Estimation approach

As we have noted earlier, much of the literature on rural income diversification in developing countries has sought to explain how assets endowments and barriers to entry tend to push or pull different households and individuals into different activities. Location may also be an important factor in the determining households' income diversification strategy decisions, but the literature is much more silent on this point mainly due to the lack of data that would allow spatially explicit analysis. The geo-referenced household data we work with, make efforts to start filling that gap possible.

In what follows our approach is similar to a meta-regression analysis in that (i) for each of the countries analyzed common metrics are used, (ii) explanatory variables for each country have been created in a uniform manner, and (iii) a standard regression model is employed in each case. This approach then minimizes the possibility that differences in results are driven by differences in the variables used or in the empirical approach, and facilitates our ability to compare results across countries.

Our modeling approach is to employ a multinomial logit model (separately for each country) to assess how location is associated with the likelihood that a household diversifies out of farming, controlling for other household characteristics. The choice of the multinomial logit is motivated by the fact that we have several unordered but mutually exclusive categories that we use to characterize household income strategies: A household can either be diversified, or fall within one of six diversification categories[14]. In the multinomial logit, *k-1* models are estimated for any outcome consisting of *k* unordered categories. Parameters estimates are then interpreted with reference to the excluded base category (farm specialization in our case).

For a unit change in the regressor, the logit of the model outcome relative to the reference group is expected to change by its parameter estimate, holding other variables constant (UCLA, 2014). As we use farm specialization as the base category the coefficients on the main variables of interest can be immediately interpreted in terms of association with higher or lower likelihood that a household diversifies or specializes in off-farm activities, compared to being a farm specializer.

In a multinomial logit, given an unordered categorical outcome variable *y* with *k* outcomes, and a set of regressors *X*, one estimates a set of *β* coefficients for each outcome *i* from 1 to *k-1* corresponding to:

$$\Pr(y = i) = \frac{e^{X\beta^{(i)}}}{e^{X\beta^{(1)}} + e^{X\beta^{(2)}} + \cdots + e^{X\beta^{(k)}}}$$

The model can be solved by Maximum Likelihood methods by setting *β(k)* equal to 0, and measuring the other coefficients in terms of changes relative to the *k* reference category (Long and Freese, 2006).

Previous studies have discussed the role of other key household characteristics, namely different forms of capital (human, natural, physical, social) and those findings are pretty consistent and robust across studies. One concern with that evidence is however the extent to which different levels and

[14] For the econometric estimation we reduce the specialization categories to five, as we collapse 'transfers' and 'other income' into one category.

composition of assets may in fact be endogenous to decisions regarding the income generation strategy. In this paper the primary interest is to gauge the extent to which truly exogenous factors like climate and distance[15] from urban centers affect households' diversification decisions. We therefore adopted a stepwise approach to model specification, introducing first only a distance variables to the right hand side, then adding a quadratic term for distance (step 2), a variable to proxy agricultural potential (step 3), quadratic interactions between distance and agricultural potential (step 4), and finally a set of household level controls (step 5).

The key variables employed in the multivariate analysis have been described in earlier sections of the paper. The specialization categories on the left hand side have been described in section II and used for the analysis in Section III.

To gauge the effects of distance, market access and agglomeration we employ the variables described in Section III that measure Euclidean ('crow-fly') distance in kilometers to cities of 20, 100, 500 thousands and one million inhabitants. For each of the 5 steps above, we therefore estimated four variants, one per each of the distance variables employed. Agricultural potential is proxied by an aridity index, also describe in Section II above. To capture the non-linearities in the relationship between diversification and distance, we introduce both a quadratic term for distance, and interaction terms between distance and aridity. This analysis allows measuring the extent of impact of location effects (agricultural potential, distance, and their interaction) on the choice of income generating strategies. In specifying our model using distance to urban centers of different sizes, we are also interested in gauging how these relationships may vary when one considers distance to small towns, as compared to distance to mid-size and large cities.

The vector of regressors in the least parsimonious specification (step 5) includes a range of additional household characteristics that are known to impact decisions about occupational choice and income diversification: separate agricultural and non-agricultural wealth indexes, and an index of access to basic infrastructure (all calculated using principal component analysis); household demographic and composition characteristics (household size, age and gender of the head, number of working age members, share of female working age adults); and variables to measure key households assets (education of the head, land owned).

Based on the theoretical and empirical literature reviewed earlier in this paper, we have some clear expectations as per the sign of the correlation between household endowments and sectors of specialization, with for instance land being strongly associated with agricultural activities, education strongly associated with nonfarm (particularly) wage activities, and low levels of assets across the board being associated with agricultural wage employment.

The expectations regarding the association between the key location variables (distance and aridity) and diversification outside of agriculture are less clear-cut, with some of the signs difficult to determine a priori. To simplify, one can cross the two dimensions and think of a two by two matrix returning four categories characterized by the possible different combinations of high/low integration and agricultural potential (Table 6).

In high potential, high integration[16] areas, one expects both farm and non-farm activities to thrive, with non-farm shares dominating the higher the integration levels. In low potential, highly integrated areas the expectation is clearly for non-farm activities to dominate as people reap off-farm opportunities as farming does not hold much promise given the unfavorable conditions. In low integration/high potential areas the expectation is on the contrary for farming to be relatively more important. Deichmann et al. (2008) find that in Bangladesh high return self and wage employment

[15] Admittedly distance may itself be endogenous as existing employment opportunities clearly play a role in a household's decision on where to live.

[16] In what follows, we loosely use the term integration as the inverse of distance.

outside of agriculture tends to decline with distance to the main urban centers, and to decline faster as the agricultural potential increases.

The low-potential low-integration areas are more difficult to sign a priori as households will on the one hand have to rely to a large extent on subsistence farming for their own survival, while on the other hand try to complement the expected meager returns from farming with (possibly equally meager) returns from nonfarm activities, including migration. The distinction among diversification out of necessity as opposed to choice proposed for instance by Ellis (2000) is useful in characterizing the situation in these areas.

Table 6 – Matrix of expected relationship between diversification outside agriculture, agricultural potential, and integration into urban areas

		Integration	
		High	**Low**
Agricultural potential	**High**	+ (?)	-
	Low	++	(?)

Our use of a quadratic distance term, and of interactions between distance and aridity to reflect these expected non linearities. While we run all our estimates including these terms, whenever the joint significance of the terms is rejected by chi-squared test we stepwise drop the interaction, then the quadratic term and present these results instead.

Results: The impact of distance from urban centers and agricultural potential on household income generation strategies

As summarized in the above discussion we effectively estimate 5 logit models, in 4 stepwise variants, using 4 different city size categories. Space does not allow discussing each of these 80 regressions in detail, and in fact there is no need for that. The more parsimonious specifications (results not reported) tend to support expectations with non-farm specialization less likely at increasing distance from cities, particularly as cities of larger size are considered. We therefore focus the discussion on the extent to which we found presence of non-linearities, their extent and direction and on the regularities and differences we find across countries, between the role of urban centers of different sizes, and by agricultural potential. To convey the main results emerging from the analysis, we use to the extent possible graphs aiming at showing the broad directions and main nonlinearities in the variables of interest[17].

[17] The entire set of regressions is available from the authors upon request and will be made available on the web.

Figure 22 reports the graphic depiction of how the likelihood of being the main specialization/diversification categories changes with distance, separately for areas with high and low agricultural potential. The graphs convey the combined effect of the quadratic and interaction terms that are otherwise difficult to read in a standard table of coefficients.

The graphs are grouped first by diversification categories (non-agricultural wage specializers, non-agricultural self-employment specializers, diversified, agricultural wage specializers). Within each category the graphs are organized by country (columns) and distance to cities of different sizes (20, 100, 500 thousands, and 1 million inhabitants).

The first result that emerges is that non-linearities are clearly present in most of the estimated relationships. For most countries and 'sectors' of specialization the role of distance changes markedly with potential, and with city size. The features of agricultural wage employment are often interlinked to the peculiarities of the institutions of rural communities (e.g. *ganju* labour in Malawi), and our definition of diversification signals involvement in a broad mix of activities where farming may still be the main one. It is therefore useful to focus on non-agricultural wage and self-employment specialization, as these are the sectors that identify more univocally engagement in activities outside of agriculture.

Looking at the graphs for these two categories, the impact of distance from cities appears to be a lot more muted in areas of higher agricultural potential. This is shown for instance in the non-agricultural wage graphs for Malawi and Tanzania, and in the self-employment graphs for Malawi and Niger (it is worth recalling that in Niger the share of non-agricultural wage specializers is extremely low, so that it is not surprising not to find high variability for non-agricultural wage in the Niger graphs).

Uganda is the one country that bucks these broad regularities and displays a U-shaped relationship for self-employment and for non-agricultural wage (the latter limited to cities greater than 500 thousand inhabitants) for both high and low potential areas. In Uganda the lines for high and low potential areas tend to cross around the middle range of the distance variable distribution. Agriculture goes hand-in-hand with off farm diversification in highly integrated areas, whereas low potential areas tend to 'dominate' high potential in terms of the odds of households specializing outside of agriculture as distance increases.

In Tanzania, the country in this sample with relatively more abundant land, the difference in potential are only apparent for non-agricultural wage specialization when large cities are considered. Otherwise, similar trends are observed as distance increases, regardless of potential.

An additional observation concerns the fact that indeed the size of the city one considers the distance from does matter in this type of analysis. The forces puling households out of agriculture are in general smaller for small and medium size towns. In rural areas close to small towns (20 thousand people) one doesn't observe substantial differences in the pull from off-farm activities, except for self-employment in Niger where households are in fact more likely to specialize in self-employment where agricultural potential is higher. The likelihood of household being diversified does present differences by agricultural potential for areas close to small towns. In Malawi, Niger and Uganda, households in high potential area close to small towns have higher odds of being diversified than household in low potential areas at similar distance, whereas the opposite is true in Tanzania.

The story therefore appears to be one of the interaction of smaller towns and potential being more relevant for explaining diversification (as defined here), while larger towns being more relevant when specialization into non farm is considered.

Going back to the idea of a two by two matrix of potential and integration categories, our findings speak of really two different matrices, one when the role of small towns is considered, one when large cities come into play. For small towns, we find support to the hypothesis that high-potential, low-integration areas see less specialization in off farm activities, the reverse being true for high-

integration low-potential areas. These were the two cells for which we had clear a priori expectations, but we also found that the role of potential is not particularly strong at least when the off-farm specialization categories are considered. The two cells where we had unclear expectations were the high potential-high integration, and low-potential low-integration areas. For the former we find that at least in Tanzania and Uganda the combination of favorable conditions for agriculture and lower distance from urban centers tends to create the conditions for more households to specialize in off-farm activities. When integration is lower and agricultural conditions more difficult, the picture is mixed, with households more likely to engage more fully in non-farm activities in Niger and Malawi, but less likely to do so in Uganda and Tanzania.

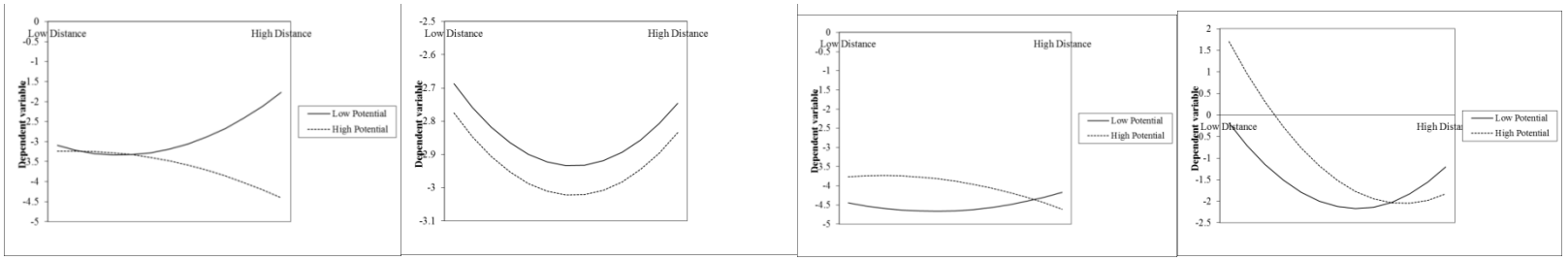
The same matrix looks somewhat different when distance to large cities is considered. The impact of distance in low potential areas is much more marked, as signaled by the relatively steep negative slope found in all countries for either self-employment or non-agricultural wage work, even though a U-shape is still found for Uganda. In other words, the impact of proximity to large cities is highest in low potential areas, as expected. In low-potential, low-integration areas the sign was uncertain a priori and we find that the impact of distance prevails, with the odds of specializing off-farm being lowest in 3 out of 4 countries. The exception is Uganda where the attraction of non-farm declines with distance from cities up to a point, but picks up again at higher distances. In high potential areas the effect of distance is much more muted, and the slopes flatter: only in Niger and Uganda the odds of being specialized off-farm relative to agriculture decline significantly with distance from major cities for households sitting in areas with higher agricultural potential.

All in all, these results point to evidence that appears to be broadly consistent with the predictions of the theory. There is no sign of African households adopting income generation strategies that differ from those observed elsewhere in terms of their relationship to basic exogenous determinants such as agricultural potential and distance from urban centers. The fact that in high potential areas the odds of being specialized off-farm are pretty much unchanged regardless of distance is also compatible with the observation earlier in the paper that farming still dominates African rural areas. Regardless of distance and integration in the urban context, when climate is favorable farming remains the occupation of choice for most.

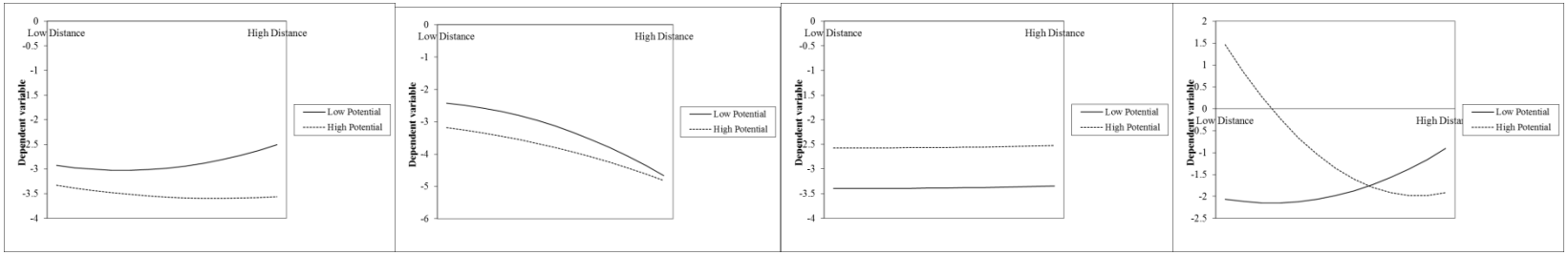
Figure 22 – Mlogit results: The effect of distance on diversification strategies, by agricultural potential (aridity) – Base category: Farm specialization.

MALAWI TANZANIA NIGER UGANDA

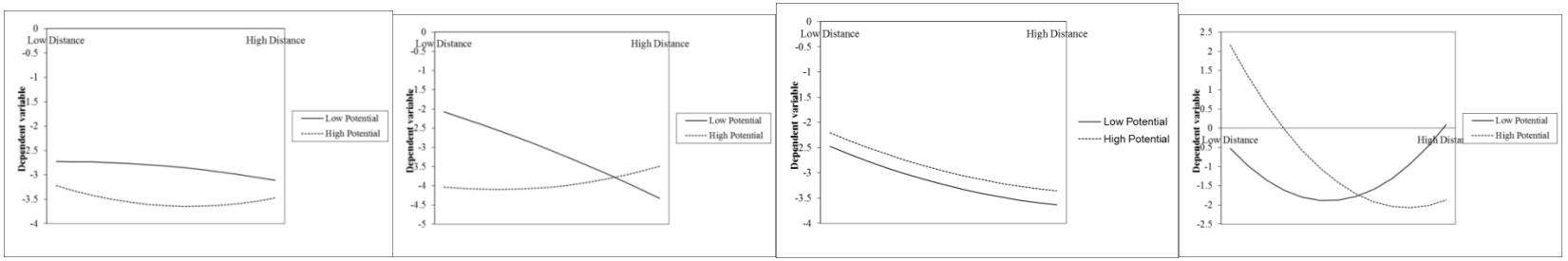
NON-AGRICULTURAL WAGE SPECIALIZERS (NAGW) 20K



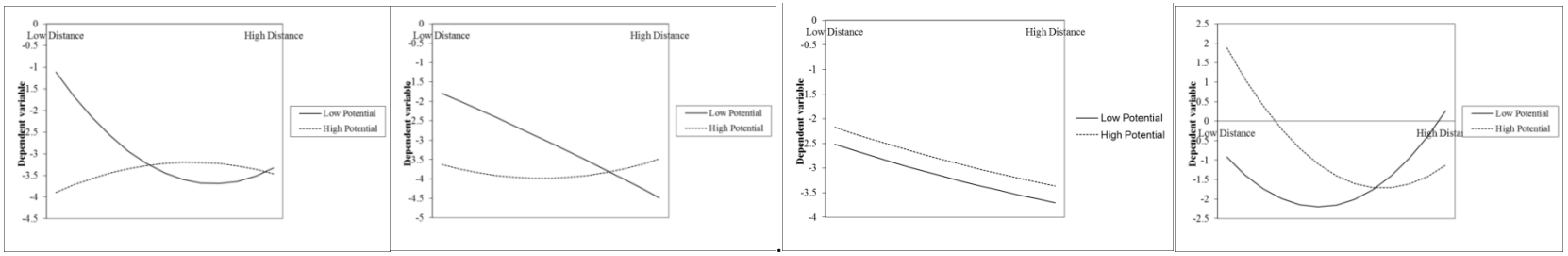
NAGW 100K



NAGW 500

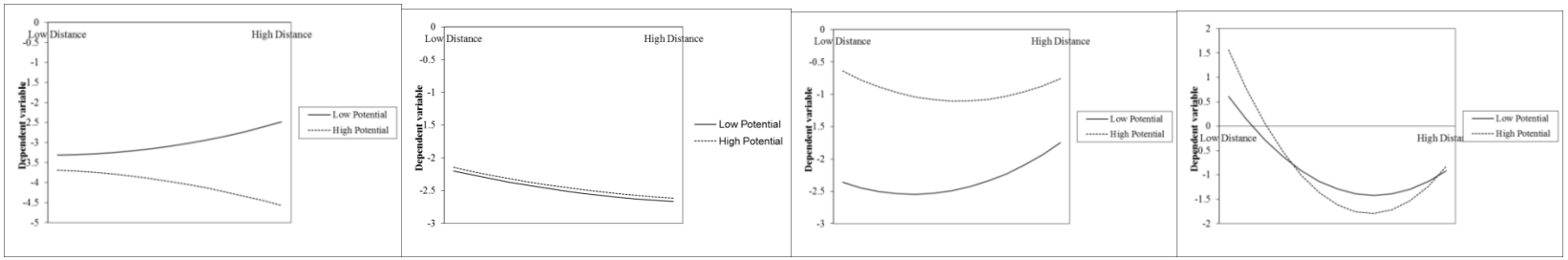


NAGW 1000k

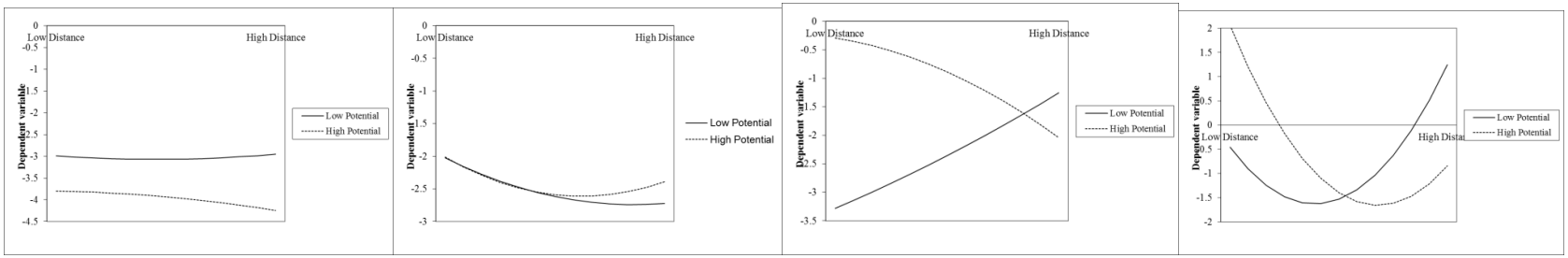


MALAWI TANZANIA NIGER UGANDA

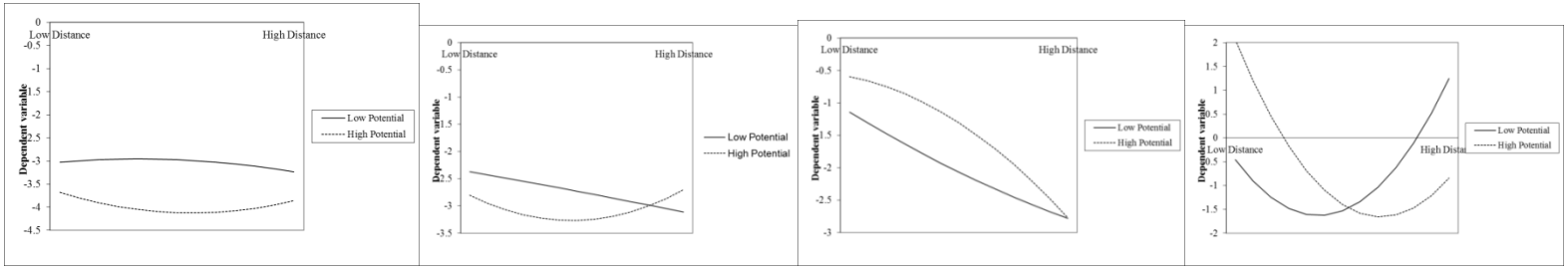
NON-AGRICULTURAL SELF-EMPLOYMENT SPECIALIZERS (SE) 20K



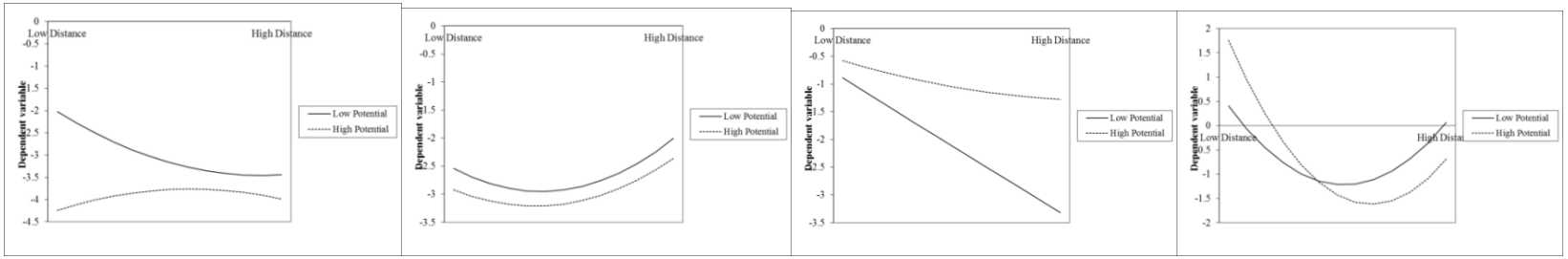
SE 100K



SE 500K

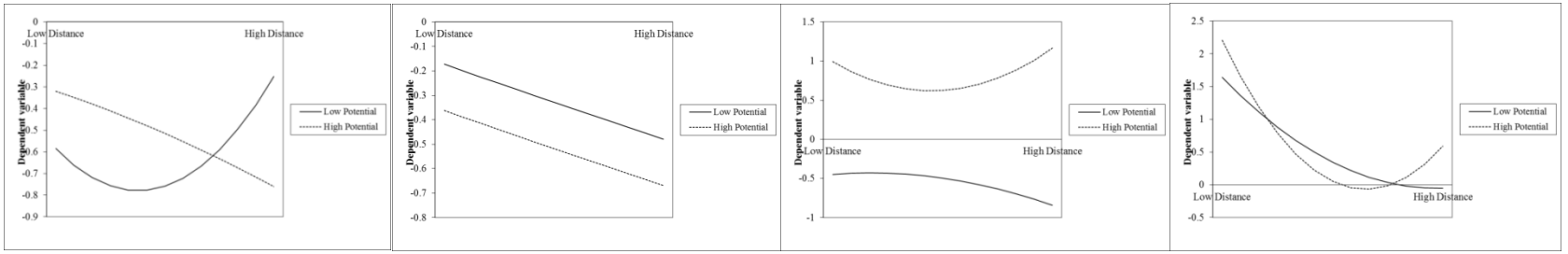


SE 1000K

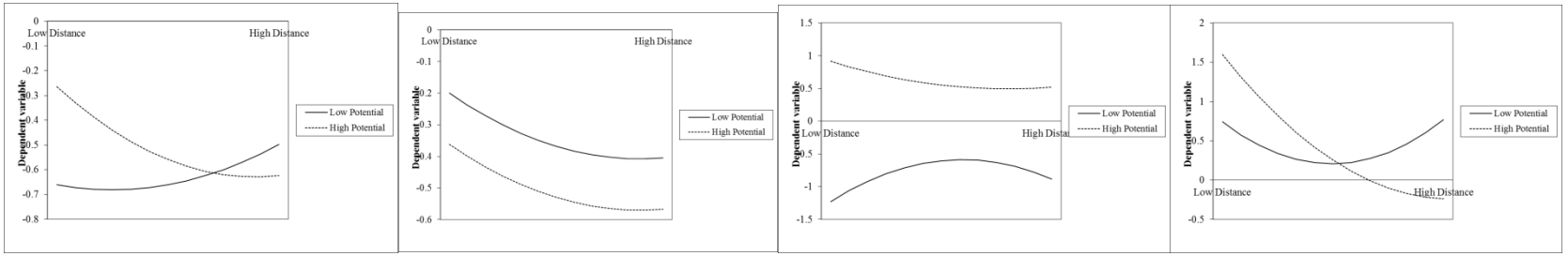


MALAWI TANZANIA NIGER UGANDA

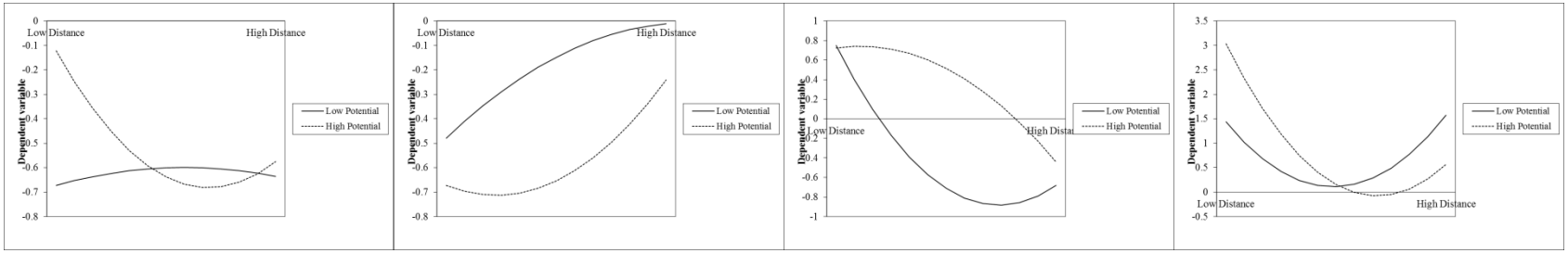
DIVERSIFIED (DIV) 20K



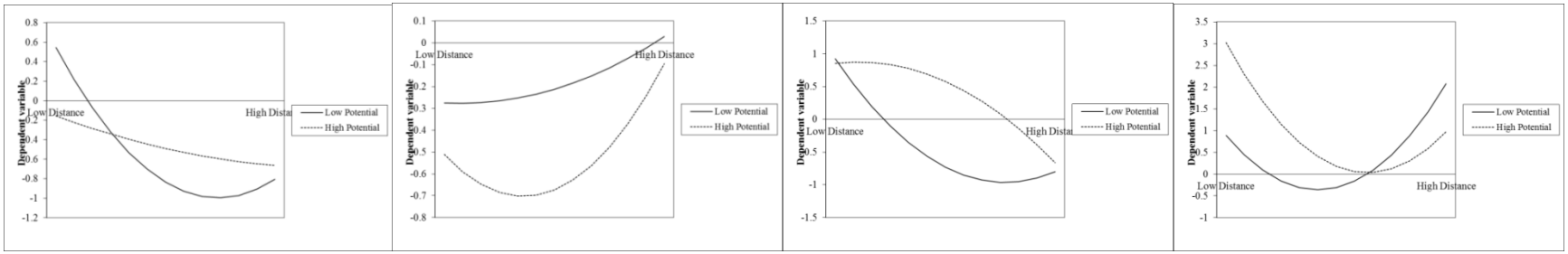
DIV 100K



DIV 500K

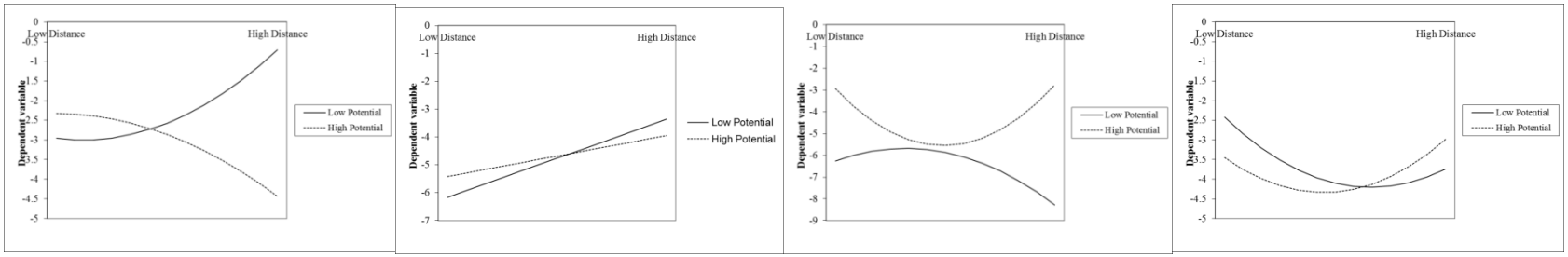


DIV 1000K

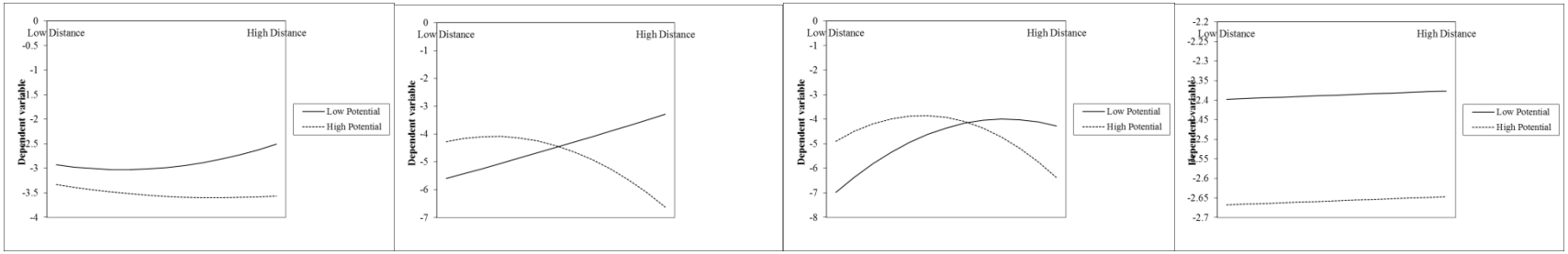


MALAWI TANZANIA NIGER UGANDA

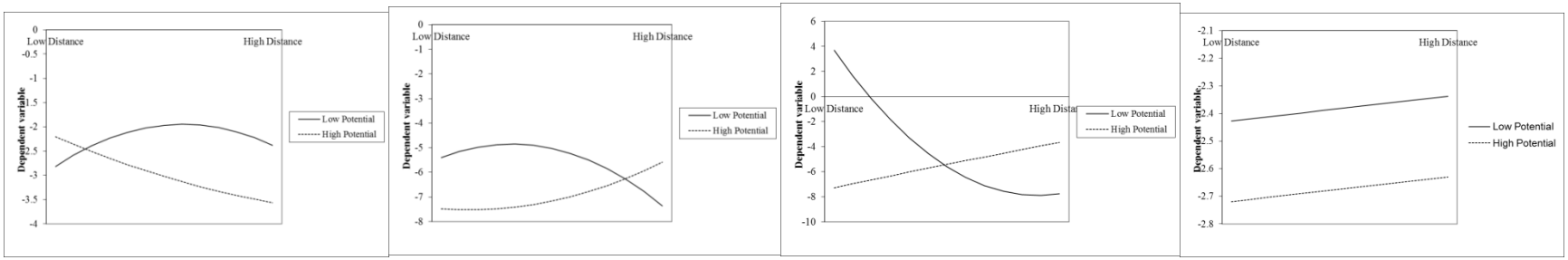
AGRICULTURAL WAGE SPECIALIZERS (AGW) 20K



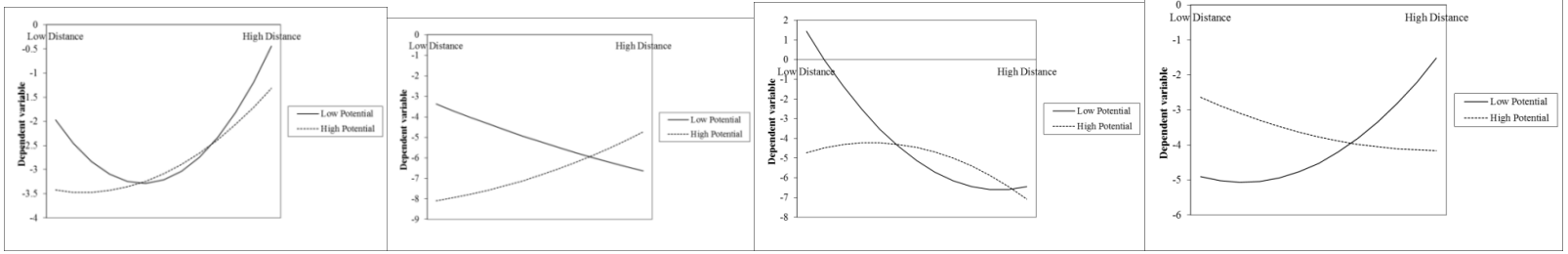
AGW 100K



AGW 500K



AGW 1000K



Conclusion

Is Africa's rural economy transforming as its economies grow? Or is it trapped in some sort of peculiar natural-resource based growth pattern that may prove unsustainable in the long-run? And in particular, is there evidence of the share of agriculture in the economy decreasing following the familiar secular pattern followed by the vast majority of the countries now enjoying middle and high-income status? The analysis in this paper has attempted to look at the evidence coming from micro-data to respond to some of these questions from the perspective of the rural economy.

The analysis of the income generating activities of rural households based on a large cross country dataset paints a clear picture of multiple activities across rural space and diversification across rural households. This diversification is true across countries at all levels of development and in all four continents, though less so in the African countries included in the sample. Bearing in mind the caveat that our sample is not representative of the whole of Sub-Saharan Africa, the evidence seems to point to African patterns of household level income diversification to have the potential to converge towards patterns similar to those observed in other developing regions. While African households are still generally more likely to specialize in farming compared to households in other regions, once the level of GDP is controlled for the shares of income and participation in non-agricultural activities are not far-off from those found elsewhere.

For most countries outside of Africa—generally with higher levels of GDP—the largest share of income stems from off-farm activities, and the largest share of households have diversified sources of income. However, for the African countries in the sample most income still derives from on farm sources of income. For both African and non African countries, diversification may function as a household strategy to manage risk and overcome market failures, or represent specialization within the household deriving from individual attributes and comparative advantage. Therefore diversification can be into either high or low-return sectors, reflect push or pull forces, and represent a pathway out of poverty or a survival strategy.

Specialization in on farm income generating strategies is the norm among the African countries in the sample. Nevertheless, agricultural-based sources of income remain critically important for rural livelihoods in all countries, in terms of both the overall share of agriculture in rural incomes and the large share of households that still specialize in agricultural and on-farm sources of income. While the nature of the diversification response will vary by a given household, in each country, African and non African, overall greater reliance on non-farm sources of income is associated with greater wealth. In almost all cases, wealthier households in rural areas have a higher level of participation in, and greater share of income from, non-farm activities. Similarly, wealthier households have a larger share of specialization into non-agricultural wage.

Conversely, agricultural sources of income are generally most important for the poorest households. Income from crop and livestock activities, as well as from agricultural wage labor, represents a higher share of total income for poorer households in almost all countries. Furthermore, a higher share of households specializing in on-farm activities, and particularly agricultural wage employment, is found at the low end of the wealth distribution.

The results offered here suggest the need to carefully consider how to promote rural development. While the diversification of rural households clearly indicates the need to look beyond agriculture in rural development policies, the overall importance of agriculture, particularly for poorer households, suggests that the promotion of RNF and agricultural activities both need to form part of any strategy. Policy makers must also pay attention to the likelihood that barriers to entry may limit the ability of poor households to take advantage of opportunities. The links between certain assets and activities imply that due consideration be given to those assets, or combination of assets, which will ensure broad growth in the rural economy. This complexity means that a particular policy is unlikely to fit

different situations across countries and even within regions in a given country and that location-specific policies are necessary.

The spatial analysis of the factors that drive specialization away from on-farm activities shows how the constraints to off-farm specialization are likely to differ between high- and low-potential, and high- and low-integration areas. Also, small and large urban centers are likely to exert different influences on the transformation of the rural economy. While this adds complexity to the formulation of policies to promote rural non-farm growth, it also testifies to a series of trends that are not uncommon in other countries, and suggests that after all the African specificity in terms of higher incidence of farming activities may be due more to a GDP-level effect, than to a different response by households to the incentives and opportunities coming from agricultural and non-agricultural growth opportunities.

References

Adams, R. (2001). Non-farm income, inequality and poverty in rural Egypt and Jordan. Policy Research Working Paper 2572. Washington DC: The World Bank.

Adams, R. (2002). Nonfarm income, inequality and land in rural Egypt. Economic Development and Cultural Change, 50(2), 339–363.

Azzari, C., Carletto, C., Davis, B., Fatchi, T., & Vigneri, M. (2006). Food and nutrition security in Malawi. In Background paper prepared for the World Bank Malawi Poverty and Vulnerability Assessment. Rome: FAO.

Barrett, C., Reardon, T. and Webb, P. (2001). Nonfarm Income Diversification and Household Livelihood Strategies in Rural Africa: Concepts, Dynamics and Policy Implications. *Food Policy* 26(4).

Barrett, C., Bezuneh, M., Clay, D., and Reardon, T. (2005). Heterogeneous constraints, incentives, and income diversification strategies in rural Africa. *Quarterly Journal of Agricultural Economics*, 44, 1: 37-60.

Bezu, S. and Barrett, C. 2012. "Employment dynamics in the rural nonfarm sector in Ethiopia: Do the poor have time on their side?" *Journal of Development Studies*, 48(9) 1223-1240.

Bezu, S., Barrett, C. and Holden, S. 2012. "Does nonfarm economy offer pathways for upward mobility?" *World Development*, 40(8),pp.1634-1646.

Binswanger-Mkhize, H. P., A. F. McCalla, and P. Patel. 2010. "Structural Transformation and African Agriculture." *Global Journal of Emerging Market Economies* 2: 113–52.

Carletto, G., Covarrubias, K., Davis, B., Krausova, M. and Winters, P. (2007). Rural Income Generating Activities Study: Methodological note on the construction of income aggregates. Agricultural Sector in Economic Development Service, Food and Agriculture Organization, http://www.fao.org/fileadmin/user_upload/riga/pdf/ai197e00.pdf.

CGIAR, 2014. Global Geospatial Potential EvapoTranspiration & Aridity Index. Methodology and Dataset Description. http://www.cgiar-csi.org/wp-content/uploads/2012/11/Global-Aridity-and-Global-PET-Methodology.pdf, accessed 4 April 2014.

Chawanote, C. and Barrett, C. 2013. "Farm and Non-farm Occupational and Earnings Dynamics in Rural Thailand", Cornell University, mimeo.

Chenery, H. and M. Syrquin. 1975. *Patterns of Development*. London: Oxford University Press.

Davis, B., P. Winters, G. Carletto, K. Covarrubias, E. Quinones, A. Zezza, K. Stamoulis, G. Bonomi, and S. DiGiuseppe. 2010. "Assets, Activities and Rural Poverty Alleviation: Evidence from a Multicountry Analysis", *World Development,* 38(1): 48-63.

de Janvry, A., Sadoulet, E., & Zhu, N. (2005). The role of non-farm incomes in reducing poverty and inequality in China. CUDARE Working Paper 1001. Berkeley: University of California.

Deichmann, U., Shilpi , F. And Vakis, R. 2008. "Spatial Specialization and Farm-Nonfarm Linkages", World Bank Policy Research Working Paper No. 4611.

Fafchamps, M. and Shilpi, F. 2003. The spatial division of labour in Nepal, *The Journal of Development Studies* 39(6), 23-66.

Fafchamps, M. and Shilpi, F. 2005. Cities and Specialisation: Evidence from South Asia, *The Economic Journal* 115(503), 477-504.

Economist (2000). *The Economist,* May 13.

Elbers, C., & Lanjouw, P. (2001). intersectoral transfer, growth and inequality in rural Ecuador. World Development, 29(3), 481–496.

FAO (1998). *The State of Food and Agriculture: Rural Non-Farm Income in Developing Countries.* Rome: Food and Agriculture Organization.

Haggblade, S., Hazell, P. and Reardon, T., eds. (2007). *Transforming the Rural Nonfarm Economy*. Johns Hopkins University Press.

IFPRI (2012). Patterns of Growth and Structural Transformation in Africa. *Thematic Research Note 02*, April. Washington DC: IFPRI.

IMF (2012). *Regional Ecomonic Outlook. Sub-Saharan Africa. Maintaining Growth in an Uncertain World.* October, Washington DC: IMF.

Lanjouw, P. (1999). Rural nonagricultural employment and poverty in Ecuador. *Economic Development and Cultural Change*, 48(1), 91.

Lanjouw, P., & Feder G. (2001). Rural nonfarm activities and rural development: From experience towards strategy. Rural Development Strategy Background Paper #4. Washington, DC: The World Bank.

Lanjouw, J. and Lanjouw, P. (2001). The Rural Nonfarm Sector: Issues and Evidence from Developing Countries. *Agricultural Economics* 26(1): 1-23.

Lanjouw, P., & Shariff, A. (2002). Rural non-farm employment in India: Access, income and poverty impact. NCAER Working Paper Series No. 81. New Delhi: NCAER.

McKinsey Global Institute, 2010. *Lions on the move. The progress and potential of African Economies.* McKinsey and Company.

Reardon, T., Taylor, J. E., Stamoulis, K., Lanjouw, A., & Balisacan, P. (2000). Effects of non-farm employment on rural income inequality in developing countries: An investment perspective. Journal of Agricultural Economics, 51(2), 266–288.

Reardon, T., Berdegue, J., & Escobar, G. (2001). Rural nonfarm employment and incomes in Latin America: Overview and policy implications. World Development, 29(3), 549–560.

Rodrik, D. (2013). Africa's Structural Transformation Challenge. Project Syndicate.

UCLA. 2014. UCLA: Statistical Consulting Group. Stata Annotated Output. Multinomial Logistic Regression. (http://www.ats.ucla.edu/stat/stata/output/stata_mlogit_output.htm . Accessed 2 April 2014).

Von Thünen, J.H. 1966. Isolated state; an English edition of Der isolierte Staat. Edited by Peter Hall, Oxford, New York, Pergamon Press.

Winters, P., B. Davis, G. Carletto, K. Covarrubias, E. Quinones, A. Zezza, K. Stamoulis, G. Bonomi, and S. DiGiuseppe. 2009. “A Cross Country Comparison of Rural Income Generating Activities”, *World Development*, 37(9): 1435–1452.

Winters, P., Essam, T., Davis, B., Zezza, A., Carletto, G. and Stamoulis, K. 2010. “Patterns of Rural Development: A Cross-Country Comparison Using Microeconomic Data”, *Journal of Agricultural Economics*, 61(3); 628-651.

Annex – Datasets

Table 3. Participation in income generating activities, rural households.

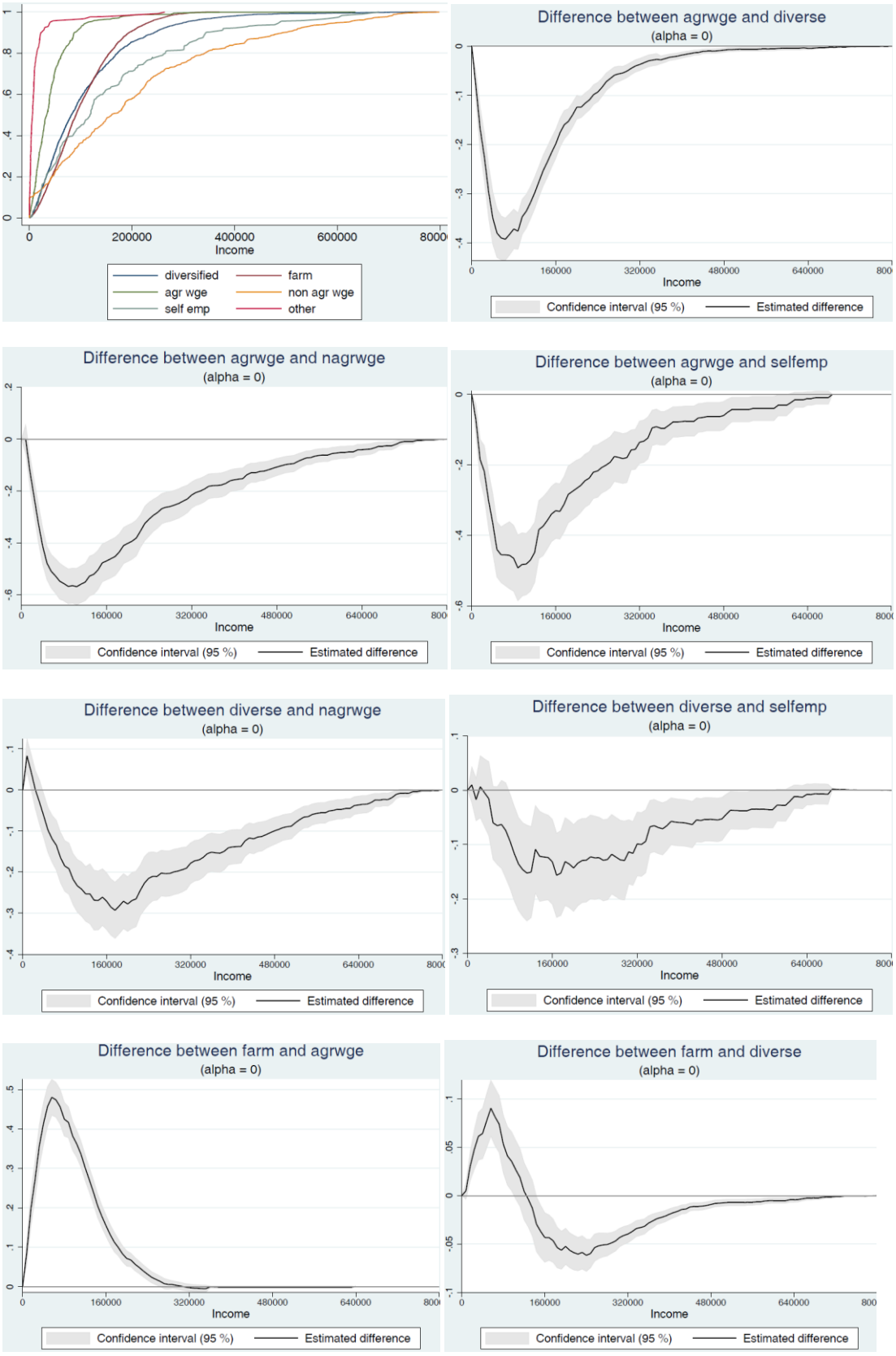
			Income-generating activity												
			Group I							Group II		Group III			
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(1) + (2) + (3)	(4) + (5) + (6) + (7)	(1) + (2)	(4) + (5)	(6) + (7)	(3) + (4) + (5) + (6) + (7)
	Country and year	Per Capita GDP, PPP Constant 2005, USD	Agriculture-Crops	Agriculture - Livestock	Agricultural wage employment	Non-farm wage employment	Non-farm self-employment	Transfers	Other	Agricultural total	*Non-Agricultural Total*	*On-Farm Total*	*Non-farm total*	*Transfers & Other*	*Off-farm Total*
African Countries	Ghana 1992	949	87.2%	54.0%	3.8%	13.8%	45.0%	36.7%	6.1%	*88.2%*	*73.2%*	*87.8%*	*53.9%*	*40.3%*	*74.8%*
	Ghana 1998	1,051	87.8%	51.4%	3.7%	17.7%	40.1%	41.3%	13.5%	*88.9%*	*74.7%*	*88.7%*	*49.3%*	*48.5%*	*75.9%*
	Ghnana 2005	1,222	84.9%	42.6%	4.2%	13.3%	40.9%	35.6%	4.5%	*87.7%*	*69.0%*	*87.0%*	*49.2%*	*38.0%*	*70.5%*
	Kenya 2005	1,340	88.5%	78.9%	13.3%	25.3%	21.5%	53.4%	13.4%	*93.9%*	*73.9%*	*92.1%*	*41.3%*	*57.4%*	*78.6%*
	Madagascar 1993	895	93.4%	78.0%	26.0%	18.2%	21.3%	43.5%	11.4%	*96.1%*	*67.0%*	*95.4%*	*35.5%*	*49.6%*	*75.0%*
	Malawi 2004	640	96.3%	65.4%	54.8%	16.0%	29.8%	88.9%	6.6%	*98.1%*	*93.5%*	*97.1%*	*41.6%*	*89.6%*	*97.2%*
	Malawi 2011	785	93.3%	47.8%	48.6%	13.1%	16.4%	66.4%	11.4%	*96.7%*	*78.6%*	*93.0%*	*27.5%*	*70.8%*	*90.6%*
	Nigeria 2004	1,707	84.6%	38.0%	1.1%	9.2%	16.5%	5.8%	3.6%	*86.0%*	*29.8%*	*85.9%*	*23.9%*	*8.8%*	*30.6%*
	Nigeria 2010	2,120	82.9%	55.0%	3.1%	14.4%	44.8%	2.9%	5.0%	*86.7%*	*55.6%*	*86.3%*	*53.4%*	*7.7%*	*56.2%*
	Niger 2010/2011	535	95.5%	77.4%	10.8%	8.1%	60.1%	57.8%	0.0%	*98.0%*	*83.6%*	*97.9%*	*64.9%*	*57.8%*	*85.6%*
	Uganda 2005/2006	966	88.2%	64.8%	20.0%	16.4%	38.4%	42.6%	1.8%	*91.9%*	*71.5%*	*89.8%*	*48.7%*	*43.5%*	*78.8%*
	Uganda 2009/2010	1,130	88.5%	67.4%	23.0%	25.2%	43.2%	31.7%	23.7%	*91.8%*	*77.3%*	*90.6%*	*55.9%*	*49.0%*	*83.4%*
	Tanzania 2009	1,240	96.8%	61.1%	21.8%	14.7%	34.1%	57.3%	1.2%	*98.5%*	*76.9%*	*98.2%*	*42.9%*	*57.7%*	*81.5%*
Non African Countries	Albania 2002	4,710	91.8%	85.7%	4.7%	27.8%	9.5%	67.8%	3.6%	*93.2%*	*85.2%*	*92.9%*	*35.3%*	*68.8%*	*86.8%*
	Albania 2005	5,463	94.7%	85.4%	5.3%	30.0%	10.9%	74.4%	18.8%	*95.4%*	*90.3%*	*95.2%*	*38.8%*	*75.8%*	*91.9%*
	Bangladesh 2000	901	81.6%	39.1%	35.4%	31.9%	25.7%	48.5%	55.0%	*87.1%*	*90.5%*	*79.0%*	*53.1%*	*74.5%*	*97.4%*
	Bangladesh 2005	1,068	85.0%	73.1%	28.7%	34.9%	22.1%	41.7%	58.8%	*92.8%*	*89.8%*	*81.9%*	*52.9%*	*76.2%*	*95.7%*
	Bolivia 2005	3,758	78.8%	48.4%	7.2%	18.2%	82.9%	26.5%	3.6%	*84.2%*	*95.8%*	*81.1%*	*91.6%*	*29.0%*	*98.3%*
	Bulgaria 1995	6,930	64.7%	40.8%	22.3%	36.8%	3.7%	65.9%	13.7%	*72.8%*	*86.5%*	*66.2%*	*38.8%*	*68.6%*	*92.1%*
	Bulgaria 2001	7,348	68.3%	64.1%	8.4%	26.5%	2.4%	89.3%	12.5%	*78.1%*	*95.4%*	*75.7%*	*28.5%*	*90.6%*	*96.8%*
	Ecuador 1995	5,658	73.5%	76.2%	39.1%	34.4%	38.8%	27.3%	48.4%	*93.0%*	*85.3%*	*88.3%*	*56.6%*	*61.6%*	*94.1%*
	Ecuador 1998	5,862	68.3%	77.7%	34.8%	33.7%	37.9%	27.8%	15.4%	*89.1%*	*70.5%*	*85.1%*	*55.9%*	*38.0%*	*85.6%*
	Guatemala 2000	3,966	87.8%	66.0%	42.6%	34.5%	30.7%	65.3%	3.7%	*93.5%*	*84.1%*	*91.2%*	*53.4%*	*66.5%*	*94.6%*
	Guatemala 2006	4,178	80.7%	46.2%	30.6%	51.0%	32.8%	70.8%	3.2%	*85.4%*	*90.2%*	*81.3%*	*66.6%*	*71.6%*	*96.5%*
	Indonesia 1993	2,487	56.8%	28.7%	19.8%	26.2%	30.3%	70.9%	11.1%	*72.0%*	*85.3%*	*61.4%*	*49.9%*	*73.7%*	*89.2%*
	Indonesia 2000	2,724	53.7%	10.2%	19.3%	31.8%	32.7%	85.4%	14.1%	*64.3%*	*92.5%*	*54.4%*	*54.9%*	*87.0%*	*93.8%*
	Nepal 1996	829	92.6%	82.4%	41.7%	35.4%	20.1%	26.5%	8.4%	*97.8%*	*69.1%*	*95.2%*	*49.8%*	*32.4%*	*84.5%*
	Nepal 2003	926	93.4%	86.2%	38.2%	36.0%	21.3%	38.3%	27.4%	*97.8%*	*82.2%*	*96.2%*	*52.3%*	*52.8%*	*90.9%*
	Nicaragua 1998	1,961	71.1%	68.1%	41.7%	37.9%	22.5%	32.6%	4.1%	*90.0%*	*67.4%*	*83.1%*	*50.3%*	*35.6%*	*85.0%*
	Nicaragua 2001	2,145	84.8%	71.9%	39.4%	35.2%	26.2%	38.7%	19.5%	*95.0%*	*72.8%*	*91.6%*	*51.9%*	*42.8%*	*87.3%*
	Nicaragua 2005	2,311	81.9%	67.3%	43.0%	29.8%	37.9%	32.8%	6.5%	*94.4%*	*70.5%*	*90.0%*	*55.9%*	*36.1%*	*83.6%*
	Pakistan 1991	1,719	60.3%	76.3%	25.0%	46.7%	31.6%	31.3%	3.3%	*84.1%*	*79.9%*	*80.4%*	*67.6%*	*33.1%*	*86.0%*
	Pakistan 2001	1,923	40.5%	64.6%	20.0%	48.5%	17.8%	31.4%	15.7%	*74.5%*	*78.1%*	*69.7%*	*57.9%*	*41.2%*	*84.8%*
	Panama 1997	7,554	87.5%	97.9%	26.8%	43.6%	53.1%	68.5%	8.5%	*99.2%*	*93.6%*	*99.1%*	*79.1%*	*71.1%*	*98.1%*
	Panama 2003	8,267	78.4%	65.2%	30.3%	42.0%	56.2%	64.5%	11.5%	*86.6%*	*86.5%*	*82.3%*	*58.5%*	*67.5%*	*93.9%*
	Tajikistan 2003	1,283	88.5%	68.9%	49.4%	29.3%	2.9%	58.0%	0.9%	*95.3%*	*72.7%*	*93.1%*	*31.6%*	*58.4%*	*91.1%*
	Tajikistan 2007	1,656	97.6%	78.1%	28.5%	44.7%	16.9%	47.7%	2.5%	*98.6%*	*78.3%*	*98.5%*	*56.4%*	*49.3%*	*88.0%*
	Vietnam 1992	997	95.1%	87.9%	15.2%	22.0%	40.8%	35.5%	4.6%	*97.1%*	*72.1%*	*94.5%*	*54.2%*	*38.1%*	*77.3%*
	Vietnam 1998	1,448	97.8%	90.8%	20.1%	31.9%	38.3%	36.4%	19.3%	*99.0%*	*79.7%*	*98.5%*	*58.6%*	*48.4%*	*85.8%*
	Vietnam 2002	1,780	78.8%	67.5%	11.2%	38.8%	40.0%	83.4%	25.2%	*85.0%*	*95.7%*	*83.2%*	*64.4%*	*86.5%*	*96.4%*

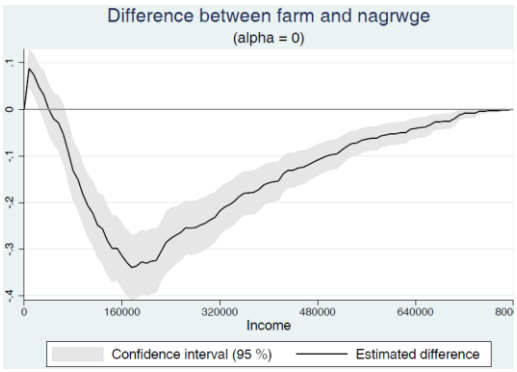
Table 4. Share of income generating activities in total rural household income

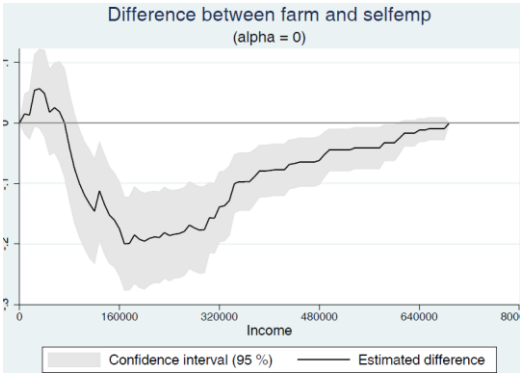
			Group I							Group II		Group III			
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(1) + (2) + (3)	(4) + (5) + (6) + (7)	(1) + (2)	(4) + (5)	(6) + (7)	(3) + (4) + (5) + (6) + (7)
	Country and year	Per Capita GDP, PPP Constant 2005, USD	Agriculture-Crops	Agriculture - Livestock	Agricultural wage employment	Non-farm wage employment	Non-farm self-employment	Transfers	Other	Agricultural total	*Non-Agricultural Total*	*On-Farm Total*	*Non-farm total*	*Transfers & Other*	*Off-farm Total*
African Countries	Ghana 1992	949	66.3%	2.6%	1.7%	7.8%	15.7%	5.6%	0.3%	*70.5%*	*29.5%*	*68.8%*	*23.5%*	*6.0%*	*31.2%*
	Ghana 1998	1051	55.0%	4.4%	1.4%	9.6%	20.5%	8.5%	0.5%	*60.9%*	*39.1%*	*59.4%*	*30.1%*	*9.0%*	*40.6%*
	Ghana 2005	1222	49.5%	3.0%	2.5%	8.6%	26.5%	9.6%	0.3%	*55.0%*	*45.0%*	*52.5%*	*35.0%*	*9.9%*	*47.5%*
	Kenya 2005	1340	32.0%	15.6%	7.2%	14.6%	9.3%	19.2%	2.1%	*54.8%*	*45.2%*	*47.6%*	*23.9%*	*21.3%*	*52.4%*
	Madagascar 1993	895	57.3%	13.2%	6.5%	6.1%	8.5%	6.2%	2.2%	*77.0%*	*23.0%*	*70.5%*	*14.6%*	*8.4%*	*29.5%*
	Malawi 2004	640	56.5%	9.5%	11.2%	7.4%	8.6%	6.4%	0.3%	*77.2%*	*22.8%*	*66.0%*	*16.0%*	*6.8%*	*34.0%*
	Malawi 2011	785	59.2%	6.0%	15.0%	7.6%	5.8%	6.1%	0.2%	*80.3%*	*19.7%*	*65.3%*	*13.4%*	*6.3%*	*34.7%*
	Nigeria 2004	1707	75.9%	4.6%	0.6%	7.2%	9.7%	1.5%	0.5%	*81.1%*	*18.9%*	*80.5%*	*16.9%*	*2.0%*	*19.5%*
	Nigeria 2010	2120	48.1%	8.9%	1.1%	10.8%	29.5%	0.5%	1.2%	*58.1%*	*41.9%*	*57.0%*	*40.3%*	*1.7%*	*43.0%*
	Niger 2010/2011	535	48.1%	8.9%	3.2%	3.9%	25.6%	10.3%	0.0%	*60.1%*	*39.9%*	*56.9%*	*29.5%*	*10.3%*	*43.1%*
	Uganda 2005/2006	966	*47.5%*	*6.9%*	*10.9%*	10.2%	15.8%	8.6%	0.1%	*65.3%*	*34.7%*	*54.4%*	*26.0%*	*8.7%*	*45.6%*
	Uganda 2009/2010	1130	47.6%	10.5%	7.8%	11.7%	16.4%	6.0%	0.1%	*65.9%*	*34.1%*	*58.1%*	*28.0%*	*6.1%*	*41.9%*
	Tanzania 2009	1240	52.6%	13.3%	4.3%	6.5%	12.7%	10.5%	0.1%	*70.2%*	*29.8%*	*65.9%*	*19.2%*	*10.5%*	*34.1%*
Non African Countries	Albania 2002	4710	15.2%	33.7%	2.2%	15.4%	5.2%	28.0%	0.4%	*51.1%*	*48.9%*	*48.9%*	*20.6%*	*28.3%*	*51.1%*
	Albania 2005	5463	17.2%	23.3%	2.8%	18.1%	7.4%	28.0%	3.2%	*43.3%*	*56.7%*	*40.5%*	*25.5%*	*31.2%*	*59.5%*
	Bangladesh 2000	901	15.5%	1.2%	20.2%	19.9%	16.4%	13.4%	13.4%	*36.9%*	*63.1%*	*16.6%*	*36.4%*	*26.8%*	*83.4%*
	Bangladesh 2005	1068	18.0%	8.6%	16.3%	22.4%	13.2%	8.9%	12.5%	*42.9%*	*57.1%*	*26.6%*	*35.7%*	*21.4%*	*73.4%*
	Bolivia 2005	3758	29.0%	6.8%	4.7%	13.1%	36.3%	9.0%	1.1%	*40.5%*	*59.5%*	*35.8%*	*49.4%*	*10.1%*	*64.2%*
	Bulgaria 1995	6930	13.0%	8.3%	13.2%	24.3%	2.3%	37.0%	1.7%	*34.6%*	*65.4%*	*21.4%*	*26.7%*	*38.8%*	*78.6%*
	Bulgaria 2001	7348	3.9%	12.0%	4.6%	16.5%	1.3%	60.5%	1.2%	*20.5%*	*79.5%*	*15.9%*	*17.8%*	*61.7%*	*84.1%*
	Ecuador 1995	5658	9.0%	3.4%	10.3%	39.1%	23.2%	8.9%	6.0%	*22.8%*	*77.2%*	*12.5%*	*62.3%*	*14.9%*	*87.5%*
	Ecuador 1998	5862	21.9%	11.3%	20.4%	18.2%	18.4%	4.7%	5.2%	*53.5%*	*46.5%*	*33.1%*	*36.6%*	*9.9%*	*66.9%*
	Guatemala 2000	3966	27.6%	2.6%	19.9%	20.2%	12.4%	16.9%	0.5%	*50.1%*	*49.9%*	*30.2%*	*32.6%*	*17.3%*	*69.8%*
	Guatemala 2006	4178	20.8%	3.1%	17.3%	27.5%	12.5%	18.3%	0.5%	*41.2%*	*58.8%*	*23.9%*	*40.0%*	*18.8%*	*76.1%*
	Indonesia 1993	2487	25.3%	4.8%	11.0%	16.0%	14.8%	25.9%	2.1%	*41.2%*	*58.8%*	*30.2%*	*30.8%*	*28.0%*	*69.8%*
	indonesia 2000	2724	23.5%	2.1%	9.7%	20.4%	17.7%	23.0%	3.6%	*35.2%*	*64.8%*	*25.5%*	*38.1%*	*26.7%*	*74.5%*
	Nepal 1996	829	31.6%	14.3%	17.7%	16.7%	9.0%	9.6%	1.1%	*63.6%*	*36.4%*	*45.9%*	*25.7%*	*10.7%*	*54.1%*
	Nepal 2003	926	20.3%	17.7%	12.6%	21.1%	9.2%	16.8%	2.4%	*50.6%*	*49.4%*	*38.0%*	*30.2%*	*19.2%*	*62.0%*
	Nicaragua 1998	1961	22.8%	11.4%	24.8%	22.5%	9.5%	7.9%	1.1%	*59.0%*	*41.0%*	*34.2%*	*32.0%*	*9.1%*	*65.8%*
	Nicaragua 2001	2145	21.1%	14.3%	21.4%	21.3%	11.1%	6.1%	4.6%	*56.9%*	*43.1%*	*35.4%*	*32.5%*	*10.7%*	*64.6%*
	Nicaragua 2005	2311	30.2%	0.0%	24.5%	17.4%	14.7%	12.0%	1.2%	*54.7%*	*45.3%*	*30.2%*	*32.1%*	*13.2%*	*69.8%*
	Pakistan 1991	1719	31.5%	14.4%	5.5%	26.6%	18.6%	2.8%	0.7%	*51.4%*	*48.6%*	*45.9%*	*45.2%*	*3.5%*	*54.1%*
	Pakistan 2001	1923	21.2%	11.4%	8.9%	28.8%	10.7%	14.5%	4.6%	*41.4%*	*58.6%*	*32.6%*	*39.5%*	*19.1%*	*67.4%*
	Panama 1997	7554	15.5%	7.2%	13.9%	29.2%	16.7%	16.1%	1.5%	*36.6%*	*63.4%*	*22.7%*	*45.9%*	*17.6%*	*77.3%*
	Panama 2003	8267	15.8%	2.0%	16.7%	27.1%	22.6%	14.6%	1.2%	*34.6%*	*65.4%*	*17.8%*	*49.7%*	*15.7%*	*82.2%*
	Tajikistan 2003	1283	37.3%	17.4%	16.9%	11.5%	1.1%	15.5%	0.3%	*71.6%*	*28.4%*	*54.7%*	*12.6%*	*15.7%*	*45.3%*
	Tajikistan 2007	1656	51.9%	9.1%	6.6%	19.2%	6.3%	6.5%	0.4%	*67.5%*	*32.5%*	*60.9%*	*25.6%*	*6.9%*	*39.1%*
	Vietnam 1992	997	52.9%	-0.9%	5.5%	11.4%	23.0%	7.7%	0.5%	*57.4%*	*42.6%*	*52.0%*	*34.4%*	*8.2%*	*48.0%*
	Vietnam 1998	1448	41.5%	14.8%	5.9%	9.2%	21.2%	7.0%	0.3%	*62.2%*	*37.8%*	*56.3%*	*30.5%*	*7.3%*	*43.7%*
	Vietnam 2002	1780	25.8%	3.5%	9.6%	37.6%	14.8%	7.1%	1.5%	*39.0%*	*61.0%*	*29.3%*	*52.4%*	*8.7%*	*70.7%*

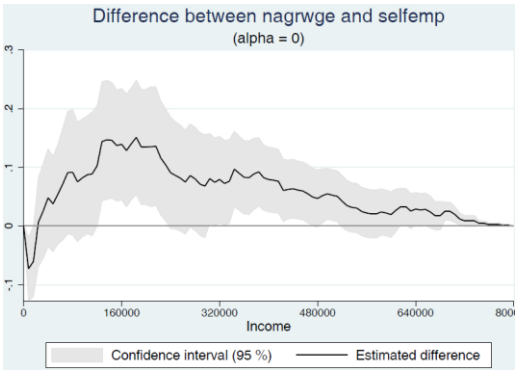
Appendix –

Figure AX. Cumulative income distribution, by income generating strategy, plus pairwise tests of stochastic dominance, Malawi 2011




Difference between farm and nagrwge
(alpha = 0)
0
160000
320000
480000
640000
Income
Confidence interval (95 %)
Estimated difference


Difference between farm and selfemp
(alpha = 0)
0
160000
320000
480000
640000
Income
Confidence interval (95 %)
Estimated difference


Difference between nagrwge and selfemp
(alpha = 0)
0
160000
320000
480000
640000
Income
Confidence interval (95 %)
Estimated difference