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Assets, Activities and Rural Income Generation: Evidence from a Multicountry Analysis

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Summary. — This paper examines the links between the assets and the economic activities of rural households in developing countries to provide insight into how the promotion of certain key assets—particularly education, land, and infrastructure—influences the economic choices of these households. Nationally representative data from 15 countries which form part of the rural income-generating activities (RIGA) database are used in the analysis. The results indicate that improved land access is linked to agricultural production and thus will lead households to take, on average, this path for improving household welfare. Higher levels of education and greater access to infrastructure appear to be most closely linked to non-agricultural wage employment.

Key words — rural income-generating activities, livelihood strategies, meta-regression analysis

1. INTRODUCTION

Interventions designed to improve the well being of rural households often focus on expanding asset ownership and access based on the view that it is the household's low asset position that limits its ability to take advantage of opportunities. Since assets determine the economic activities of a household in a given context, an intervention that improves a household's asset position is not likely to be path neutral; that is, such interventions are likely to promote participation in certain income-generating activities and thus a particular path for improving household welfare.

Historically, farming has been considered the principal economic activity of rural households, particularly poor rural households, and the dominant view of development has been the small-farm first paradigm which emphasizes promoting agriculture among smallholders (Ellis & Biggs, 2001). As such, the main asset whose accumulation has been promoted has been land, based on the argument that land ownership and access are closely linked to agricultural production and, correspondingly, to food security and rural income generation. Additionally, by supplying land through land reform or by providing titles to owners to secure property rights, there are hopes of overall efficiency gains in agriculture through improved land utilization and allocation. The small-farm first perspective, therefore, emphasized land as the key asset to bring about gains in both equity and efficiency.

Recent evidence clearly shows, however, that rural households are involved in a range of economic activities and that agriculture, while remaining important, is not the sole, or in some cases, even the principal activity of the poor (Davis *et al.*, 2008; FAO, 1998; Haggblade, Hazell, & Reardon, 2007). This realization has led to a greater emphasis within the rural development literature on what is referred to as the livelihoods approach. The livelihoods approach recognizes that households use a range of assets in a variety of activities, including agricultural and non-agricultural activities, as part of a livelihood strategy and accepts that there are multiple paths to improving well being (Ellis, 2000). This observation has led some, such as Riggs (2006), to question the merit of a land-focused vision of rural development. This, of course, begs the question of which asset or set of assets is best promoted as part of a strategy to improving the welfare of rural households. Riggs answers this question by arguing that the best means of promoting pro-poor growth in the countryside is through endowing rural households with skills, presumably through increased education.

This shift in thinking by Riggs and others has been reflected in development practice. In the 1980s and 1990s as budgets were reduced as part of broader debt reduction programs, the state steadily decreased it support for all types of agricultural programs. Furthermore, in the last decade, there has

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been an increasing emphasis on alleviating rural poverty through the accumulation of human capital, at least for the children of the poor. In particular, the increasingly popular conditional cash transfer (CCT) programs provide cash to the poor if their children attend schools and they receive regular medical health check-ups. While the cash provided to rural households through CCT programs may alleviate short-run poverty and act as a social safety net, the long-run asset focus is squarely on human capital development and, in particular, promoting higher education levels. [1] As with land, which is fundamentally linked to agriculture, promoting education may be tied to certain economic activities. The evidence from a range of studies, as well as this paper, suggests a strong link between education and rural non-agricultural wage employment. [2]

The objective of this paper is to examine the links between the assets and the economic activities of rural households and to compare those links across a range of developing countries. The relationship between certain assets and the capacity of rural households to generate income from different activities might be country specific and depend largely on the particular cultural and historical context of the country as well as its current policies. Alternatively, the asset–activities relationship may depend on the country's level of development—as countries develop and shift away from agriculture and toward manufacturing and services the magnitude of the returns to assets may shift from one activity to another or may change for a given asset. Most likely, the reality is somewhere in the middle, with the relationship between assets and livelihoods being influenced by both country-specific characteristics and general patterns of development. Through understanding the asset–activity relationship, the hope is to provide insight into how the promotion of certain key assets—particularly land, education, and infrastructure—influences the path rural households are likely to take to improve their well being.

Previous studies have examined the role of certain assets, but quite often with limited case study information in specific contexts. These studies have also tended to be partial analyses which only analyze certain income generating specific activities such as agricultural or rural non-agricultural employment. Some clear trends have emerged, but mixed conclusions as well which might be attributed to differences in the level of analysis, in the type of data collected or in the methods employed. To avoid these problems, in this paper, comparable data and methods are used to ensure comparability of result and to allow for cross-country comparisons. In particular, we use data from a series of Living Standard Measurement Surveys (LSMS) and similar surveys conducted in a number of developing countries. The data in all cases are national in scope and representative of the rural population and form part of the rural income-generating activities (RIGA) database. [3] The questions in the survey regarding income-generating activities are similar and therefore, variables created from the survey data are comparable. The data thus allow the comparison of the relationship between assets and activities across a range of developing countries, something that is missing in previous analysis of rural income-generating activities. The results also allow cross-country comparisons to determine whether results vary by region and level of development. The approach is akin to a meta-regression analysis where a similar set of dependent and independent variables are used across a range of data sets to draw general conclusions (Stanley, 2001).

The remainder of this paper is organized as follows. In the next section, the relationship between assets and activities is discussed and hypotheses formed about expected relationships. Section 3 provides a discussion of the multicountry data set and how it was constructed. Section 4 presents a profile of the rural income-generating activities of rural households and an initial analysis of the relationship between key assets and household activities. Section 5 explains the methodological approach taken to analyze the link between assets and activity choice. Section 6 presents the results of the econometric analysis of the data and Section 7 provides conclusions and policy implications of the analysis.

2. ASSETS AND RURAL INCOME-GENERATING ACTIVITIES: A CONCEPTUAL FRAMEWORK

Ellis (2000) defines a livelihood as comprising the assets, the activities and the access to these that together determine the living gained by an individual or household. Household assets are defined broadly to include natural, physical, human, financial, public, and social capital as well as household valuables. These assets are stocks, which may depreciate over time or be expanded through investment. The value and use of an asset depend not only on the quantity owned but also on the ownership status and the fungibility of the asset. For example, land that has a clear and transferable title may be sold while human capital, although clearly owned, cannot be transferred. Assets, such as literacy and numeracy of household members, can potentially be used in a number of productive activities while others, such as farm machinery, tend to be coupled with particular activities. In some cases, such coupling may be the product of specialization and can lead to higher returns to the asset. However, the lack of fungibility of coupled assets can dictate the economic path a household takes or can lead to an asset not being used to its full potential.

Based on access to a set of assets, households allocate labor to different activities to produce outcomes such as income, food security, and investment spending. The allocation of labor to a particular activity may be a short-run response to make-up income deficits due to an economic shock or to obtain liquidity for investment, may be an active attempt to manage risk through diversification of activities, or may be part of a long-term strategy to improve household well being. For these reasons, at a given point in time households may have a diverse portfolio of economic activities.

The decision to allocate labor to certain activities is conditioned on the context in which the household operates. The context includes natural forces, such as natural disasters, weather patterns, and agricultural pests, and human forces such as markets, the state and civil society. Markets influence a household's labor allocation through prices as well as through the functioning of markets including whether market participation requires substantial transaction costs and thus pose a barrier to entry. The state influences activities through a variety of past and present actions such as the investment in infrastructure, provision of services, coordination and efficiency of activities, design of interventions, implementation and enforcement of laws, regulation as well as interaction with the private sector and NGOs. Finally, civil society shapes activities because institutions determine the acceptability of and returns to activities, influence the use of assets, and establish the rules that govern the use of social capital. [4]

While the context in which a household operates varies both across and within countries, there are a few key assets that appear to be closely linked with labor allocation decisions and thus lead households to certain economic activities across a range of contexts. Land, education, and infrastructure accesses appear in particular to be associated with certain economic

activities. These three assets are often the focus of policies designed to promote rural development. While such policies are often intended to improve the efficiency of resource use, by design or by default, they also influence household labor allocation decisions and the pathways that households take to improve their capacity to generate income. Regardless of the context, they may be expected to be associated with certain labor allocation choices and it is this link we wish to explore here. Even if a similar association is found across countries between certain assets and economic activities, the relationship may vary in magnitude by region (Africa, Asia, Eastern Europe, and Latin America) or by level of development of a country and this too is explored.

(a) *Land*

Land ownership is expected to be closely linked to agricultural production, including both crop and livestock production. It is an asset that is not fungible across a range of activities and has a direct value only in agricultural production, although it can be used for different agricultural activities. It may have an indirect value in other economic activities, however, as collateral for credit and thus is potentially linked to these activities. In general, however, those without access to some land are expected, on average, to focus on other economic activities and limited land access is hypothesized to be linked to participation in off-farm (agricultural wage and non-agricultural income generating) activities.

The evidence generally supports these conclusions, particularly the result that land is negatively associated with non-agricultural activities. For Mexico, Yunez-Naude and Taylor (2001) find a positive relationship between land size and participation in crop and livestock activities although no relationship between crop income and land size. They do find a positive relationship for land size and livestock income. They also find a negative relationship between land size and participation in wage employment, as do Winters, Davis, and Corral (2002) for Mexico. Corral and Reardon (2001) find a positive but diminishing effect of land on total farm income in Nicaragua, but also find a negative link to non-agricultural wage employment participation and income as well as farm wage income. For Egypt, Adams (2002) finds a positive relationship to agricultural and livestock income and a negative relationship to overall non-agricultural income. A number of other studies show a negative relationship between land size and non-agricultural employment participation or income for a range of countries including Chile (Berdegue *et al*., 2001), Ecuador (Elbers & Lanjouw, 2001), China (de Janvry *et al*., 2005; Zhang & Li, 2001; Zhu & Luo, 2005), and India (Lanjouw & Shariff, 2002).

Thus, land ownership seems to dictate whether households remain in agriculture or shift to off-farm activities. The expectation is that this relationship is stronger in countries where land scarcity is a greater issue, such as in parts of Asia, and limited land ownership suggests limited options. The relationship, however, may get weaker as development occurs and agriculture becomes less important and non-agricultural activities increase in importance. Thus, for the relatively more developed countries, land may not play a substantial role in determining the household labor allocation.

(b) *Education*

The human capital of a household, as measured by schooling, is expected to generally be linked to a shift to non-agricultural activities since this is where the returns to education are most likely to be highest (Taylor & Yunez-Naude, 2000). This does not necessarily imply that there are no returns to education from agriculture, but rather that, on average, increased education appears to be likely to lead to a shift away from agricultural activities. A lack of education creates a barrier to entry in many non-agricultural activities and education is expected to be particularly important in participation in non-agricultural activities.

A number of studies on rural non-agricultural wage employment support this conclusion for a range of countries including Tanzania (Lanjouw *et al*., 2001), Chile (Berdegue *et al*., 2001), Ecuador (Elbers & Lanjouw, 2001), Brazil (Ferreira & Lanjouw, 2001), Mexico (Taylor & Yunez-Naude, 2000; Winters *et al*., 2002), Honduras (Isgut, 2004; Ruben & Van den Berg, 2001), and China (de Janvry *et al*., 2005). Evidence for rural non-agricultural self employment is mixed: a few studies—Tanzania (Lanjouw *et al*., 2001), Chile (Berdegue *et al*., 2001), Ecuador (Elbers & Lanjouw, 2001), Mexico (Taylor & Yunez-Naude, 2000), China (de Janvry *et al*., 2005)—show a positive relationship between education and participation in rural non non-agricultural self-employment while others find no influence.

Overall, education is hypothesized to be linked to a shift away from agricultural toward non-agricultural activities and to higher returns from these non-agricultural activities. The strength of these results is expected to increase as development occurs and the opportunities in the non-agricultural economy expand.

(c) *Infrastructure and urban proximity*

Access to infrastructure and population centers is likely to increase opportunities in non-agricultural activities. Infrastructure such as electricity is a useful input for certain self-employment activities. In addition, proximity to markets provides opportunities to sell output, and purchase inputs, from self-employment activities as well as opportunities for non-agricultural wage employment. Of course, access to markets may also provide higher returns to certain agricultural activities through better input supply and greater opportunities for high-value crops. On average, while it is unlikely that those with infrastructure access and within proximity to urban centers will be more likely to participate in agricultural activities, those that do participate may obtain more money from those activities.

Results on the importance of infrastructure and proximity vary across previous studies possibly because of different definitions of infrastructure and market access. For example, in Brazil Ferreira and Lanjouw (2001) find that being near an urban region increases the probability of participating in non-agricultural wage employment while Elbers and Lanjouw (2001) find in Ecuador that households near larger urban areas and remote rural areas participate less in non-agricultural activities relative to those near smaller urban centers. For Nicaragua, Corral and Reardon (2001) find that having access to electricity and an improved road both increase the probability of being involved in rural non-agricultural wage employment and the amount of income earned from that activity. de Janvry *et al*. (2005) find that proximity to the county capital influences participation in rural non-agricultural activities in China. Winters *et al*. (2002) find that in Mexico those in proximity to urban centers is less likely to participate in agricultural wage activities while those in semi-urban environments are more likely to participate in non-agricultural wage employment.

Even with the differences in measures, the results point to a strong influence of access to infrastructure and proximity to urban areas, as well as a positive correlation between access and rural non-agricultural wage employment. Greater access to infrastructure is therefore hypothesized to be positively linked to non-agricultural activities and negatively related to participation in agricultural activities. As the non-agricultural activities expand with development, the expectation is that this effect will be even stronger.

(d) *Demographics, wealth, social capital, and other factors*

Beyond these key assets, a number of other variables of course are also likely to influence activity choice. Demographic characteristics, particularly the amount of labor available, could lead to an expanded range of activities, particularly in contexts in which land is limited. Other demographic factors such as the age of the household, which reflects the stage of life of the head, and the gender of the household head, which may influence available opportunities, are also expected to play a role in activity choice. The amount of investment the household has previously made in agricultural and non-agricultural assets also matters as does the level of social capital of the household. Finally, the local context including the functioning of markets, availability of common property resources and local government policy, are all likely to influence household decision making with respect to activity choice. Although these and other factors are included in the analysis and discussed, or at least controlled for *via* locality fixed effects, the focus of the paper is on the three key assets noted above.

(e) *Assets, activities, and the level of development*

The above discussion points to a few key hypotheses regarding the relationship between key assets and income generating activities—namely, (i) land ownership is positively associated with participation in and income earned from agricultural activities and negatively associated with non-agricultural activities and agricultural wage participation; (ii) education is positively associated with participation in and income earned from non-agricultural activities and negatively associated with agricultural activities, and (iii) infrastructure and proximity to urban centers is positively associated with participation in and income earned from non-agricultural activities and negatively associated with agricultural activities. While, as noted above, these hypotheses have been previously tested, there remains some ambiguity in the results across studies and the findings come principally from case studies where there is some question of national validity. In this paper, we seek to test these hypotheses using nationally representative data from a number of countries.

Beyond testing these hypotheses for individual countries, a key strength of available data is in the fact it represents a range of countries at different levels of development. As such, it is possible to test hypotheses regarding how the relationships between assets and activities vary by level of development. In particular, the expectation is that with development the aforementioned relationships strengthen. This is expected given that with development, agriculture tends to become less important to the economy as a whole and non-agricultural sectors tend to become more important (Chenery & Syrquin, 1975). This transformation of the economy is likely to provide more opportunities in the non-agricultural economy and thus greater options for those with education and access to infrastructure and urban centers.

3. THE MULTICOUNTRY RIGA DATABASE

The data used in this analysis come from household surveys covering 15 different countries, which form part of the RIGA database created as part of a joint FAO–World Bank project to develop comparable income aggregates and corresponding data for a series of developing countries. [5] The range of countries selected for inclusion in RIGA is based on an attempt to get widespread geographic coverage across the four regions of interest—Africa, Asia, Eastern Europe as well as Latin American, and the Caribbean—while ensuring the comparability of the data. For each of the included countries, multitopic household surveys were used that had similar survey instruments with detailed questions on all household income generating activities to ensure that income aggregates could be created in a comparable manner. Additional information on household characteristics, including demographic structure, education, asset ownership, infrastructure access, and location, was also available in each survey. While clearly not representative of all developing countries, the list does represent a significant range of countries and is useful in providing insight into the income-generating activities of rural households in the developing world.

Details of the manner in which comparable income aggregates were created for this study can be found in Carletto, Covarrubias, Davis, Krausova, and Winters (2006). Here, a few key choices regarding the organization of the data are discussed. The first choice relates to the definition of rural and, correspondingly, which households are considered rural households for the analysis. Countries generally have their own mechanisms for determining what constitutes rural and urban. Analysis of rural households may vary just by virtue of the fact the definitions of rural vary. In exploring this issue, de Ferranti, Perry, Lederman, Foster, and Valdes (2005) show there is significant variability across countries in Latin America and the Caribbean in the government's definition of the rural population, which generally underestimate the size of the rural population. The bias in government definitions seems to be toward excluding rural towns from the definition of rural even though their economies are strongly linked to the natural resource base and the surrounding rural economic activity. Furthermore, commuters may live in urban areas and work in rural ones and *vice versa*. In general, this bias is likely to understate the relative importance of rural non-agricultural activities to the rural economy as a whole. While this potential problem is recognized, the available information in the data sets does not allow for an alternative definition of rural. Furthermore, it may make sense to use government definitions of rural since presumably this definition reflects local information and is also the definition used to administer government programs.

The second choice is to determine how to disaggregate income data in a manner that is consistent across countries. One common initial division is between agricultural and non-agricultural activities. A second common division of income, for both agriculture and non-agricultural activities, is between wage employment and self-employment. In addition, transfer payments, either from public or private sources may be included. Of course, the manner of dividing income aggregates varies by study as does the level of disaggregation. For example, income from agricultural production can be divided between livestock and crop income and crop income further into cash crops and staple products. Rural non-agricultural wage employment may be divided by sector or skill level. The choices often depend on data availability or the purpose of the study.

For this study, seven basic categories of income have been identified for analysis: (1) crop production income; (2) livestock production income; (3) agricultural wage employment income; (4) non-agricultural wage employment income; (5) non-agricultural self-employment income; (6) transfer income; and (7) other income. The creation of wage employment and transfer income is relatively straightforward since the income is directly reported or can be calculated from wages and time worked. Self employment income from agricultural or non-agricultural activities is more complicated since revenues must be calculated and costs subtracted from those revenues to obtain income. Again, details can be found in Carletto *et al*. (2006). For each survey, these income aggregates are created following the same procedure and, since the survey instruments themselves were chosen for their similarity, the differences in the variables across data sets should reflect cross-country variation rather than differences in variable definition, variable construction method, or data collection.

Note that by lumping all of the activities by sector together, there is no distinction between activities within a sector that may be high productivity or low productivity. For example, one might expect certain crop production activities to be high productivity while others are not. Exploring this possibility is beyond the scope of this paper and here the focus is on looking at broad sectoral differences. The results should be viewed as average relationships for a given activity and not necessarily reflect all activities in that sector.

The third choice relates to the unit of analysis. While it is most common to evaluate income-generating activities at the household level, some analysis is conducted at the individual level. The value of looking at the individual level is that it gives a clear idea of how individual characteristics are related to participation and returns to activities. However, it may be difficult to establish if income accrues solely to one particular individual since some activities are joint activities, particularly self-employment activities. Additionally, the activities of one member of a household are likely to be simultaneously determined as part of an overall household income generation and diversification strategy. [6] The appropriate approach depends on the questions being asked in the research. For this paper, the household was deemed the appropriate level of analysis both based on the view of the importance of the household as a social institution in which decisions are made and the availability of data at the household level.

4. RURAL INCOME-GENERATING ACTIVITIES IN DEVELOPING COUNTRIES

Table 1 presents data on participation rates in rural income generating activities for the countries included in this analysis ordered by the level of development from poorest to richest. [7] The definition of participation used here is the receipt of any household income by any household member from that income-generating activity. Table 2 shows the household income from the different income-generating activities as a share of total household income. Income is calculated using local currency units so reporting shares rather than income levels facilitates comparison. Note that the data come from national surveys that are designed to be representative of the population although in most cases the poor have been over sampled. Therefore, the calculated participation rates and income shares have been weighted to provide accurate estimates of the true values for the rural population.

The results indicate the continued importance of agricultural activities for rural households. As can be seen in Table 1, crop and livestock production still remain key activities with participation rates in the analyzed data sets indicating that 54–98% of rural households participate in crop production while 10–91% of rural households participate in livestock production. In many countries, including Malawi, Bangladesh, Nepal, Tajikistan, Nicaragua, Guatemala, Ecuador, and Panama, more than one in three rural households participate in agricultural wage markets. Rural households across all of these countries are actively engaged in agricultural activities. Although participation rates in agricultural activities are high, as can be seen in Table 2, the share of total income from agricultural activities is substantially lower than the participation

Table 1. *Household participation in rural income-generating activities*

Country and year	Agriculture – crops (%)	Agriculture – livestock (%)	Agricultural wage employment (%)	Non-agric. wage employment (%)	Non-agric. self-employment (%)	Transfers (%)	Other (%)	Agricultural total (%)	Non-agricultural total
Malawi 2004	96.3	65.3	54.8	16.0	29.8	88.9	6.6	97.0	93.4
Madagascar 1993	93.4	78.0	26.0	18.2	21.3	43.5	11.4	96.1	67.0
Bangladesh 2000	90.9	80.4	41.6	35.4	20.1	26.4	8.5	87.1	90.5
Nepal 2003	93.4	86.2	38.2	36.0	21.3	38.3	27.4	97.8	82.2
Ghana 1998	93.4	78.0	3.7	18.2	21.3	43.5	11.4	88.9	74.7
Tajikistan 2003	88.5	68.9	49.4	29.3	2.9	58.0	0.9	95.3	72.7
Vietnam 1998	97.8	90.8	20.1	31.9	38.3	36.4	19.3	99.0	79.8
Pakistan 2001	97.8	90.8	20.1	31.9	38.4	36.4	19.4	74.5	78.1
Nicaragua 2001	84.8	71.9	39.4	35.2	26.2	38.7	19.5	95.0	72.8
Indonesia 2000	53.7	10.2	19.3	31.8	32.7	85.4	14.1	64.3	92.5
Guatemala 2000	87.8	66.0	42.6	34.5	30.7	65.3	3.7	92.6	84.1
Albania 2005	94.9	85.4	5.3	30.0	10.9	74.4	18.8	95.6	90.3
Ecuador 1995	73.5	76.2	39.1	34.4	38.8	27.3	48.4	93.0	85.3
Bulgaria 2001	68.3	66.5	16.5	20.2	2.4	89.3	12.5	80.7	94.3
Panama 2003	61.2	56.9	35.4	31.9	25.7	48.5	55.0	86.6	86.5
Simple mean	85.0	71.4	30.1	29.0	24.1	53.4	18.5	89.6	83.0
Minimum	53.7	10.2	3.7	16.0	2.4	26.4	0.9	64.3	67.0
Maximum	97.8	90.8	54.8	36.0	38.8	89.3	55.0	99.0	94.3

Table 2. *Rural household share of income from different activities*

Country and year	Agriculture – crops (%)	Agriculture – livestock (%)	Agricultural wage employment (%)	Non-agric. wage employment (%)	Non-agric. self-employment (%)	Transfers (%)	Other (%)	Agricultural total (%)	Non-agricultural total (%)
Malawi 2004	56.1	9.4	11.4	7.4	8.7	6.6	0.3	77.0	23.0
Madagascar 1993	57.3	13.2	6.5	6.1	8.5	6.2	2.2	77.0	23.0
Bangladesh 2000	29.4	14.4	18.3	17.5	9.3	9.8	1.2	62.1	37.9
Nepal 2003	20.3	17.7	12.6	21.1	9.2	16.8	2.4	50.6	49.4
Ghana 1998	57.3	13.2	1.4	6.1	8.5	6.2	2.2	77.0	23.0
Tajikistan 2003	37.3	17.4	16.9	11.5	1.1	15.5	0.3	71.6	28.4
Vietnam 1998	41.5	14.8	5.9	9.2	21.2	7.0	0.3	62.2	37.8
Pakistan 2001	38.1	16.1	6.3	9.8	22.0	7.4	0.3	60.5	39.5
Nicaragua 2001	20.6	14.5	21.5	21.3	11.2	6.2	4.7	56.6	43.4
Indonesia 2000	22.4	13.7	8.2	27.3	10.1	13.9	4.4	44.3	55.7
Guatemala 2000	27.6	2.6	19.9	20.2	12.4	16.9	0.5	50.1	49.9
Albania 2005	20.1	22.1	2.6	17.8	7.3	27.1	3.2	43.3	56.7
Ecuador 1995	22.1	3.5	21.9	20.9	12.8	18.2	0.5	47.5	52.5
Bulgaria 2001	4.1	11.5	9.7	11.5	1.4	60.7	1.2	25.2	74.8
Panama 2003	15.3	2.2	20.0	19.7	16.3	13.2	13.1	37.6	62.4
Simple mean	31.3	12.4	12.2	15.2	10.7	15.4	2.5	56.2	43.8
Minimum	4.1	2.2	1.4	6.1	1.1	6.2	0.3	25.2	23.0
Maximum	57.3	22.1	21.9	27.3	22.0	60.7	13.1	77.0	74.8

rates and is often lower than non-agricultural activities. Taken together, agricultural activities still represent between 25% and 77% of income generated by rural households and make up, on average, 56% of all generated income. Of the agricultural activities, in terms of share of income generated, crop production appears most important in all of the countries except for Albania and Bulgaria where livestock income is more important and Panama and Nicaragua where income from agricultural wage employment is more important.

Tables 1 and 2 confirm previous findings that the rural non-agricultural economy plays a critical role in the income generation of rural households. For the countries analyzed, between 16% and 36% of households are involved in non-agricultural wage employment with an average participation rate of 29%. Two to 39% of households are involved in non-agricultural self-employment with an average of 24%. Transfers, which include both public and private transfers, are received by 26–89% of rural households and numerous households receive other forms of income, such as income from rental property. On average, 44% of rural household income is from non-agricultural activities. This ranges from a low of 23% in Madagascar and Malawi to a high of 75% in Bulgaria. The importance of each of the different types of rural non-agricultural activities varies by country. For Albania, Bulgaria, and Tajikistan, where there are large government pension programs, and particularly in the case of Albania, where remittances are a considerable source of income, transfers are the most important source of rural non-agricultural activity. For Malawi, Madagascar, Ghana, Vietnam, and Pakistan self-employment activities are the most important non-agricultural activity. For the remaining majority of countries, non-agricultural wage employment is the most important non-agricultural activity.

Compared to previous results a number of conclusions should be noted. Recent analysis of census data indicates that the share of workers primarily employed in rural non-agricultural activities is 11% for Africa, 25% for Asia, 36% for Latin America, 22% for West Asia and North Africa (Haggblade, Hazell, & Reardon, 2002), and 47% for Eastern Europe (Davis, 2004). Our results suggest that the participation rates are generally higher than those reported previously—78% for Africa, 83% for Asia, 82% for Latin America, and 92% for Eastern Europe. This could be due to the fact census data used in previous studies often only includes primary occupation which is likely to underestimate participation. Also found, which is less frequently highlighted in the rural non-agricultural literature, is the widespread receipt of transfers from public and private sources. In all of the data sets, over one in four households receive some form of transfer and in six cases participation rates exceed 50%. However, only in two cases—Albania and Bulgaria—do these participation rates translate into more than 20% of household income.

In terms of overall income shares, surveys of the literature indicate that rural non-agricultural income represents on average 42% of rural income in Africa, 32% in Asia, 40% in Latin America, and 44% in Eastern Europe and the CIS (Davis, 2004; FAO, 1998). Again, our results show that these activities are even more important than those noted previously, except in Africa, and represent 44% the income generated by rural households. Furthermore, we find a greater range of importance across region than those reported previously. For our sample countries, on average 23% of rural income in Africa, 41% in Asia, 52% in Latin America and 66% in Eastern Europe come from rural non-agricultural activities. In all the countries included except the African countries and Tajikistan, income from rural non-agricultural activities exceeds one-third of total income and for the six most developed countries non-agricultural income is equal to or exceeds agricultural income in importance.

Looking across the level of development, few patterns emerge with respect to participation rates except for a slight increase in participation in non-agricultural wage employment and transfers. For shares of income, Figure 1 presents the agricultural and non-agricultural shares by level of development. The figure shows that non-agricultural income becomes more important as an income source as development occurs.

To examine the relationship between key assets and income generating activities, the next step is to see how activities vary by asset ownership. Table 3 presents the asset variables used in

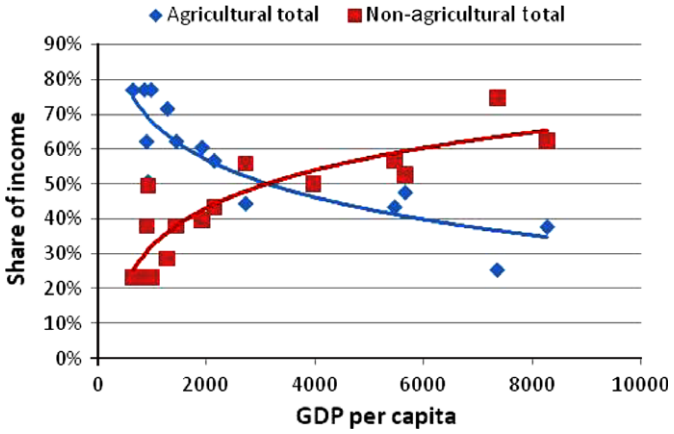

Figure 1. *Share of income by level of development.*

the analysis. The first set of variables—schooling, age of household head, family labor size, and the gender of the household head—represents the human capital and demographic composition of the household. Schooling is measured by the years of education of the head of household since it gives a good indication of household education and is the measure of schooling that is least likely to be simultaneously determined with current household activities. As seen in the table, there is a range of average schooling levels across the data sets ranging from a low in Guatemala of 2.3 years to a high in Tajikistan of 9.5 years. In general, the former communist countries (Albania, Bulgaria, Tajikistan, and Vietnam) have on average higher levels of schooling. Age of the head of household is included to reflect changes that occur in the life cycle of a household as well as a measure of experience. Average ages range from 43 to 57 with the higher ages of household heads found in Eastern Europe. The availability of family labor is likely to influence the range and type of activities in which a household is involved. Family labor is defined in all countries as the total number of household members that are between 15 and 60 years of age and ranges from an average of 3.7 members in Tajikistan down to 1.7 members in Bulgaria. Finally, we distinguish whether a household head is female, which generally indicates the head is a widow or the husband is not in the household for reasons such as migration. Female-headed households are most prevalent in Ghana where they account for 29.9% of households and least common in Albania where only 7.4% of households are headed by a female.

The next set of variables measures household access to natural capital, physical capital, and household wealth. Natural capital is measured by the hectares of arable land owned, which ranges from 0.1 in Tajikistan to 6.1 in Panama. For both agricultural productive assets and household nonproductive assets, developing comparable measures was challenging given the range of assets used for production in the countries being analyzed and the differences in the way in which wealth is stored. Comparable measures are desirable in conducting a cross-country analysis to ensure that differences in results across country are not driven by differences in variables used. In both cases, the choice was made to create indices of wealth that would facilitate comparison across countries provided that in each case the index is positively associated with wealth. Following Filmer and Pritchett (2001), a principal components approach is used in which indices are based on a range of assets owned by households. The choice of assets incorporated depended on the country in question but for agricultural wealth included items such as number of livestock owned and agricultural assets owned (tractor, thresher, harvester, etc.) for agricultural wealth and for non-agricultural wealth household durables (TV, VCR, stove, refrigerator, etc.) as well as household infrastructure (running water, brick walls, etc.). By definition, the mean of these indices is at or near zero.[8] While the measures are not quantitatively the same across country, they are comparable in the sense that they measure assets with a higher value indicating a higher asset position.

To test the hypothesis regarding the relationships between economic activity and access to infrastructure and proximity to urban centers, we need a measure of access to this type of public capital. The difficulty in doing so is that while most surveys included questions on infrastructure and distances to urban areas of key services, few of the variables are comparable. To address this issue, an infrastructure access index, including

Table 3. *Summary statistics of independent variables*

Country and year	Household head education (years)	Age of head	Household labor size	Female head (%)	Land ownership (Ha)	Agricultural wealth index	Wealth index	Infrastructure index
Malawi 2004	4.2	43.1	2.1	24.0	1.5	−0.005	−0.003	0.000
Madagascar 1993	2.8	42.7	2.4	17.8	1.1	−0.003	−0.004	−0.003
Bangladesh 2000	2.6	44.6	2.7	8.7	0.4	0.000	0.000	0.000
Nepal 2003	2.4	47.1	2.8	19.5	0.7	0.000	0.001	0.002
Ghana 1998	4.2	45.6	2.1	29.9	1.1	0.000	−0.003	−0.001
Tajikistan 2003	9.5	49.3	3.7	14.4	0.1	0.000	0.001	0.001
Vietnam 1998	6.4	47.2	2.6	21.6	0.2	0.000	−0.002	0.000
Pakistan 2001	3.0	45.6	3.4	8.8	0.9	−0.003	0.001	0.000
Nicaragua 2001	2.5	46.2	2.9	18.8	6.0	−0.001	0.000	−0.001
Indonesia 2000	6.2	46.0	3.1	16.9	0.8	0.000	−0.001	0.001
Guatemala 2000	2.3	44.0	2.6	14.7	1.4	0.000	0.001	0.000
Albania 2005	7.9	52.1	2.6	7.4	0.8	0.000	−0.003	0.001
Ecuador 1995	4.4	47.5	2.5	14.1	5.7	0.000	−0.001	−0.003
Bulgaria 2001	7.8	56.7	1.7	21.8	0.7	0.000	0.000	0.000
Panama 2003	5.8	49.0	2.4	19.1	6.1	−0.003	−0.002	−0.002
Simple mean	4.8	47.1	2.6	17.2	1.8	−0.001	−0.001	0.000
Minimum	2.3	42.7	1.7	7.4	0.1	−0.005	−0.004	−0.003
Maximum	9.5	56.7	3.7	29.9	6.1	0.000	0.001	0.002

both public goods (electricity, telephone, etc.) and distance to infrastructure (schools, health centers, towns, etc.) was created using principal components in a manner similar to the wealth indices. As with the wealth indices, the variables included in the creation of the index varied by country and are by definition at or near mean zero.

Finally, in each survey some measures of social capital are available including migrant networks and information on participation in associations and organizations. While these are included in the analysis, the link between social capital and activity choice depends on the type of social capital and the country under study. For example, in some countries where migration is prevalent migrant networks may play an important role in activity choice, but it is unclear what role that might be and whether it would be the same for all countries. Because of this, unlike other variables a single index was not created and while these variables are included in the econometric analysis as controls, their relationship to activity choice is not presented.

Prior to investigating the connection between assets and activities in the data, it is also important to document the relationships between household welfare and the three key assets examined in this paper: land, education, and infrastructure.[9] Given the conventional thinking regarding rural development, strong and positive links are expected between the three key assets and welfare. Table 4 provides a snapshot of these relationships and, with limited exceptions[10], confirms these links and suggests their potential to play an instrumental role in the well being of rural households. In other words, higher *per capita* expenditure levels are consistently associated with more land ownership, additional education, and more access to infrastructure in these surveys; however, it should be noted that causation cannot be interpreted from this preliminary analysis.

As an initial examination of the relationship between assets and activities, Table 5 presents the share of income from agricultural and non-agricultural activities by land, education and infrastructure categories. With rare exception, clear patterns emerge. For land, households are divided by the landless and then land quintile from smallest to largest. In general, an increasing quantity of land leads to greater share of agricultural income. This pattern is most pronounced going from landless to the lowest land quintile. The positive relationship seems to diminish at higher quintiles (going from the third to fifth quintile) and in a number of cases the relationship becomes slightly negative suggesting that those with largest land holdings may not be most involved in agriculture. The positive relationship between land and agriculture is driven by increases in both crop and livestock income shares across land category (not shown).

For education, households are divided by the level of education attained by the household head with the lowest being no education, followed by some primary education (1–5 years), primary plus some secondary education (6–10), and completion of secondary or more (>10). With the exception of Tajikistan, Albania and Bulgaria, the evidence from across the countries suggests that education is associated with a higher share of income from non-agricultural sources. For Albania and Bulgaria, those with no education receive more income from non-agricultural sources and the pattern is consistent for the other categories. The relationship between education and non-agricultural income appears to be the case in particular for those with the highest education (>10). Breakdowns of non-agricultural activities (not shown) indicate that this relationship is primarily driven by rural non-agricultural wage activities, which show a clear positive correlation with education, although in some cases this relationship holds for non-agricultural self-employment activities as well.

Finally, the last set of columns shows the relationship between the infrastructure index and income shares. Recall that the indices were defined in such a way that the higher the index the greater the access. With the exception of Bulgaria, the results show that infrastructure access is positively associated with non-agricultural activities and negatively associated with agricultural income. Further breakdowns by income category (not shown), point to rural non-agricultural wage employment as the primary reason suggesting access and thus proximity to urban centers and infrastructure availability is likely associated with greater wage employment opportunities. The findings conform to the above hypotheses and suggest a clear connection between particular assets and household activities across a range of countries.

5. METHODOLOGICAL APPROACH

The approach taken to analyze the data from the RIGA database is similar to a meta-regression analysis. Meta-regression analysis is a systematic approach to examining study-to-study variation in empirical research. The idea is to explain

Table 4. *Rural household land, education, and infrastructure levels by expenditure quintiles*

	Land owned (ha)						Household head education (years)						Infrastructure index					
	1	2	3	4	5	All	1	2	3	4	5	All	1	2	3	4	5	All
Malawi 2004	1.19	1.49	1.63	1.61	1.60	1.51	3.0	3.6	4.0	4.6	5.8	4.2	−0.18	−0.16	−0.11	0.01	0.45	0.00
Madagascar 1993	0.90	1.19	1.05	1.18	1.40	1.14	2.1	2.7	3.0	2.8	3.3	2.8	−0.20	−0.17	0.03	0.07	0.25	0.00
Bangladesh 2000	0.12	0.19	0.28	0.44	0.73	0.35	1.2	1.7	2.2	3.2	4.9	2.6	−0.40	−0.28	−0.10	0.08	0.70	0.00
Nepal 2003	0.35	0.55	0.63	0.82	0.94	0.72	0.9	1.7	2.2	3.0	4.1	2.4	−0.50	−0.34	−0.24	0.07	0.93	0.00
Ghana 1998	0.82	0.94	1.35	1.21	1.38	1.14	2.3	4.2	4.4	4.9	5.2	4.2	−0.58	−0.22	0.01	0.31	0.48	0.00
Tajikistan 2003	0.14	0.15	0.14	0.14	0.14	0.14	8.7	9.3	9.7	9.9	10.2	9.5	−0.14	−0.04	−0.01	0.01	0.17	0.00
Vietnam 1998	0.18	0.21	0.22	0.23	0.28	0.23	5.8	6.2	6.4	6.4	7.0	6.4	−0.42	−0.11	−0.05	0.18	0.41	0.00
Pakistan 2001	0.43	0.56	0.85	1.05	1.58	0.90	1.8	2.4	2.9	3.4	4.5	3.0	−0.25	−0.14	−0.04	0.08	0.34	0.00
Nicaragua 2001	3.70	4.86	8.08	5.46	7.79	5.97	1.4	2.0	2.4	2.8	4.0	2.5	−0.37	−0.11	−0.09	0.10	0.47	0.00
Indonesia 2000	1.09	0.85	0.71	0.80	0.68	0.83	4.4	5.0	5.9	7.0	8.8	6.2	−0.35	−0.14	0.01	0.10	0.38	0.00
Guatemala 2000	1.13	1.53	1.20	0.93	2.43	1.44	1.3	1.6	2.0	2.5	3.9	2.3	−0.40	−0.22	0.00	0.06	0.57	0.00
Albania 2005	0.66	0.73	0.79	0.88	0.98	0.81	6.8	7.4	8.3	8.0	8.9	7.9	−0.33	−0.10	0.01	0.06	0.36	0.00
Ecuador 1995	3.92	4.05	4.44	5.81	10.23	5.67	3.2	3.7	4.3	5.0	6.0	4.4	−0.22	−0.12	0.00	0.10	0.24	0.00
Bulgaria 2001	0.30	0.58	0.74	0.78	0.97	0.67	6.0	7.1	7.9	8.9	9.1	7.8	−0.59	−0.08	0.07	0.21	0.40	0.00
Panama 2003	5.54	4.43	5.22	6.71	8.74	6.13	3.3	4.9	5.7	6.6	8.3	5.8	−0.92	−0.43	0.09	0.33	0.92	0.00

Table 5. *Sources of income by asset category*

	Land quintile	Share agric. (%)	Share non-agric. (%)	Head education category	Share agric. (%)	Share non-agric. (%)	Infrastructure index quintile	Share agric. (%)	Share non-agric. (%)
Malawi 2004	Landless	47	53	No education	81	19	1st	84	16
	1st	72	28	Primary	80	20	3rd	78	22
	3rd	81	19	Middle school	76	24	5th	61	39
	5th	85	15	Higher: >10 years	59	41			
Madagascar 1993	Landless	60	40	No Education	83	17	1st	86	14
	1st	79	21	Primary	78	22	3rd	79	21
	3rd	87	13	Middle school	64	36	5th	58	42
	5th	85	15	Higher: >10 years					
Bangladesh 2000	Landless	32	68	No Education	41	59	1st	43	57
	1st	38	62	Primary	32	68	3rd	45	55
	3rd	43	57	Middle school	32	68	5th	25	75
	5th	42	58	Higher: >10 years	22	78			
Nepal 2003	Landless	38	62	No Education	52	48	1st	60	40
	1st	44	56	Primary	48	52	3rd	48	52
	3rd	51	49	Middle school	47	53	5th	35	65
	5th	54	46	Higher: >10 years	33	67			
Ghana 1998	Landless	55	45	No education	70	30	1st	74	26
	1st	65	35	Primary	56	44	3rd	67	33
	3rd	77	23	Middle school	57	43	5th	32	68
	5th	82	18	Higher: >10 years	33	67			
Tajikistan 2003	Landless	55	45	No education	65	35	1st	77	23
	1st	61	39	Primary	69	31	3rd	73	27
	3rd	77	23	Middle school	70	30	5th	60	40
	5th	80	20	Higher: >10 years	73	27			
Vietnam 1998	Landless	32	68	No education	68	32	1st	76	24
	1st	55	45	Primary	64	36	3rd	64	36
	3rd	68	32	Middle school	63	37	5th	37	63
	5th	73	27	Higher: >10 years	54	46			
Pakistan 2001	Landless	29	71	No education	46	54	1st	52	48
	1st	70	46	Primary	39	61	3rd	46	54
	3rd	74	31	Middle school	37	63	5th	25	75
	5th	64	24	Higher: >10 years	27	73			
Nicaragua 2001	Landless	46	54	No education	63	37	1st	81	19
	1st	61	39	Primary	58	42	3rd	60	40
	3rd	75	25	Middle school	38	62	5th	33	67
	5th	77	23	Higher: >10 years	17	83			
Indonesia 2000	Landless	21	79	No education	38	62	1st	50	50
	1st	48	52	Primary	42	58	3rd	37	63
	3rd	57	43	Middle school	37	63	5th	22	78
	5th	54	46	Higher: >10 years	22	78			
Guatemala 2000	Landless	44	56	No Education	59	41	1st	67	33
	1st	42	58	Primary	49	51	3rd	44	56
	3rd	58	42	Middle school	30	70	5th	11	89
	5th	66	34	Higher: >10 years	8	92			
Albania 2005	Landless	8	92	No Education	33	67	1st	50	50
	1st	37	63	Primary	46	54	3rd	41	59
	3rd	46	54	Middle school	49	51	5th	28	72
	5th	50	50	Higher: >10 years	36	64			
Ecuador 1995	Landless	44	56	No education	63	37	1st	75	25
	1st	47	53	Primary	58	42	3rd	43	57
	3rd	63	37	Middle school	45	55	5th	36	64
	5th	59	41	Higher: >10 years	31	69			

(*continued on next page*)

Table 5—*Continued*

	Land quintile	Share agric. (%)	Share non-agric. (%)	Head education category	Share agric. (%)	Share non-agric. (%)	Infrastructure index quintile	Share agric. (%)	Share non-agric. (%)
Bulgaria 2001	Landless	15	85	No education	15	85	1st	20	80
	1st	19	81	Primary	22	78	3rd	21	79
	3rd	26	74	Middle school	23	77	5th	22	78
	5th	22	78	Higher: >10 years	20	80			
Panama 2003	Landless	27	73	No education	50	50	1st	60	40
	1st	39	61	Primary	42	58	3rd	35	65
	3rd	47	53	Middle school	33	67	5th	12	88
	5th	32	68	Higher: >10 years	11	89			

how the choice of methods, design and data affect a certain type of analysis and thus lead to variation in results. To do this, the following steps are taken: (i) data from relevant studies are collected into a standard database, (ii) a single summary statistic for the analysis is identified and put into a common metric, (iii) a set of explanatory variables to include in a regression analysis are determined, and (iv) the particular regression model for the analysis is chosen (Stanley, 2001; Stanley & Jarrell, 2005). The meta-regression analysis is then the application of this consistent approach to data analysis for different data sets. The objective of conducting such an analysis is to compare the results obtained through the meta-regression analysis with those found through previous studies using the same data. An example of meta-regression analysis is the evaluation of economic research on gender wage discrimination, which generally finds there is wage discrimination by gender but that it varies in magnitude (Stanley & Jarrell, 1998).

In our case, there is concern over the accuracy of the results of previous studies of income-generating activities because they have tended to use case study information or, if national, census information only on participation in primary activities. Given this is the case, rather than collecting data from previous research, we have embarked on creating nationally representative and comparable data. From the outset, we have sought to avoid the problems of having different results driven by differences in data. However, our approach mirrors meta-regression analysis in that (i) for each of the countries analyzed common metrics (participation and income from seven income-generating activities) 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 (which is described below). 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 country.

The next step is to describe the specific econometric methods used to analyze the relationship between certain assets and activities for each of the data sets. As discussed in the conceptual framework (Section 2), barriers to entry, such as a lack of land or education, may limit the ability of a household to allocate labor to a certain activity. As such, the decision to participate in a given activity should be viewed as independent of the decision on the level of participation in an activity. Given this is the case, a common approach to conducting this type of analysis is to examine participation in individual activities using a discrete dependent variable model and then to separately consider the level of income from that activity (Taylor & Yunez-Naude, 2000; Winters *et al*., 2002).

When looking at levels of income from each activity, there is some concern about the endogeneity of activity choice and thus selectivity bias as well as efficiency in parameter estimates due to the simultaneous nature of activity choice. The approach taken here to deal with bias and inefficiency in parameter estimates is to follow Taylor and Yunez-Naude (2000) who use Lee's generalization of Amemiya's two-step estimator in a simultaneous-equation model. In this approach, the resulting estimators are asymptotically more efficient than other two-stage estimators, such as the commonly used Heckman procedure.

For the econometric analysis, therefore, as the first step a probit of participation in each activity category (seven equations) is estimated using the complete set of explanatory variables noted in Table 3 along with additional country-specific controls for social capital and regional fixed effects. The estimated coefficients on the explanatory variables test the aforementioned hypotheses regarding the relationship between key assets (land, education, and infrastructure) and participation in each activity. In the second step, the level of income obtained for each activity is estimated using a simultaneous equation system (with seven equations) that includes the complete set of explanatory variables noted previously as explanatory variables, except for the agricultural wealth variable for non-agricultural activities and the non-agricultural wealth variable for agricultural activities, as well as an inverse Mill's ratio to control for selectivity bias. The estimated coefficients in this case, test the hypotheses regarding the relationship between the key assets and the level of income earned from each activity.

6. ASSETS, PARTICIPATION, AND INCOME GENERATION: RESULTS OF THE ANALYSIS

For each country included in the analysis, the probit regressions of participation (seven equations per country) and the simultaneous equation system for the level of income (seven equations per country) described in Section 5 are estimated. Given the large volume of data analysis conducted for this study, it is necessary to organize the data in a manner that makes it easier to present. Since our interest is in understanding the role assets play in income-generating activities, the organizing principle used here is to examine results for key assets and present them in individual tables. This is done below. Complete results of the analysis are presented in the appendix. The results are presented separately for the probits, where marginal effects calculated at the sample mean are reported, and the level of income. Note that in the interest of space, results for the "other" category of income are not reported in any tables.

Before proceeding, it is worth noting that in analyzing the relationship between assets and activities it is very difficult to

ensure that a causal relationship is established. All the available data are cross-sectional and thus collected for a single 12-month period. For any given asset, determining whether it is possession of the asset itself that leads to participation in an activity is problematic. Consider land, for example. Even if land is quasi-fixed in the short-run, greater land ownership may be the result of previous investment in agriculture and reflect something about a household that makes them more likely to invest in agricultural assets. It then becomes difficult to identify if it is land that leads to greater agricultural involvement or unobservable characteristics of the household. For some assets, such as schooling, the schooling of the head of household is used since it is less likely to be problematic than a variable such as highest level of schooling in the household or mean schooling. Even so, there is the potential for problems. For this reason, in the analysis below we remain cautious about inferring causality. However, given the strength of the results, there does appear to be clear evidence of strong correlations between certain assets and activities and we do believe these have implications for policy.

(a) *Land*

Land ownership is hypothesized to be closely linked to crop and livestock production and expected to positively influence the participation in and generation of income from those activities. The marginal impact of land ownership on participation in individual activities and on the level of income earned from those activities is presented in Tables 6 and 7, respectively. In general, the results for the probit regressions on participation indicate that the more hectares of land a household owns the more likely it is to participate in self-employment agricultural activities (crop and livestock). This relationship is significant in most cases, although not all (12 of 15 cases for crops and 10 of 15 cases for livestock). In most cases, land ownership is negatively related to participation in both agricultural wage (10 of 15 cases) and non-agricultural wage (7 of 15 cases) suggesting that a lack of land pushes households into wage employment. The marginal effects of land on the probability of participation show no clear pattern across level of development, although some regional

Table 6. *Relationship between land ownership and participation in income-generating activities*

Country and year	Agriculture – crops	Agriculture – livestock	Agricultural wage employment	Non-agric. wage employment	Non-agric. self-employment	Transfers
Malawi 2004	**0.0039**	**0.0078**	−0.0027	−0.0035	−0.0028	0.0015
	18.41	**2.05**	1.41	1.60	1.50	1.11
Madagascar 1993	**0.0008**	0.0077	**−0.0155**	−0.0003	0.0030	0.0107
	2.10	1.40	**2.50**	0.07	0.59	1.60
Bangladesh 2000	**0.2331**	−0.0145	**−0.0673**	**−0.0623**	0.0044	**−0.0104**
	6.27	1.02	**2.10**	**3.99**	0.74	**1.94**
Nepal 2003	**0.0000**	**0.0177**	**−0.1592**	**−0.0444**	**−0.0219**	−0.0013
	4.22	**1.72**	**4.87**	**3.52**	**2.44**	0.14
Ghana 1998	**0.0068**	**0.0080**	−0.0008	**−0.0071**	**−0.0068**	−0.0012
	4.47	**2.34**	0.91	**3.23**	**1.84**	0.51
Tajikistan 2003	**0.4147**	−0.0866	**0.2994**	**−0.1306**	−0.0196	**−0.1549**
	4.34	−1.39	**3.51**	**−2.01**	−1.63	**−2.07**
Vietnam 1998	**0.0000**	**0.0280**	**−0.0891**	**−0.1542**	**−0.1255**	**−0.1109**
	2.46	**3.45**	**3.94**	**5.05**	**4.29**	**3.96**
Pakistan 2001	**0.3572**	**0.0140**	**−0.0156**	**−0.0411**	**−0.0161**	**−0.0137**
	13.67	**5.94**	**5.05**	**9.45**	**4.91**	**4.85**
Nicaragua 2001	0.0004	**0.0042**	**−0.0037**	−0.0001	−0.0008	−0.0005
	1.28	**2.80**	**3.12**	0.13	1.12	0.71
Indonesia 2000	**0.0361**	0.0007	**−0.0329**	−0.0001	−0.0011	0.0011
	31.70	1.58	**2.56**	0.08	1.03	1.65
Guatemala 2000	**0.0219**	**0.0060**	**−0.0060**	−0.0031	0.0002	0.0000
	2.57	**1.78**	**2.92**	1.43	0.21	0.18
Albania 2005	**0.0000**	**0.0000**	−0.0070	**−0.0718**	**−0.0332**	**0.0423**
	2.49	**4.06**	0.68	**3.13**	**2.41**	**2.08**
Ecuador 1995	**0.0084**	**0.0033**	0.0002	−0.0012	**0.0007**	0.0002
	2.42	**2.42**	0.29	1.23	**1.78**	0.62
Bulgaria 2001	0.0173	0.0049	**−0.0100**	0.0130	0.0016	0.0085
	0.92	0.51	**1.71**	1.25	1.25	1.35
Panama 2003	0.0017	**0.0068**	**−0.0032**	−0.0006	**0.0015**	**−0.0011**
	1.42	**4.02**	**5.13**	1.31	**2.11**	**3.13**

Notes: *t*-statistics presented below each coefficient. Bold indicates significance with at least 90% confidence. Marginal effects evaluated at the sample mean reported.

Table 7. *Relationship between land ownership and income-generation by activity (in local currency)*

Country and year	Agriculture – crops	Agriculture – livestock	Agricultural wage employment	Non-agric. wage employment	Non-agric. self-employment	Transfers
Malawi 2004	**197.51**	7.67	**−107.01**	81.08	**−179.66**	**−13.19**
	8.13	1.03	**3.47**	0.78	**2.24**	**1.72**
Madagascar 1993	**48,496.25**	2083.67	−1,011.78	**−2,654.80**	−3,788.78	−512.39
	9.86	0.97	0.79	**2.21**	0.52	0.74
Bangladesh 2000	−8.31	−17.43	**279.37**	**2,879.90**	**−2,417.04**	**−294.85**
	0.09	0.64	**1.69**	**6.88**	**5.97**	**1.74**
Nepal 2003	**1,932.64**	**509.38**	**−2,260.99**	−1,010.06	−4.01	457.46
	14.27	**2.55**	**7.94**	0.93	0.01	1.34
Ghana 1998	**36,016.83**	1,460.66	284.88	**−60,957.53**	6,841.33	−367.29
	8.24	1.28	0.10	**8.48**	0.32	0.34
Tajikistan 2003	**223.81**	**124.72**	61.00	−75.46	**−412.93**	29.29
	3.68	**2.80**	1.59	−1.14	**−3.76**	1.37
Vietnam 1998	**1,162.48**	5.15	**−892.31**	**−4,084.29**	**−8,530.29**	**−569.75**
	7.01	0.05	**7.20**	**7.84**	**3.14**	**3.12**
Pakistan 2001	**−1,265.52**	53.26	**−405.91**	**−1,433.48**	222.82	**−162.83**
	−13.10	1.34	**−4.23**	**−7.82**	0.47	**−1.84**
Nicaragua 2001	**30.04**	**31.15**	**−94.69**	**−41.28**	10.73	0.31
	3.76	**4.52**	**5.06**	**2.75**	0.69	0.10
Indonesia 2000	−1729.80	−443.07	−27,965.86	−1,719.78	**−25,675.03**	−1,756.69
	0.81	0.48	1.05	0.34	**3.68**	1.09
Guatemala 2000	5.65	**3.40**	**−20.93**	**−63.73**	5.73	0.55
	1.08	**2.02**	**2.48**	**3.89**	0.60	0.13
Albania 2005	**66,089.98**	**176,316.04**	**92,637.10**	**−333,615.25**	**−1,282,900.00**	67,561.69
	2.25	**6.19**	**2.18**	**2.24**	**4.04**	1.44
Ecuador 1995	−1,221.19	579.18	1,194.88	−3,092.68	−8.56	388.28
	−0.18	0.85	0.64	−1.13	0.00	0.73
Bulgaria 2001	20.38	1.54	11.02	−5.11	6.13	21.29
	1.43	0.14	0.62	0.16	0.28	1.24
Panama 2003	**−1.09**	**0.96**	**−3.59**	**−6.88**	1.73	−0.31
	3.08	**2.87**	**2.09**	**3.22**	1.06	0.44

Notes: *t*-statistics presented below each coefficient. Bold indicates significance with at least 90% confidence. Values of coefficients are in local currency units.

differences emerge. In particular, in Asia (Bangladesh, Nepal, Pakistan, and Vietnam) the probability of participating in wage employment (agricultural and non-agricultural) appears to have a strong negative association with land ownership indicating that in these Asian countries a lack of land is driving individuals to participate off-farm.

Moving to income levels, the results generally indicate that greater quantities of land owned are linked to greater income from crops in most cases (8 of 15 countries). The exceptions, where more land is significantly linked to lower crop income, are Pakistan and Panama. This may be because in many cases land may be farmed more intensively in small farms, particularly in peri-urban areas, and income earned form these activities may be high. Thus, land size becomes less important for income earned. Similarly for livestock, in five cases land is positively and significantly linked to livestock income. In no cases is a significant negative relationship between land and livestock income found. Nonetheless, the possibility remains that land size in itself matter less than whether the land is located near urban centers. In a number of cases, greater land ownership limits income from other activities, particularly wage earning activities, indicating those that have access to land tend to use labor on the farm rather than off the farm.

The results found here are consistent with findings elsewhere noted above. Taken together, the results of the analysis and the literature suggest that not only does larger land size appear to be linked to agricultural production, but also is negatively associated with agricultural and non-agricultural wage employment, particularly in Asia. The results, however, do not support the hypothesis that this relationship becomes weaker with development. Overall the results suggest that policies that tend to focus on land access support an agricultural path of improving the welfare of rural households.

(b) *Schooling*

Investment in schooling, by increasing human capital levels, is hypothesized to shift households toward non-agricultural activities and away from agriculture. Table 8 presents the marginal impacts of schooling from the probits on participation in income generating activities. For every data set, schooling is positively and significantly associated with participation in

Table 8. *Relationship between head schooling and participation in income-generating activities*

Country and year	Agriculture – crops	Agriculture – livestock	Agricultural wage employment	Non-agric. wage employment	Non-agric. self-employment	Transfers
Malawi 2004	0.0000 0.14	**0.0051** **3.34**	**−0.0182** **10.69**	**0.0129** **11.67**	**−0.0031** **2.18**	**0.0057** **6.69**
Madagascar 1993	**−0.0001** **2.49**	**−0.0055** **1.73**	−0.0043 1.06	**0.0164** **5.08**	0.0055 1.62	0.0059 1.27
Bangladesh 2000	**0.0035** **2.62**	**0.0012** **0.54**	**−0.0294** **13.12**	**0.0154** **7.72**	−0.0001 0.08	**0.0110** **5.24**
Nepal 2003	0.0000 0.27	**−0.0040** **3.80**	**−0.0373** **11.90**	**0.0070** **2.74**	0.0018 0.87	−0.0013 0.48
Ghana 1998	−0.0001 1.59	**−0.0041** **1.70**	**−0.0019** **2.68**	**0.0143** **9.90**	**0.0064** **2.88**	**0.0044** **1.92**
Tajikistan 2003	**0.0025** **1.70**	−0.0013 −0.76	0.0016 0.58	**0.0292** **10.07**	−0.0005 −1.52	**−0.0218** **−7.08**
Vietnam 1998	0.0000 0.60	0.0006 1.02	**−0.0040** **1.97**	**0.0163** **6.59**	−0.0037 1.42	**0.0078** **3.02**
Pakistan 2001	−0.0006 0.61	−0.0004 0.72	**−0.0092** **7.84**	**0.0125** **8.82**	−0.0008 0.97	**0.0100** **7.86**
Nicaragua 2001	**−0.0002** **1.99**	−0.0047 1.50	**−0.0310** **6.43**	**0.0272** **6.28**	0.0056 1.52	−0.0004 0.08
Indonesia 2000	**−0.0063** **4.36**	**0.0013** **1.67**	**−0.0112** **10.55**	**0.0118** **9.21**	**−0.0035** **2.68**	−0.0014 1.42
Guatemala 2000	**−0.0031** **6.34**	**−0.0091** **2.90**	**−0.0231** **5.88**	**0.0315** **9.14**	0.0015 0.48	−0.0001 0.37
Albania 2005	0.0000 1.34	0.0000 0.78	**0.0032** **1.77**	**0.0386** **9.67**	0.0024 1.21	**−0.0186** **5.83**
Ecuador 1995	**−0.0051** **3.16**	**−0.0040** **1.85**	**−0.0265** **7.46**	**0.0205** **6.00**	−0.0026 0.73	0.0049 1.60
Bulgaria 2001	**0.0094** **1.67**	0.0004 0.10	−0.0018 0.74	**0.0112** **2.17**	0.0001 0.12	**−0.0054** **2.20**
Panama 2003	**−0.0006** **2.92**	**−0.0121** **4.66**	**−0.0231** **8.30**	**0.0226** **7.74**	**−0.0049** **1.75**	**−0.0076** **2.82**

Notes: *t*-statistics presented below each coefficient. Bold indicates significance with at least 90% confidence. Marginal effects evaluated at the sample mean reported.

rural non-agricultural wage employment. Marginal effects, evaluated at the sample mean, range from 0.7% to 3.9% for each additional year of schooling. Interestingly there is little indication of a uniform impact of schooling on participation in non-agricultural self-employment. For transfers, the results are mixed and are likely to depend on the country-specific context. For agricultural activities, schooling is negatively associated with participation in both crop and livestock production in many, although not all, cases. However, schooling is positively related to participation in livestock production in Malawi, Bangladesh, and Indonesia, and to crop production in Bangladesh, Tajikistan, and Bulgaria. In all cases, however, the marginal impacts are not large. In most cases (11 of 15), participation in agricultural wage activities tends to be negatively related to schooling. The one exception where a positive relationship is found is in Albania. These results reflect those consistently found elsewhere that schooling is linked to a shift to non-agricultural wage employment, and that agricultural wage employment is the refuge of the poor and relatively poorly educated.[11]

Looking across the level of development of the countries, the results suggest that the education effect on non-agricultural wage employment is even stronger at higher levels of development. This can be seen in Figure 2 that plots the marginal effect of each additional year of education on the probability of non-agricultural wage employment. The marginal effects are generally higher for more developed countries. The figure also shows the marginal effects for agricultural wage and while consistently negative no clear pattern emerges based on the level of development.

Looking at Table 9, the income level associated with higher schooling levels appear to be greatest for rural non-agricultural wage employment with positive significant results in nearly all cases (except Madagascar, Tajikistan, and Bulgaria) and marginal effects that are generally higher than all other categories. In contrast, schooling is not positively and significantly related to returns to non-agricultural self-employment in most cases. The results suggest that education leads not just to a shift toward participation in rural non-agricultural wage activities, but also to greater income from those activities. For agricultural wage income, the results indicate schooling has either no impact on returns from this activity or a negative significant impact. Finally, schooling has a mixed effect on agricultural production activities with positive, negative and

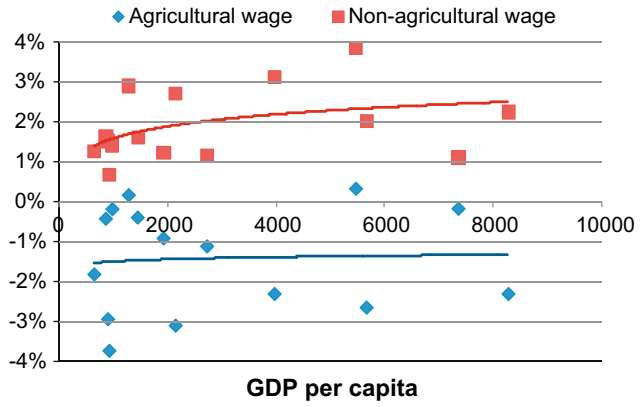

Figure 2. *Education and participation in wage employment by level of development.*

no relationship in a variety of cases. The results indicate that as hypothesized households with a head with a higher level of schooling tend to shift toward non-agricultural wage employment and the effect is stronger with the level of development. Contrary to expectations, however, this hypothesis with respect to non-agricultural self-employment cannot be confirmed. Thus, policies that tend to focus on promoting rural education are supporting non-agricultural wage employment as the main path toward improving the welfare of rural households.

(c) *Access to infrastructure*

The expectation is that households with greater access to electricity, water, communication, roads and other forms of infrastructure have a broader range of opportunities in non-agricultural activities in comparison to those with less access, who may be limited to agricultural activities. Recall that the higher the index the greater the access to infrastructure and, correspondingly, the closer the distance of the household to towns and markets. Tables 10 and 11 present the relationship between the infrastructure index and rural income generating activities. With some exceptions, access to infrastructure appears positively and significantly associated with participation

Table 9. *Relationship between head schooling and income-generation by activity*

Country and year	Agriculture – crops	Agriculture – livestock	Agricultural wage employment	Non-agric. wage employment	Non-agric. self-employment	Transfers
Malawi 2004	**30.83**	−4.75	**−121.47**	**611.13**	39.23	**−35.51**
	1.69	0.82	**4.26**	**5.97**	0.79	**5.64**
Madagascar 1993	**−5,590.18**	−1,006.23	**2,665.03**	−854.93	6,726.91	349.30
	1.69	0.70	**3.17**	0.78	1.24	0.71
Bangladesh 2000	**170.42**	−4.23	**−444.18**	**193.94**	−165.32	**467.55**
	5.30	0.52	**7.34**	**2.12**	1.02	**4.28**
Nepal 2003	**129.52**	**138.83**	**−613.24**	**695.22**	**462.87**	**171.71**
	3.49	**2.49**	**9.48**	**3.79**	**4.18**	**1.68**
Ghana 1998	−5459.28	**−3,718.54**	−2,689.14	**137,553.28**	−9,372.03	**6,945.40**
	1.34	**3.99**	0.42	**10.55**	0.48	**4.26**
Tajikistan 2003	**5.13**	0.31	0.57	11.88	**−11.15**	**−4.53**
	2.47	0.18	0.49	1.06	**−3.98**	**−4.50**
Vietnam 1998	9.20	**48.02**	**−32.10**	**398.47**	**−296.12**	**83.89**
	0.63	**5.35**	**2.83**	**7.63**	**2.42**	**6.07**
Pakistan 2001	**−188.19**	**40.73**	**−274.77**	**1,190.33**	33.63	42.27
	−3.95	**1.81**	**−4.62**	**17.10**	0.37	0.73
Nicaragua 2001	−24.45	**108.79**	**−719.54**	**712.72**	182.89	29.88
	0.52	**2.75**	**5.10**	**6.04**	1.60	1.52
Indonesia 2000	**17,190.60**	334.56	**−22,460.00**	**85,835.04**	**−66,959.25**	**18,528.01**
	5.99	0.25	**2.73**	**7.93**	**3.70**	**8.88**
Guatemala 2000	**99.55**	−3.45	**−147.19**	**612.48**	−39.24	−5.61
	4.41	0.53	**4.13**	**8.24**	0.92	0.31
Albania 2005	−2,105.78	**−12,443.92**	−8,960.21	**179,979.74**	61,346.64	−9,116.48
	0.48	**3.01**	1.33	**2.88**	1.56	1.10
Ecuador 1995	**150,849.94**	−111.02	**−56,496.31**	**126,119.06**	20,624.80	**22,960.13**
	2.61	−0.02	**−2.02**	**5.39**	0.64	**2.58**
Bulgaria 2001	−3.78	−9.38	−5.26	21.67	3.74	1.78
	0.48	1.61	0.63	1.18	0.32	0.19
Panama 2003	**−6.08**	**4.73**	**−31.11**	**203.08**	**37.12**	5.41
	3.06	**2.64**	**2.66**	**10.02**	**4.52**	1.23

Notes: *t*-statistics presented below each coefficient. Bold indicates significance with at least 90% confidence. Values of coefficients are in local currency units.

Table 10. *Relationship between infrastructure access and participation in income-generating activities*

Country and year	Agriculture – crops	Agriculture – livestock	Agricultural wage employment	Non-agric. wage employment	Non-agric. self-employment	Transfers
Malawi 2004	**−0.0013**	**−0.0493**	**−0.0203**	**0.0255**	**−0.0177**	**−0.0057**
	6.04	**5.99**	**1.89**	**5.01**	**2.68**	**1.82**
Madagascar 1993	**−0.0002**	**−0.0352**	−0.0093	**0.0291**	**0.0225**	**−0.0307**
	3.47	**3.86**	0.89	**3.20**	**2.42**	**2.30**
Bangladesh 2000	−0.0067	**0.0551**	**−0.0289**	−0.0007	0.0051	0.0027
	0.73	**4.96**	**1.69**	0.08	0.68	0.29
Nepal 2003	**0.0000**	**−0.0111**	**−0.0585**	**−0.0282**	0.0052	**0.0351**
	4.06	**2.75**	**3.73**	**2.08**	0.49	**2.63**
Ghana 1998	**−0.0014**	**−0.0553**	0.0034	**0.0169**	0.0180	−0.0028
	6.66	**4.27**	0.95	**2.38**	1.49	0.23
Tajikistan 2003	**−0.0163**	**−0.0222**	**0.0407**	**0.0210**	**0.0089**	**−0.0442**
	−2.45	**−2.38**	**3.63**	**2.04**	**5.08**	**−3.78**
Vietnam 1998	0.0000	**−0.0043**	**−0.0482**	**0.0393**	**0.0285**	−0.0127
	1.17	**1.73**	**5.59**	**3.91**	**2.63**	1.19
Pakistan 2001	**−0.0107**	**−0.0206**	**−0.0379**	0.0047	**0.0196**	**−0.0101**
	2.39	**8.91**	**8.34**	0.79	**4.93**	**1.70**
Nicaragua 2001	**0.0006**	**−0.0338**	**−0.0891**	**0.0690**	**0.0799**	0.0048
	1.86	**2.90**	**6.24**	**5.00**	**6.14**	0.35
Indonesia 2000	**−0.0783**	**−0.0163**	**−0.0156**	**0.0313**	**0.0562**	−0.0009
	9.18	**3.44**	**2.78**	**4.03**	**7.03**	0.17
Guatemala 2000	−0.0015	−0.0162	**−0.0840**	**0.0539**	**0.0575**	**0.0014**
	0.89	1.66	**7.80**	**5.11**	**6.06**	**1.85**
Albania 2005	**0.0000**	**0.0000**	**−0.0103**	**0.0417**	**0.0454**	−0.0094
	2.43	**3.52**	**1.84**	**2.99**	**5.11**	0.83
Ecuador 1995	−0.0048	0.0019	**−0.0267**	**0.0606**	**0.0358**	**0.0378**
	0.75	0.23	**2.18**	**4.86**	**2.81**	**3.50**
Bulgaria 2001	0.0231	0.0138	**−0.0138**	**0.0328**	0.0047	−0.0081
	1.33	1.01	**1.86**	**1.89**	1.32	1.00
Panama 2003	**−0.0088**	**−0.1784**	−0.0228	**0.0313**	**−0.0863**	**0.0277**
	8.02	**12.12**	1.54	**2.06**	**5.58**	**1.91**

Notes: *t*-statistics presented below each coefficient. Bold indicates significance with at least 90% confidence. Marginal effects evaluated at the sample mean reported.

in rural non-agricultural wage employment (12 of 15 cases). It also appears to be positively and significantly associated with the level of non-agricultural wage employment in most cases (12 of 15 cases). Not surprisingly, when a significant relationship exists, infrastructure tends to be negatively associated with participation in a range of agricultural activities, including crop and livestock production as well as agricultural wage. There is only one positive relationship between participation in agricultural wage employment and infrastructure access (Tajikistan). The results for agricultural income levels are somewhat more varied.

Finally, note that the results for participation in rural non-agricultural self-employment are positive and significant in most cases (although negative in the case of Malawi and Panama). This is also the situation for non-agricultural self-employment income for half of the surveys and for all the Asian countries except Pakistan. This provides a clear indication that access to markets and infrastructure increases the probability of participation in non-agricultural activities.

These results are consistent with a number of studies showing the positive link between infrastructure access and rural non-agricultural wage and self-employment supporting the hypothesis that this relationship is positive. Overall the results suggest that policies that tend to focus on promoting infrastructure are supporting non-agricultural wage and self-employment as the main path toward improving the welfare of rural households.

(d) *Other factors*

A number of other factors are included in the analysis but in the interest of space the results are not presented. Rural households with greater labor endowments are expected to be pushed toward off-farm activities since on average they are likely to have higher labor-to-land ratios. The results are as expected across in nearly all countries. The more labor available to households the more likely households are to participate in a diversity of activities, with the exception of transfers. This is probably because transfers are often provided to the elderly by the government and *via* remittances to parents, both of which tend to have smaller households. Looking at the magnitude of marginal effects, the results seem to suggest that greater family

Table 11. *Relationship between infrastructure access and participation in income-generating activities*

Country and year	Agriculture – crops	Agriculture – livestock	Agricultural wage employment	Non-agric. wage employment	Non-agric. Self-employment	Transfers
Malawi 2004	**−158.74**	19.52	−31.65	**5,776.35**	−247.81	34.34
	2.30	0.88	0.27	**18.26**	1.01	1.29
Madagascar 1993	−13,656.32	−5,214.01	−1,124.26	**11,176.49**	−24,825.32	**3,363.35**
	1.34	1.18	0.49	**4.43**	1.54	**2.40**
Bangladesh 2000	**670.27**	**194.46**	**−572.57**	**652.47**	**3,601.80**	**1,200.56**
	5.52	**2.98**	**2.78**	**2.15**	**5.08**	**3.95**
Nepal 2003	255.19	**855.92**	**−1,631.48**	**1,462.33**	**1,680.30**	**1,456.58**
	1.65	**3.65**	**7.11**	**1.88**	**3.01**	**2.23**
Ghana 1998	**−59,919.54**	**−20,497.61**	16,531.81	**164,348.28**	−14,364.69	**25,982.04**
	2.49	**2.68**	1.17	**7.58**	0.20	**4.72**
Tajikistan 2003	**−30.21**	−5.48	**12.12**	14.12	**188.28**	−0.96
	−3.60	−0.79	**2.23**	1.34	**3.66**	−0.26
Vietnam 1998	**311.92**	**136.24**	**−289.64**	**898.85**	**2,528.86**	−19.42
	5.78	**3.98**	**4.49**	**6.46**	**3.28**	0.55
Pakistan 2001	−324.30	**257.53**	**−1,341.17**	**1,532.37**	−672.95	173.96
	−1.64	**2.65**	**−5.25**	**6.06**	−1.02	1.17
Nicaragua 2001	**−465.69**	52.46	**−1,876.70**	**1,334.54**	233.41	**146.39**
	3.37	0.43	**5.22**	**3.61**	0.24	**2.39**
Indonesia 2000	**123,704.42**	13,224.29	−3,014.43	1,559.47	**1,440,104.90**	**70,958.50**
	5.76	1.34	0.14	0.03	**5.24**	**5.75**
Guatemala 2000	**−218.33**	−21.41	**−908.99**	**916.52**	**738.98**	**120.02**
	3.78	1.19	**8.44**	**5.00**	**3.13**	**2.18**
Albania 2005	−11437.48	−11898.15	35,075.93	**294,251.55**	**1,297,827.78**	**91,404.65**
	0.71	0.77	1.38	**3.51**	**3.56**	**3.50**
Ecuador 1995	−155,721.72	**−48,698.39**	−39,196.82	52,254.65	−170,261.18	**152,591.68**
	−0.80	**−2.51**	−0.60	0.61	−1.30	**2.38**
Bulgaria 2001	**70.05**	2.78	−21.99	**155.87**	−16.48	−1.36
	2.79	0.15	0.77	**2.61**	0.35	0.04
Panama 2003	**−23.39**	**29.07**	2.75	**313.42**	**424.32**	**66.35**
	2.36	**2.50**	0.07	**4.21**	**6.73**	**3.00**

Notes: *t*-statistics presented below each coefficient. Bold indicates significance with at least 90% confidence. Values of coefficients are in local currency units.

labor size is a strong factor in pushing households toward participation in wage activities, in general, as well as into non-agricultural self-employment in some cases. For the level of income from activities, more labor tends to bring about greater income gains for most activities, but much larger gains (as measured by marginal effects of an additional laborer) from non-agricultural wage employment, agricultural wage employment and in some cases non-agricultural self-employment. Taken together, the results indicate that a larger labor endowment pushes rural households into activities that are alternatives to agriculture.

Another component of household demographic characteristics that are of interest is the gender of the head of household. In most cases, a male member of the family is identified as the head of the household, but in each country there is a significant proportion (on average just over one-sixth) in which the household head is female. The expectation is that in the majority of these cases this is because the household is a single parent household due to the death of a spouse, separation, or migration of the spouse. Interestingly, the results indicate that without exception female-headed households tend to be more likely to get transfers and in most cases to get greater amounts of transfers. This is most likely because spouses who migrate are likely to remit back to households and both private and public transfers are more likely to be given to single-headed households out of concerns for the well being of such households.

The age of the household head is included to reflect the experience of the household head as well as the effect of the life cycle. The results clearly suggest that older household heads are much less likely to participate in either agricultural or non-agricultural wage employment. With the exception of a few countries in Latin America, they are also less likely to participate in non-agricultural self-employment activities. This may reflect that these households began their path of economic activity prior to the availability of alternatives to agriculture. They then tend to have remained in agricultural production while younger heads have followed alternative routes to improve their household's well being.

As noted previously, both the agricultural and household wealth variables are indices created using principal components. Wealth variables such as these partially reflect the household investment of income earned in previous periods.

Households that have previously worked in agriculture are much more likely to invest in agricultural production while households that have not are more likely to invest in other forms of wealth. Given this case, the expectation is that households that have invested in agricultural wealth will continue to pursue those activities while those that have invested in non-agricultural wealth will be more likely to focus on non-agricultural sectors. In general, the results correspond to expectations. Households with greater agricultural wealth tend to participate in livestock and crop production and gain, on average, more income from those activities. Interestingly, in a few cases the results indicate that having more agricultural wealth is linked to rural non-agricultural self-employment. This could be due to the fact some self-employment activities, such as agricultural processing, are linked to agriculture. The generally negative relationship between agricultural wealth and both agricultural and non-agricultural wage employment suggest, as expected, that those who have invested in agriculture are not likely to participate in these activities. The results for non-agricultural wealth also support the idea that households who have invested in non-agricultural wealth are more likely to be in non-agricultural activities. Participation in and returns to non-agricultural wage employment and non-agricultural self-employment are positively and significantly linked to non-agricultural wealth. Interestingly, in a number of cases agricultural wage employment is negatively linked to both forms of wealth. This provides additional evidence that in those cases agricultural wage employment is a refuge sector where only the poorest households participate.

7. CONCLUSIONS AND POLICY IMPLICATIONS

The objective of this paper is to examine the links between key assets and the income-generating activities of rural households in developing countries. The approach to identify these relationships is to use household data from a range of countries and comparable methods thereby conducting an analysis akin to meta-regression analysis. This approach minimizes the possibility that cross-country differences are due to differences in data, variable definition, or method. The analysis confirms the importance of rural non-agricultural activities in the livelihood strategies of rural households and suggests that previous studies that rely on case study information or census data probably underestimate the importance of the rural non-agricultural economy. This could be due to the fact that case study data are likely to be in more agriculturally oriented rural regions and census data miss occupations other than the primary one.

The analysis also shows clear links between key assets and the activity choice and level of income from different economic activities. In particular, we find that land access is linked to greater agricultural production and less participation in agricultural wage and non-agricultural wage activities and thus lead households to take, on average, this path toward improving household well being. Land is found to be a particularly strong indicator of activity choice in parts of Asia where land scarcity is an important factor in rural development. Higher levels of education appear to be most closely linked to non-agricultural wage employment. This relationship is found to strengthen as countries develop, presumably with the expanding importance of the rural non-agricultural economy. Education does not appear to be closely linked to non-agricultural self-employment as hypothesized suggesting that the educated prefer the security of wage employment. Education is negatively related in most cases to agricultural wage employment indicating a preference to non-agricultural wage employment among the educated. Like education, infrastructure is closely linked to non-agricultural wage employment, but also non-agricultural self-employment, most likely since this provides access to markets and inputs for production.

Land, education, and infrastructure are assets that can be accumulated and their usefulness and value can be greatly influenced by government policy. The accumulation of assets by households which are the result of state intervention is therefore likely to push households toward certain economic activities. Given this is the case, a key question to consider is which assets should a government promote given its limited resources. There are some who argue that a land-focused approach to improving the well being of rural households may be outdated and not reflect current reality. Clearly, the results presented here support the idea that households are involved in a range of activities and a sole focus on land access, which necessarily promotes a focus on agricultural production, which is misplaced. In fact, the sole focus on any single asset for promoting rural development, including education, or infrastructure, is likely to be misplaced since such a focus promotes a certain pathway for rural households since these assets are linked to certain activities.

This suggests the need for a mix of investment in assets that critically depends on the level of development of the country as well as on the local conditions. Of course, for a central government to identify such conditions requires local information and participation and suggests the need for some form of decentralized approach to rural development, such as a territorial approach that has received recent notice. A territorial approach is described by de Janvry and Sadoulet (2004) as an approach that distinguishes between different areas, and that seeks to integrate rural and urban activities in a territorial dimension centered on regional economic projects and the economic incorporation of the poor. Such an approach would allow policy makers to identify how key assets, such as land, education, and infrastructure, are likely to shape the decisions of the local rural population. Ignoring the path-specific implications of individual or joint interventions will only leave policies vulnerable to being imbalanced and ineffective.

NOTES

1. See Handa and Davis (2006) for a discussion of the development objectives of CCT programs.

2. For evidence showing a positive relationship between education and rural non-agricultural wage employment see Berdegue, Ramirez, Reardon, and Escobar (2001), Corral and Reardon (2001), de Janvry, Sadoulet, and Zhu (2005), Elbers and Lanjouw (2001), Ferreira and Lanjouw (2001), Isgut (2004), Lanjouw, Quizon, and Sparrow (2001), Ruben and Van den Berg (2001), Taylor and Yunez-Naude (2000) and Winters *et al.* (2002).

3. For information on the RIGA project see http://www.fao.org/es/ESA/riga/index_en.htm.

4. Institutions can be defined as a set of ordered relationships among people which define their rights, exposures to the rights of others, privileges and responsibilities (Schmid, 1972).

5. A description of these data can be found on the Food and Agriculture Organizations website at http://www.fao.org/es/ESA/riga/index_en.htm.

6. This does not necessarily imply a unitary household model. Even in alternative models such as a collective model, the decisions of one individual can be influenced by the relative bargaining power of other individuals in the household.

7. The level of development is determined by (i) obtaining the GDP *per capita* for the year in which the survey was administered from the World Development Indicators, (ii) putting this into US dollar terms using the purchasing power parity exchange rate, and (iii) calculating the value in real 2005 terms using the US consumer price index.

8. The values of the indices are not comparable across countries, though the method of construction is comparable and in all cases the values go in the same direction: more is better. Thus while for the econometric analysis the sign of the parameter is comparable across countries, the magnitude of the effect is not.

9. Welfare is measured as *per capita* expenditures for each household.

10. The exceptions are for land where Indonesia shows a negative relationship between land ownership and welfare and for a few other countries where trends are not completely clear across all categories.

11. See, for example, Lanjouw *et al.* (2001) for Tanzania, (Berdegue *et al.*, 2001) for Chile, Elbers and Lanjouw (2001) for Ecuador, Ferreira and Lanjouw (2001) for Brazil, Winters *et al.* (2002) for Mexico, Corral and Reardon (2001) for Nicaragua, Ruben and Van den Berg (2001) and Isgut (2004) for Honduras, and de Janvry *et al.* (2005) for China.

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APPENDIX A. SUPPLEMENTARY DATA

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.worlddev.2009.01.010.