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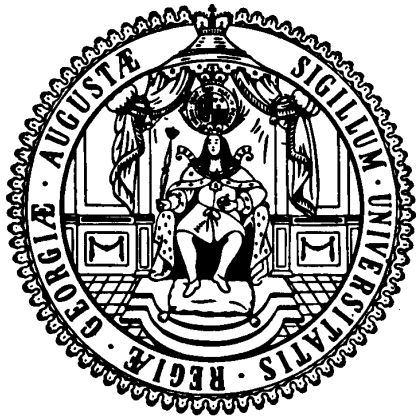

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Geography, Livelihoods and Rural Poverty in Honduras: An Empirical Analysis using an Asset-base Approach

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Summary

The overall objective of this paper is to develop an appropriate conceptual and analytical framework to better understand how prospects for growth and poverty reduction can be stimulated in rural Honduras. We employ complementary quantitative and qualitative methods of analysis, driven by an asset-base approach. Emphasis on assets is appropriate given high inequalities in the distribution of productive assets among households and geographical areas in Honduras. Such inequalities are likely to constrain how the poor share in the benefits of growth, even under appropriate policy regimes. We focus on household assets (broadly defined to include natural, physical, human, financial, social and locational assets) and their combinations necessary to take advantage of economic opportunities. We examine the relative contributions of these assets, and identify the combinations of productive, social, and location-specific assets that matter most to raise incomes and take advantage of prospects for poverty-reducing growth. Factor and cluster analysis techniques are used to identify and group different livelihood strategies; and econometric analysis is used to investigate the determinants of different livelihood strategies and the major factors that impact on income. Spatial analysis, community livelihood studies and project stocktakings are brought in to complement some of the more quantitative household survey data used. Our conclusions and recommendations are mainly focused on hillsides and hillside areas since the majority of the available data is for these areas.

Our research resulted in five key findings with important strategic implications. First, there exists significant heterogeneity of rural areas in Honduras in terms of their asset endowments. But even areas with good economic potential often have persistent high rates of poverty because the poor lack the basic asset base to be able to capitalize on this potential. Second, poverty is widespread and deep in rural Honduras, particularly in hillside areas where most households have limited assets on which to base their livelihood strategies. High poverty density in hillside areas and the fact that some 80 percent of all rural poor are located in these areas, should make these areas a target of national rural poverty reduction strategies. Overlap between high poverty rates and high poverty densities in many hillside areas means that investments there should reach significant proportions of the country's rural poor with minimal

leakages. Third, agriculture should form an integral part of the rural growth strategy in hillside areas, but its potential is limited. Over the past 25 years, agriculture has not been a strong engine of growth in rural Honduras. But high reliance of rural households on agricultural and related income means that any strategy targeted to these areas will have to build upon the economic base created by agriculture. Even though agriculture alone cannot solve the rural poverty problem, those remaining in the sector need to be more efficient, productive and competitive. Strategic actions and investments involving food security, security and access to land and forests, infrastructure provision, improved natural resource management, non-agricultural rural employment and migration are needed to achieve broad-based and sustainable agricultural growth and reduced rural poverty. Fourth, there is a need to move from geographically untargeted investments in single assets to a more integrated and geographically based approach of asset enhancement with proper complementarities. A multisectoral investment program is required to upgrade and improve access to household assets, with proper and more explicit complementarities. Finally, asset investment programs need to be adapted according to the specific needs of regions and households. While some household assets programs should be national in nature, others require more local adaptation and must be carried out in tandem, according to specific needs of regions and households. Investment strategies should be formulated on broad regional bases, but options within regions should be tailored to local asset bases.

I. Introduction

Major economic, political and social changes have taken place in Central America over the past decade. While these changes have stimulated some improvements in well-being and reductions in poverty, particularly in urban areas, the region is still characterized by persistent and stark inequalities in assets and well being (Morley, 2001). Broad-based growth is heavily constrained by unequal asset distribution. This inequality is most manifest in landholdings, but many productive, social and location assets are equally poorly distributed (Attanasio and Szekeley, 2001).

Honduras is one of the poorest countries in the Western Hemisphere and still a predominantly rural country, with about 60% of the population living in rural areas. The vast majority of rural people live in areas classified as hillside areas with limited agricultural potential (see Box 1 for definitions). The dominance of food and agriculture-related activities in the livelihoods of most rural people and the fact that most of the poor are located in hillside areas raises important questions about how agriculture can serve as an engine of growth to reduce poverty. Also, will small farms be able to survive in the future in hillside areas as trade is liberalized under the Central America Free Trade Agreement (CAFTA)?

Box 1. Defining 'Hillsides', 'Hillside Areas' and 'Valleys'
'Hillsides' are areas with slopes of more than 12%. 'Hillside areas' also include flat-floored valleys, 300 to 900 meters in elevation, which are scattered throughout the interior hillsides. 'Valleys' refer mainly to the lowland areas in the north and northwest of the country, which are generally considered as high-potential areas for agriculture. In Honduras, hillside areas account for roughly 80% of the total land area where the major economic activity consists of smallholder farming focusing on production of basic grains, coffee and livestock. Agricultural potential in hillside areas varies with agro-ecological factors such as elevation, rainfall, and soil characteristics. However, compared to areas with lower slope and elevation, agricultural options in hillside areas are constrained. Rather than profit maximization, food security is the most important objective of most smallholder households living in hillsides areas. Many hillside areas also have less access to transport infrastructure and services.

Analysts acknowledge that new strategies are needed to promote sustainable poverty-reducing economic growth in rural Central America. A central theme of this literature is that agriculture cannot serve as the sole engine of poverty-reducing rural growth, and that balanced and integrated multi-sectoral approaches are needed (Jansen and Hazell 2005, Cuellar 2003, Echeverría 2001). Such approaches should consider differences in asset endowments across

space and across household groups. Variations in environmental conditions, access to infrastructure and services, and effectiveness of public and private institutions dictate a spatially differentiated rural strategy. Strategies should include provision of key missing assets and increase the productivity of existing assets. They should recognize how some assets complement each other and how asset bases, income-earning strategies and well-being are inter-related.

The objective of this paper is to analyze the determinants of rural growth and sustainable poverty reduction for Honduras. The basic premise is that heterogeneous conditions necessitate complementary analyses of spatial determinants of growth and well-being, and better knowledge about how assets complement one another, and how household livelihood strategies, conditioned on spatial attributes and asset bases, determine well-being outcomes. The study combines geographical information systems (GIS) techniques, quantitative household analysis, and qualitative analyses of assets and livelihoods. The combination generates a description of rural space that recognizes the differential effects of policies and asset bundles across space and households.

Findings show that area economic potential is unevenly distributed and that high rates of poverty persist even in rural areas with relatively high economic potential. In such areas, many households lack the assets necessary to exploit the area's potential to their advantage. Other areas have weak potential due to poor agro-ecological conditions, remoteness, or both. Investments in such areas should seek to strengthen economic mobility (e.g. investments in education and health) and policy makers need to take a long-term perspective. Included among the more important assets are human capital, land and other physical capital, and location-specific assets such as access to roads and markets. The household's livelihood strategy affects prospects for economic progress; lack of sufficient assets constrains many from adopting favorable strategies. Households may also lack the right combination of assets needed to take advantage of economic opportunity and improve their well-being.

The remainder of the paper is organized as follows: The next section provides a brief background to the economic and policy context of rural Honduras. Section 3 introduces our conceptual framework, followed by a discussion of methods and data in section 4. In section 5 we provide a spatial overview based on GIS data which provides the foundation for the

interpretation of the main analytical results. In section 6 we use household survey data to investigate the main determinants of household income and their linkages with asset endowments and livelihood strategies. Factor and cluster analysis techniques are used to identify and group different livelihood strategies; and econometric analysis is employed to investigate the determinants of different livelihood strategies and the major factors that impact on income. Finally, section 7 presents general conclusions and some implications for priority setting of investments and other appropriate interventions.

II. Background

Honduras has a total population of 6.8 million and a relatively high population growth rate of 2.6% per year. It is one of the poorest and most unequal countries in the Latin America and Caribbean (LAC) region. Per capita annual income in 2002 was US$ 920 (World Bank 2004). Social indicators such as child malnutrition rate (17%), life expectancy at birth (66 years), child mortality rate (32 per 1000 births), and literacy rate (less than three-quarters of the population) are among the poorest in the LAC region. Honduras has acquired Highly Indebted Poor Country (HIPC) status and prepared a Poverty Reduction Strategy Paper (PRSP) in 2001. Honduras reached the so-called "completion point" in April of 2005 which qualifies the country for major debt relief and will allow Honduras to use its savings on debt servicing to improve essential public services.

Beginning in the early 1990s, Honduras adopted a range of macroeconomic stabilization programs as part of a continuing process of structural adjustment. The traditional economic import substitution model was gradually replaced by an export growth-led model focused on market and trade liberalization. Major elements of the reform process included reduction of trade barriers and protection of domestic manufacturers, more flexible exchange rate arrangements, financial market liberalization, adjustments of public utility tariffs, and the development of a legal framework to strengthen property rights.

Rural growth and poverty reduction have been constrained by a series of recent shocks. The decline in international commodity prices for major export crops such as coffee and bananas

has severely impacted resource-poor farmers and agricultural laborers. The global economic slowdown has exacerbated problems of unemployment. Negative economic impacts have resulted from natural shocks including Hurricane Mitch, destructive and erratic rainfall, and recurrent droughts. Unequal distribution of assets and inadequate public policies dampen low factor productivity, especially land and labor productivity. Over the past decade, income distribution in rural areas has worsened (Figure 1), with increasing numbers of people at both tails of the distribution that exhibits a virtually stagnant mean.

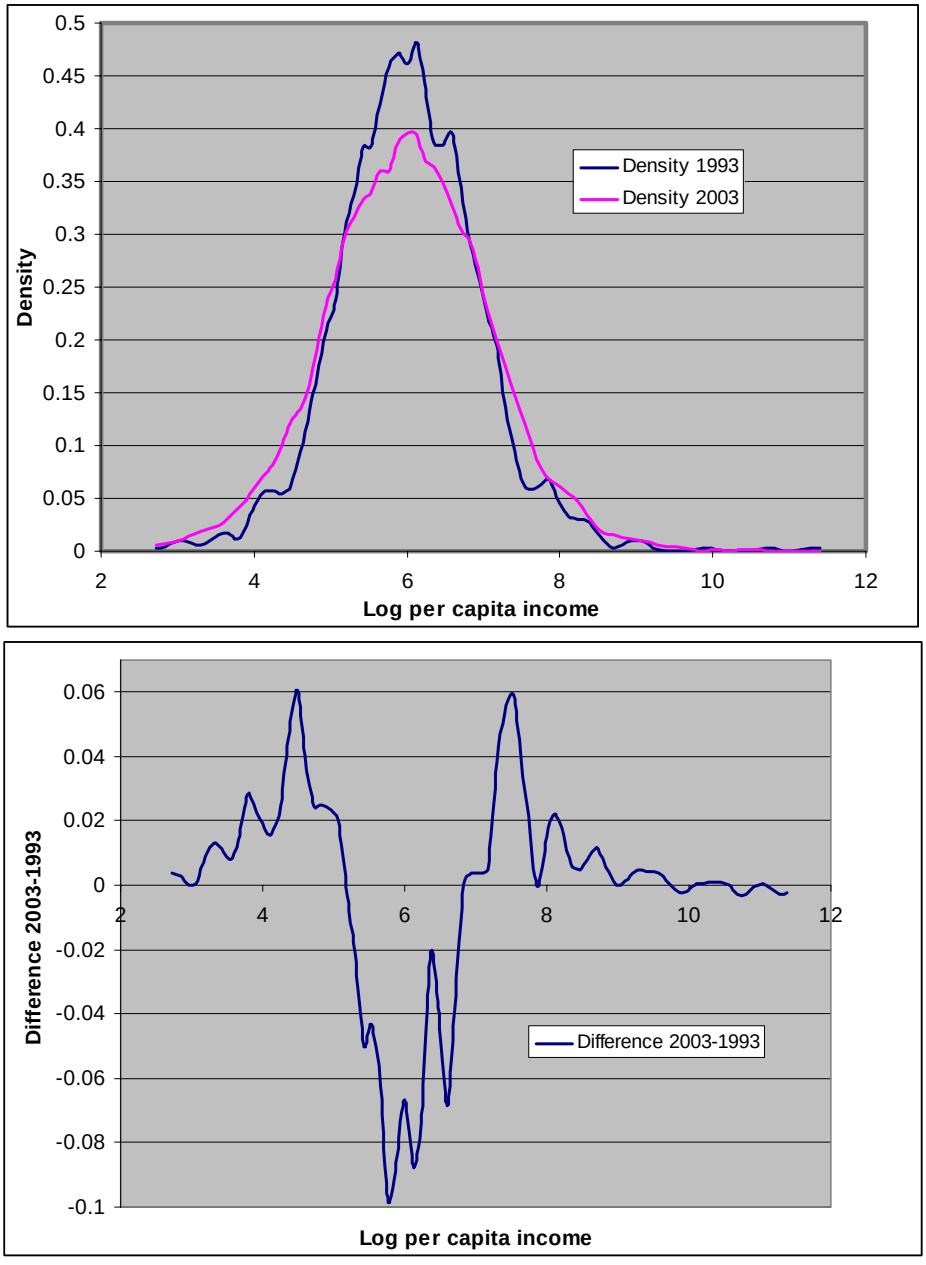
The economic crisis in the rural sector and is occurring at a time when adjustments are expected in comparative advantage of agricultural and other enterprises, as Honduras has committed itself to a continuation of the process of market liberalization as a part of CAFTA.[1] Sensitive commodity imports include food staples that are important for the typical Honduran diet (primarily maize, beans and rice but also dairy products and sugar), all of which are produced to a substantial extent by small farmers. Free trade of these staples could bring positive welfare effects for the poor who are net purchasers of such goods and create opportunities for growth. For others, accelerating the long deteriorating time trend of terms of trade for agriculture will critically affect the cash value of the production surplus.

As a result of slow and highly volatile economic growth in Honduras, poverty rates have remained stubbornly high and the absolute number of poor people keeps on rising. Official poverty estimates are 66% at the national level and 75% in rural areas (SAG, 2004). Tejo (2000) estimates rural poverty at 82% based on ECLAC data for 1999 (ECLAC, 2003), with about three-quarters of rural households living in extreme poverty. Estimates of rural poverty by the National Statistical Institute (INE) based on the 2001 Population Census (INE, 2002) are closer to the higher estimates by ECLAC: According to the recent poverty map at the municipal level (INE, 2003), two out of every three people in Honduras are poor (per capita income < US$ 1.50/day) and three out of every four poor people are extremely poor (per capita income < US$ 1.00/day). In all cases, regardless of the definition of poverty and the data used, there is no doubt

[1] Honduras started negotiations for CAFTA in January 2003 and reached an agreement in December 2003. CAFTA was signed on May 28 2004 and ratified by the Honduras Congress on March 3, 2005.

that poverty in Honduras is highly correlated with living in a rural area: most of the poor are found in rural areas and much of the rural population is poor.

Figure 1. Changes in income distribution in rural Honduras, 1993-2003



***Source**: Based on data from the Permanent Household Surveys 1993 & 2003, National Statistics Institute (INE), Honduras*

Nationally, 59% of all poor households and 65% of the extremely poor live in rural areas. As might be expected, food insecurity is also most pervasive in rural areas (GoH/WFP, 2003).

Rural poverty is particularly deep in the hillside areas: Jansen et al. (2006) estimate that more than 90% of the population located in hillside areas live on less than US$ 1.00/day/capita. In contrast to the concentration of poverty in hillside areas, most areas with lower poverty incidence are located in the "T of development" (Box 2), large parts of which are classified as urban area.

Box 2. The "T of Development" in Honduras

The so-called "T of Development" in Honduras comprises 55 counties located along the fertile north coast and the central corridor area, connecting the capital city of Tegucigalpa in the south and San Pedro Sula, the industrial center of the country in the north. These are also the counties with the highest human development index (HDI) values. The HDI as calculated by UNDP (1998) for each *municipio* (equivalent to county) in Honduras is based on a composite of separate indices for income, health and education. Most counties that make up the "T of Development" are located in the valleys and/or close to urban areas. Hillside areas are by-and-large excluded from the T of development.

Throughout Latin America, rural households that diversify their economic activities into occupations outside the agricultural sector tend to earn higher incomes than those who rely exclusively on primary agricultural production. However, a salient characteristic of rural Honduras is the relative lack of non-agricultural activities (and corresponding employment opportunities) compared to other Central American countries. In 1997 such activities accounted for 22% of total rural income on average, compared to 60% in Costa Rica, 42% in Nicaragua, and 38% in El Salvador (Reardon et al., 2001). Non-agricultural rural activities are most common in areas located near the industrial corridor in the north of the country and near the capital city of Tegucigalpa (largely coinciding with the rural parts of the "T of Development").

Agricultural sector policy reforms were also implemented in the 1990s, notably a much-reduced role of government, including drastic reductions in public sector institutions such as state extension services. In addition, after more than three decades of heavy government intervention in support of land distribution and rural credit provision, a number of land market liberalization initiatives were introduced while rural interest rates were liberalized in an effort to stimulate commercial bank lending. Also, direct support measures such as consumer subsidies on staple foods (which had a regressive effect since they mostly benefited better-off urban

dwellers) and guaranteed producer prices were gradually abolished, culminating in the elimination of the former Institute of Agricultural Marketing. For a short period of time, agricultural credit was subsidized, but classic problems such as poor targeting, high default rates, and the lack of sustainable financial institutions led to the abolishment of these programs. Distortions in the markets of traditional export commodities (e.g. taxes on coffee and banana exports) were (partially) corrected, while the focus on agricultural policies shifted from a focus on food security (i.e., basic grains crops) and traditional exports to the production of high-value non-traditional export crops.

It was expected that the economic reform process would increase the competitiveness of the agricultural sector *vis-à-vis* the non-agricultural sectors, leading to higher incomes and decreases in rural poverty. But this has not been the case. Growth in the agricultural sector lagged behind other sectors in the 1990s (Table 1) and prices for most agricultural products declined, along with agricultural incomes and wages. The intersectoral terms of trade of the agricultural sector relative to the non-agricultural sectors have decreased substantially over the past two decades (Figure 2).

Table 1. Shares in GDP and growth rate by economic sector in Honduras, 1983-2003

	GDP % shares			Annual % Growth Rates	
	1983	**1993**	**2003**	**1983-1993**	**1993-2003**
Agriculture	21.2	20.6	13.5	3.8	2.2
Industry	25.3	30.1	30.7	3.9	3.2
Services	53.5	49.3	55.8	3.4	3.6

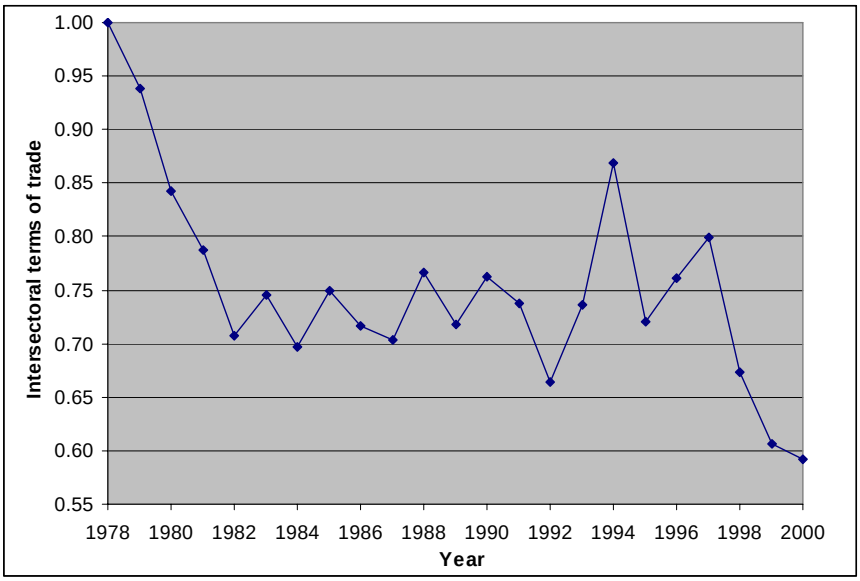
***Source**: www.worldbank.org/data/countrydata/aag/hnd_aag.pdf*

Within the agricultural sector virtually all sub-sectors have lost a substantial part of their purchasing power. Small farmers, whose often already poor livelihoods rely to a substantial extent on basic grains[2] production, were particularly hard-hit, losing about one-third of their purchasing power over the past twenty-some years (Jansen et al., 2002). Nevertheless and in

[2] Throughout Central America, the term "basic grains" (*granos básicos*) refers mainly to maize and beans but also includes sorghum and rice.

spite of low market values for basic grains, many small farmers' primary goal (particularly in the hillsides) is still to produce food.

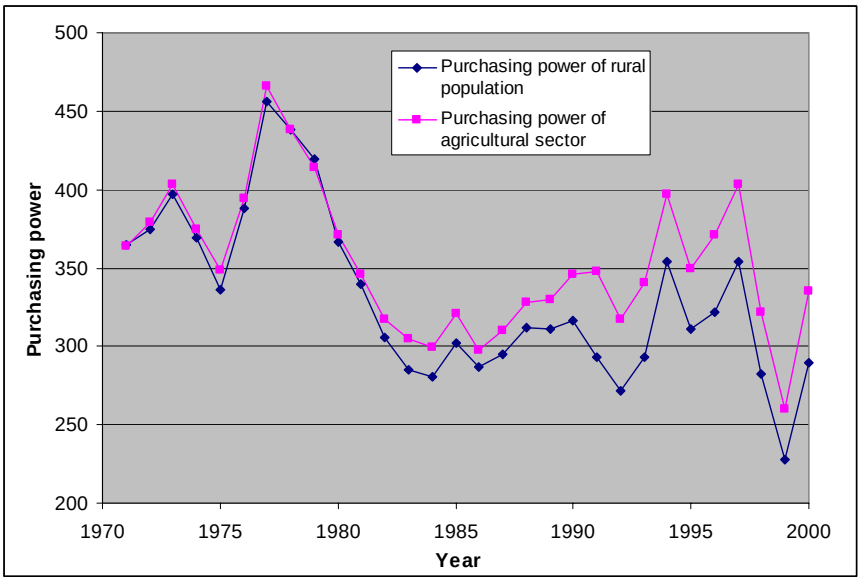
Figure 2. Terms of trade of the Honduran agricultural sector, 1978-2000



***Source**: Based on data in Table A11 in Cotty et al. (2001).*

The decreasing terms of trade for the agricultural sector as a whole and the loss in purchasing power of virtually all sub-sectors have had a strong negative impact on the welfare of the rural population in general and almost certainly have contributed to the increase in the absolute number of rural poor. Figure 3 shows the time trends regarding real purchasing power of the rural population, in Lempiras (Lps) per person per year using the consumer price index as the deflator. Figure 3 also displays the trend in purchasing power of the agricultural sector, again in Lps per person per year but this time using the price index for non-agricultural goods as the deflator. Both trends closely follow each other, showing a rise in the mid-1970s, a collapse in the late 1970s and early 1980s, slow recovery during the late 1980s and early 1990s, and another collapse in the late 1990s. It thus seems that the following conclusion of Barham et al. (2002) is indeed confirmed: "…..the liberalized agrarian economy of Honduras shows little sign of operating in the pro-poor fashion that some have hypothesized."

Figure 3. Purchasing power of the rural population and the agricultural sector in Honduras, 1971-2000 (Lempiras of 1978/capita/year)



***Source**: based on data in Table A15 in Cotty et al. (2001)*

III. Conceptual framework: The asset-base approach

Our conceptual framework is anchored to an *asset-base approach* (Siegel, 2005). The asset-base framework includes the following components: *assets* (productive, social, location-specific), the *context* (policies, institutions and risks), household behavior (*livelihood strategies*), and *outcomes* (measures of household well-being). Household and community decisions determine outcomes such as household well-being, environmental preservation, and community prosperity. The welfare-generating potential of assets depends on the asset-context interface. Policy reforms and building of assets need to be considered in tandem.

A household's **assets** consist of the stock of resources used to generate well-being (Moser 1998, Siegel and Alwang 1999, Rakodi 1999). Assets span human capital including age, education and training, and family structure; natural capital (e.g. climate, land, soil water deficits, soil fertility); physical capital (equipment, livestock); financial assets (transfers, credit, savings); location-specific factors such as access to infrastructure and public services; and social

capital measured by the household's participation in various types of organizations. In the asset-base framework, the poor are "asset-poor," with limited or low-productivity assets.

Certain assets are effective only if combined with others; *asset complementarity* matters. For example, access to land has different implications for well-being depending on its location relative to markets and other infrastructure, on access to credit and inputs, and on education of the land owner. Education may have markedly different implications for welfare generation depending on location and the functioning of labor markets and related institutions. Other important determinants of asset productivity include regulatory and legal systems, which determine the security and transferability of assets, and the existence of means of exclusion. These factors are part of the context.

The **context** in which households operate helps determine the welfare-generating potential of assets and prospects for improved well-being. The political, legal, and regulatory contexts affect how assets are managed and whether successful livelihood strategies can be undertaken (Zezza and Llambi, 2002).

Household management of its asset portfolio constitutes its **behavior** or **livelihood strategy**. Livelihood strategies refer to the way households use their assets such as land and labor allocations, investments in education, migration, and participation in social capital building. Livelihood strategies include a range of on- and off-farm agricultural and non-agricultural activities (Berdegué et al. 2001, Corral and Reardon 2001). Asset accumulation and livelihood strategies are important drivers of sustained improvements in well-being.

We are concerned with **outcomes** that reflect household well-being and prospects for growth over time. The asset-base conceptual framework leads us to consider a variety of measures of household well-being and to use quantitative and qualitative analyses. In addition to income and consumption, poor rural households are concerned about food security, health status, vulnerability in general, empowerment and self-esteem, participation in community affairs, environmental quality, and hopefulness toward the future (Narayan et al., 2000).

IV. Methods and data

Implementation of the asset-base approach requires multiple analytical techniques and data sets (Table 2). Each technique helps inform the others so that the analysis is fully integrated into the spirit of the asset-base approach. We begin by examining the spatial distribution of assets and economic potential. This spatial analysis provides a broad view of rural heterogeneity in Honduras, identifies areas where assets might be conducive to broad-based growth, and identifies potential conflicts between growth and poverty-reduction objectives in rural areas. We use geo-referenced data and GIS overlays to identify which areas are likely to be amenable to growth-oriented interventions and whether the poor are likely to benefit from such investments. The spatial distribution of poverty provides information on historical impacts of regional interventions on poverty reduction and provides guidance for targeting future investments and programs.

Table 2. Description of techniques and data used, by study component

Study Component	Data used
Spatial analysis	*Sistema Nacional de Información Territorial* (SINIT) and *InfoAgro*, the Ministry of Agriculture's GIS unit. Supplemented with the 1988 and 2001 population censuses, and maps from the World Food Program's vulnerability assessment (GoH/WFP 2003).
Quantitative household analysis	Two sub-national surveys: (i) conducted in 2000-01 for a land tenure and rural finance study of the University of Wisconsin, in both hillside areas and valleys; (ii) carried out in 2001-02 by the International Food Policy Research Institute in cooperation with Wageningen University and PRONADERS (National Program for Sustainable Rural Development), in hillside areas only. Together they cover parts of 12 provinces, 42 counties, 206 villages and contain observations on 1,225 households (Jansen et al. 2005).
Qualitative analysis	The IFPRI household survey was accompanied by qualitative diagnostic surveys in the same 95 communities, using local NGOs supervised by staff from PRONADERS. They involved the characterization and diagnosis of problems, limitations, and opportunities resulting in community profiles (Jansen et al. 2003). Stocktakings for the following World Bank projects: Honduras Rural Land Management project; Project Access to Land (PACTA); and Biodiversity and Priority Areas Project (PROBAP).

The quantitative analysis builds on the spatial analysis by addressing the issue of how household livelihood strategies and levels of well-being are determined within these heterogeneous rural areas. It begins by regressing household livelihood strategies on basic assets

controlled by the household (see table 3 for a list of the variables included). These assets encompass the broad classes identified and discussed above (human, natural, physical, financial, locational and social capital). Subsequently we model the measure of household well-being as dependent on livelihood strategies and assets. The basic model is:

1) $L_j = f(X_j, Y_j, Z_j)$

2) $\ln W_j = f(X_j, Z_j, L_j^*)$

where L_j represents the livelihood strategy pursued by household j, W_j the welfare measure for household j, and X, Y and Z are vectors of household-specific and location assets. The Z-vector contains, in some cases, regional dummy variables, and census segment-level, community-level or *municipio* (county)-level means of variables (such as participation in social capital-building activities, and population density and change). The function f (.) is a generic functional form and we use single equation estimators appropriate to the nature of each dependent variable. We use a multinomial logit model to estimate equation 1 since L_j is a polychotomous choice variable. We use a linear form to estimate equation 2 with OLS.

Equations 1 and 2 represent a simple model of livelihood strategy choice and production of household well-being or income. The idea is that a household's livelihood strategy is shaped by its asset portfolio and that more and better assets produce higher levels of household well-being. Assets that are especially significant or have an especially powerful effect may be targets for strengthening interventions.

Issues of exogeneity and causality are difficult to sort out in regressions of the sort of equations 1 and 2. The problem is one of theory and inference and is particularly relevant for equation 2: we wish to know, for example, if an increase in education of the household head will lead to higher household well-being, all other assets held constant. If education level and well-being are endogenously determined, if the model is missing household-specific variables affecting both education and well-being, or if errors in measurement of education levels are

Table 3. Description of variables used in analysis of household livelihood strategies and well-being

Dependent variables	Variable names	Variable description
Natural assets	natass1-5	1) Average altitude of farmer's plots (in feet); 2) Annual rainfall in mm (Wisconsin households); 3) Natural log of summer rainfall in mm; 4) Water deficit for maize during October-January in mm (IFPRI households); 5) Natural log of soil fertility (IFPRI households, see Jansen et al. 2005 for details)
	land	Quantity of land (manzanas (mz), 1 mz = 0.7 ha))
	ownland	Quantity of land owned (manzanas)
	landtitle	Quantity of land titled (manzanas)
Human assets	mhh	(=1 if male-headed)
	hsize	Number of household members
	deprat	Dependency (household members < 12 or > 70 yrs)/(members between 12 and 70 yrs)
	ed	Median years of schooling of household members > 7 yrs
	age	Natural log of head's age (years)
	migrant	IFPRI households: average % of time that an adult lives and works outside the household. Wisconsin households: Total number of man-months spent outside the household by household members
	femadult	% of females (>12) in household
	training	(=1 if HH has received agricultural training)
	techass	(=1 if HH has received extension visits)
Physical assets	busassets	Value of machinery, equipment and transportation (Lempiras[1], L.)
	livestock	Value of livestock (L.)
Location assets (all variables defined at local level)	distance	Natural log of market access (index of travel time to nearest market)--IFPRI households; distance to daily market, km--Wisconsin households
	popdens	Natural log of population density at community level
	road	Road density at community level (= km of roads/km^2, IFPRI households)
	capdist	Distance between community and county capital or capital of another county (if closer), in km; Wisconsin households only
Social capital	socap	Various dummy variables representing household participation in community, agricultural, savings and loan, and other organizations.
Financial capital	credit	Dummy variable (=1 if household has access to any form of credit)
Livelihood strategies		See Table 5
Interaction terms		land*credit; natural log of land*distance; land*ed; ed*distance; ownland*natass5 (IFPRI households only)

[1] One US$ = 16 L.

correlated with the error in equation 1, then problems emerge. The regression parameter will be a biased estimate of the true (theoretical) relationship between education and well-being, and we can not be sure if a policy to improve educational attainment will improve well-being.

This bias is likely to become more important as we investigate variables that are more subject to immediate household choice, such as livelihood strategies. We address this bias in several ways when conducting the analysis and interpreting the coefficients. For example, when we examine the impacts of livelihood choice on household well-being, we use instrumental variables based on equation 1 to purge the effects of the endogenous nature of the choice on our estimates of well-being. We account for endogeneity using a two-stage estimation process. In the first stage we estimate the determinants of the livelihood strategy (equation 1). In the second stage, when examining the impacts of household livelihood strategies on well-being outcomes, we use predicted household livelihood class on the right hand side of the well-being regression (equation 2). The variable L^* in equation 2 indicates that the livelihood choice is endogenously determined by unobserved factors. We also allow interactions between some asset variables (to measure the strength of asset complementarity). We assured proper identification of the system by including Y_j in equation 1 but not in equation 2.

The household analysis is complemented with qualitative studies that provide additional insights into household- and community-level decision making processes. These include participatory analyses of livelihoods and community-level analyses of impacts of recent projects. The qualitative assessments were designed to obtain information about which assets community members thought were most important and how they contribute to improved well-being.

V. Economic geography of rural Honduras

After Guatemala, Honduras is the second largest country in Central America, with a land area of about 112,000 km^2 (figure 4). About 80 percent of the country's land area west of the eastern province of Gracias a Dios consists of hillsides (interior highlands) or hillside areas, with the remaining 20 percent classified as lowland valleys (see box 1 for terminology). Within the interior highlands, numerous flat-floored valleys are mainly used for extensive livestock

operations. Hillside areas are dominated by subsistence agriculture and staple food production and are characterized by small landholdings, low levels of technology, and low productivity.

Figure 4. Map of Honduras

Source: University of Texas map collection

Most hillside areas are not really suitable for intensive agricultural use. The reality is very different, however; despite the absence of a recent land use map, many hillside areas are known to be used for food staple production using unsustainable technologies that have led to increasing degradation of natural resources, particularly soil, forest, and water resources (Kok, 2001; Pender et al., 2001; Jansen et al., 2005).

Average population density in Honduras is relatively low (60 persons/km^2) but given the mountainous nature of the country, the number of people per unit of arable land tends to be much higher. Over half of the population is classified as rural. Rural Honduras is characterized by substantial heterogeneity in economic potential and performance of sub-regions. Part of this

heterogeneity is due to inherent differences in topography and agro-ecological conditions, and part is due to historical decisions to steer public investments toward more favored areas. In general, access to urban markets and services, and non-farm employment opportunities are very limited for most inhabitants of the interior hillside areas.

Of the total of about 4 million rural inhabitants, an estimated 80% lives in the hillside areas. The most densely populated hillside areas include the Western border with Guatemala and the Southwestern border with El Salvador. Population change between the 1988 and 2001 censuses did not follow a uniform spatial pattern. Urban areas grew faster than rural areas, in particular the areas near Tegucigalpa and San Pedro Sula. But population in most hillside areas also increased substantially, by between 1.5 and 4% per year on average during the period 1988 and 2001. On the other hand, some hillside areas with high proportions of landless people experienced much lower population growth or even population decline. Internal temporary migration has also historically been an important livelihood strategy in Honduras, with most migrants leaving rural areas in the southwestern parts of the country where land is of poor quality and the supply of basic services limited.

Coverage of basic social infrastructure (e.g., schools and clinics) and physical infrastructure (e.g., roads, communication, water and sanitation, electrification) in rural areas expanded significantly in the 1990s, some as part of reconstruction efforts in response to damage caused by hurricane Mitch. However, there remain major gaps in the coverage and access by poor households and communities to infrastructure and public services, especially in hillside areas. Public investments have historically been skewed towards the 55 *municipios* that make up the "T of Development," stretching from the capital Tegucigalpa to the industrial center at San Pedro Sula. These municipios have relatively good natural capital, so investments there are based on growth potential. Outside the T, public investments (particularly road networks and other infrastructure) have been concentrated where agro-ecological conditions are favorable for export agriculture such as coffee (concentrated on small and medium-sized farms in the west) and bananas (mostly on large plantations in northern valleys). Most other rural areas, the hillsides in particular, are found outside the T of Development and have been largely bypassed by public investments.

Most major roads follow the valleys between Tegucigalpa and San Pedro Sula. Other major road networks head south out of Tegucigalpa to the Gulf of Fonseca near Choluteca; and eastward through the coffee producing areas near El Paraíso. The road network running parallel to the Guatemala border between San Pedro Sula and Santa Rosa de Copán serves the major coffee producing area in the country. A major road running parallel the Caribbean Sea serves the north coast, which contains significant agricultural potential. But many rural communities are isolated from major (primary and secondary) roads and/or are isolated during the rainy season when roads are impassable, especially in the hillside areas where the road network is less well developed than in the valleys. In general terms the eastern half of Honduras has very low road densities while the western half has higher densities. This result mirrors the distribution of population and shows a constraint to growth in the east due to lack of infrastructure; for example, there are no major highways in Gracias a Dios.

While about 70% of the rural population is covered by water and sanitation infrastructure, access and services are not always available. Electricity coverage in rural areas is only 20%, as opposed to 85% in urban areas (GoH, 2004). The lack of social and physical infrastructure has clear implications for the productivity and competitiveness of agricultural and non-agricultural activities in Honduras, and limits opportunities for poverty-reducing growth.

VI. Key findings from quantitative and qualitative analyses

Unlike other Central American countries, no nationally representative household survey is available for Honduras. Therefore, the household-level analyses presented in this paper are based on data from two sub-national surveys that collected similar (though not 100% identical) information and are largely complementary in terms of their geographical coverage (see Table 2). Together these surveys cover parts of 12 (out of 18) provinces (*departamentos*), 42 (out of 298) counties (*municipios*), 206 villages (*aldeas*) and 400 hamlets (*caserios*). The total number of households (*hogares*) for the combined surveys is 1,225. Both household surveys were supplemented by adding secondary, mostly geo-referenced information that included (but was not limited to) rainfall, altitude, population density, and road density from various sources.

The first step in our household-level analysis is to categorize the livelihood strategies and understand how household well-being is related to each strategy. Livelihood strategies can be identified and characterized in a number of ways, but we begin by examining the main source of employment for all household members (table 4). Households depending on agricultural activities are worse off than others; poverty rates are higher and mean levels of well-being are lower. Figure 5 shows the full distribution of well-being by household employment class. The distributions for the agricultural-based strategy are shifted to the left of the other strategies, consistent with higher poverty among such households shown in table 4. The non-agricultural employment strategies have lower densities of well-being at the very low end of the distribution, far to the right of the poverty line. They also have a more pronounced rightward skew with much higher densities above the poverty line. However, the nature of the difference is not dramatic: while some non-agricultural employment tends to have higher returns than agricultural employment, many non-agricultural occupations of the rural poor in the Honduran hillsides have relatively low returns (e.g., domestic services; see Ruben and van den Berg 2001).

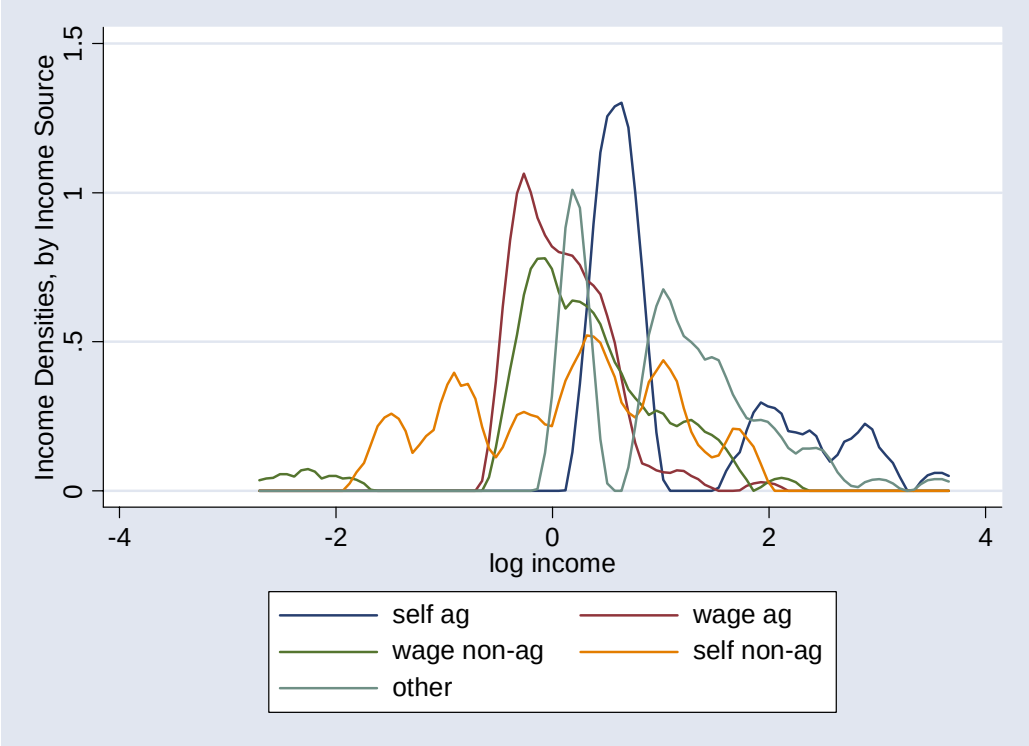
Table 4. Indicators of rural well-being by main source of employment

Main source of employment	Percent obs.	Percent poor	Percent extremely poor
Agriculture, self employed	36.9	87.7	80.6
Agriculture, wage employed	18.8	98.2	96.9
Non-agriculture, wage employed	9.6	85.3	75.7
Non-agriculture, self employed	3.5	74.7	62.8
Transfers, other	31.2	88.9	82.6

For our final classifications of households, we conducted factor and cluster analyses[3] of households to group them into distinct livelihood strategy categories. The identification of livelihood strategy categories is followed by the estimation of an appropriate version of equation 1 (using multinomial logit models), followed by estimation of equation 2.

[3] We used a combination of hierarchical cluster and k-means cluster analyses to create livelihood clusters. The hierarchical cluster analysis, used in the first step, efficiently grouped households together. However, hierarchical clustering can give rise to misclassification of observations at the boundaries between clusters and the k-means analysis, which is iterative, eliminates these problems (Wishart, 1999). The IFPRI households were clustered on the basis of time allocation and land use patterns, and the Wisconsin households on the basis of similar land use patterns and income shares.

Figure 5. Well-being density by major source of employment strategy, rural Honduras



Note: kernel density estimates using the Epanechnikov kernel.

Finally, the IFPRI household survey was accompanied by qualitative diagnostic surveys at the community level in the same 95 communities where the household survey was conducted between May 2001 and March 2002 with the help of local non-governmental organizations (NGOs) with long-term experience in the area. The community-based livelihood studies complement the household surveys and involved the characterization and diagnosis of problems, limitations and opportunities resulting in community profiles. Although highly participatory and informal, structured methods were used in close cooperation with a carefully selected representative group of community stakeholders of about 20 persons in each community. Key elements in each diagnostic included the history of the community, the agricultural production

systems, management of natural resources, access to infrastructure, public facilities and services.[4]

Identification of key livelihood strategies and household groups

The IFPRI households were grouped into seven clusters, each representing a separate livelihood strategy (Table 5). Livelihood strategies in hillside areas mostly revolve around agricultural and small-livestock activities, with relatively few households engaging in higher-return activities such as production of vegetables or non-farm activities. Over one-half of households pursue a livelihood strategy that centers on basic grains production (livelihood clusters #1 and #2), whereas households in other livelihoods groups also tend to produce basic grains. Livestock is also an important livelihood strategy (clusters #1 and #5), and to a lesser degree coffee production (and employment in coffee plantations). Perhaps surprisingly and certainly shockingly, none of the livelihood strategies followed by the IFPRI households in the hillside areas was able to generate an average annual income above the extreme poverty line of US$ 365/capita (US$ 1.00/person/day), let alone above the poverty line of US$ 550/capita annual income (figure 6). Differences in outcome variables can be regarded as the result of differences in asset endowments that, in turn, are causal factors for differences in livelihood strategies represented by the clusters.

The Wisconsin households were clustered into six livelihood strategies (Table 5). About one-quarter of households pursued a diversified livelihood strategy and nearly 30 percent are coffee producers. Basic grain production and livestock production are also important livelihood strategies. In contrast to the IFPRI livelihood strategy group clusters, the Wisconsin sample includes households whose livelihood strategies are dominated by a business or receipt of remittances. In general terms, the Wisconsin households are considerably less poor than the IFPRI households (Figure 7), mainly due to better asset endowments. However, also in the Wisconsin sample there are distinct differences according to livelihood strategies.

[4] Examples of specific information sought include major occupations of the community's inhabitants, dominant land use types, land tenure arrangements; perceptions regarding natural resource degradation, market access, health and education; forms of community-based organization and collective action, and influence of external projects and programs. For details and an econometric analysis of the community-level information, see Jansen et al. (2003).

Figure 6. Annual per capita income in US$, by livelihood strategy (IFPRI households)

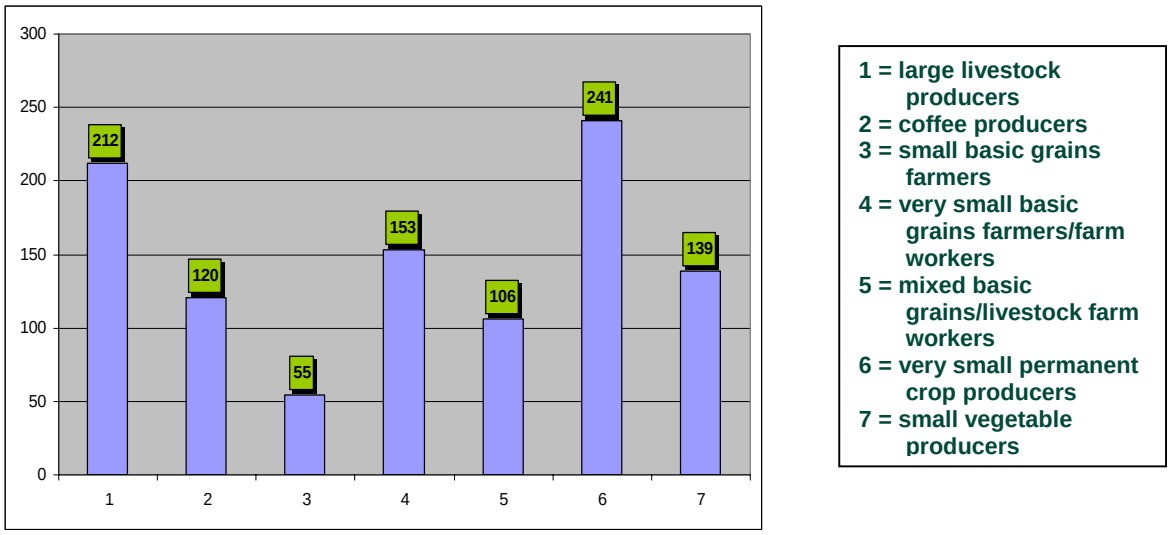


Figure 7. Annual per capita income in US$, by livelihood strategy (Wisconsin households)

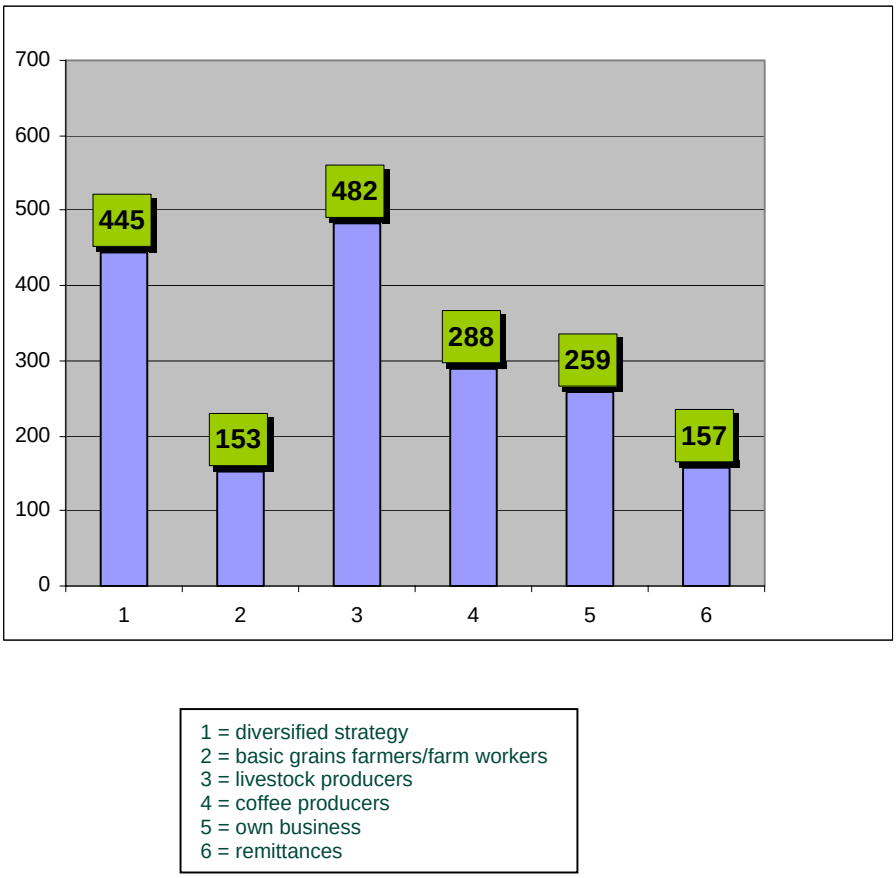


Table 5. Description of livelihood strategies

Livelihood strategy (LS)	LS1	LS2	LS3	LS4	LS5	LS6	LS7
IFPRI household sample	*Livestock producers*	*Coffee producers*	*Basic grains*	*Basic grains & farm workers*	*Mixed basic grains, livestock & off-farm work*	*Tree producers*	*Vegetable producers*
Description	Extensive livestock farming on larger holdings located at lower altitudes (average 32 ha). Highest income cluster in sample.	Relatively small holdings (average 3.5 ha), located at higher altitudes. Low incomes due to coffee crisis.	The poorest farmers among all livelihood groups. Mostly basic grains production. Small farms (average 2 ha), located at high elevations with steep slopes, geographically isolated, with limited off-farm opportunities.	Smallest landholdings (< 2 ha). Subsistence farmers earning higher incomes than cluster 3 by working outside the own farm (mostly in agriculture).	Subsistence farmers with larger land holdings (average farm size > 10 ha). Hire labor and devote more time to livestock. Work outside own farm.	Small holdings, produce fruits, oil palm etc. Located in more favorable agro-ecological areas with high population densities and good access to paved roads. But still very poor.	Most labor devoted to working on own farms. Surprisingly poor.
% of sample	15.6	7.4	18.1	22.6	30.9	3.2	2.1
Wisconsin household sample	*Diversifiers*	*Basic grains & farm workers*	*Livestock*	*Coffee*	*Own business*	*Remittances*	
	Larger farms (average 43 ha), diversified farm operations, off-farm work in agricultural and nonagricultural occupations. Less poor.	Subsistence farmers very similar to livelihood 4 in the IFPRI sample. Very poor.	Medium-size cattle farms (average 25 ha). Little off-farm work but less poor.	Similar to livelihood 2 of the IFPRI sample but larger farms (average 12 ha) resulting in somewhat higher incomes.	Own business generates most income, despite relatively large farms (average 38 ha). But still very poor.	Live on remittances, despite average land holdings of 12 ha. Household head is often female. Little off-farm work. Poorest households in the Wisconsin sample.	
% of sample	13.5	26.1	11.5	28.4	6.8	10.7	

Determinants of livelihood strategies

The results of the multinomial model estimation (equation 1) are shown in tables 6 and 7. Together the explanatory variables reflect the main elements of the household asset portfolio. The model results generally support our use of an asset-base approach as the fit was relatively good and the results are plausible. The variables included in each model were chosen based on availability within the data set, model misspecification tests, and consistency with the asset-base framework[5].

Better-educated families are more likely to depend on remittances (table 7). In the IFPRI sample, which mainly included agricultural producers, education does not have a strong impact on choice of one agricultural-based livelihood strategy over another (table 6). The diversified basic grains/livestock/farm worker strategy is more common among households who own more land, are male headed but have more female adults, have more migrants, and where the head is older. This livelihood strategy appears to represent one destination in a household's life cycle; as households become more mature, they seek and are able to diversify into off-farm activities as well as livestock. Hillside households with migrating members find it easier to diversify away from basic grains towards more remunerative livelihood strategies based on livestock, coffee or off-farm work.

Among agricultural households, land ownership increases the likelihood of a diversified livelihood strategy (LS 5 in table 6) while making the low profitability basic grains-based livelihood less likely (table 7). Access to titled land has a similar effect, increasing the probability of coffee growing in the hillsides (table 6) while also making diversification and livestock growing more likely (table 7).

Natural capital has less impact on choice of livelihoods than expected *a-priori*: elevation stimulates coffee-based livelihoods while fewer problems with water are associated with more off-farm work and less dependence on basic grains (Table 6).

[5] Several variants of each equation were examined, including instrumental variable estimates for the "endogenous" variables—education, access to infrastructure, and participation in social capital, quantile regressions, addition of cluster-level variables, etc. The models were subjected to misspecification tests. Reported results are robust to alternative specifications.

Several location-specific assets, including access to technical assistance and distance to key facilities affect livelihood choices. The results from the Wisconsin household sample suggest that higher population densities can stimulate households to pursue market production and move away from less remunerative livelihood strategies based on basic grains production for food security. Market access and access to credit are important for a coffee-based livelihood strategy even though the latter may reflect reverse causality (coffee producers have easier credit access).

Finally, social capital is an important determinant of livelihood strategy choice. Households that are member of a financial organization are more likely to pursue a livelihood based on economic activities outside agriculture (LS 5 in table 7) while most community organizations seem to be stimulating agriculture-based livelihood strategies (table 6). Not surprisingly, livestock ownership is important in livestock-based livelihoods while coffee growers have more physical capital.

Table 6. Multinomial logit model, IFPRI households (livelihood strategy #3 is comparison group)

Cluster	1 Livestock producers			2 Coffee producers			4 Basic grains /farm workers			5 Mixed basic grains/livestock/ off-farm work		
No of HH	**58**			**28**			**85**			**116**		
Explanatory variables	**Estimate**	**Std. error**	**p-value**	**Estimate**	**Std. error**	**p-value**	**Estimate**	**Std. error**	**p-value**	**Estimate**	**Std. error**	**p-value**
intercept	-0.644	2.534	0.799	1.300	2.916	0.656	2.946	1.729	0.088	-3.119	1.795	0.082
deprat	-0.194	0.379	-0.609	-0.677	0.498	0.174	-0.344	0.288	0.232	-0.045	0.269	0.867
hsize	-0.007	0.107	0.944	-0.134	0.135	0.322	0.012	0.083	0.883	-0.403	0.082	0.623
mhh	0.451	0.972	0.642	2.215	1.439	0.124	0.160	0.685	0.816	**2.369**	**0.929**	0.011
femadults	-2.523	1.832	0.169	0.534	1.200	0.789	**-3.347**	1.472	0.023	0.820	1.478	0.579
age	0.009	0.0183	0.642	0.013	0.021	0.525	-0.010	0.014	0.482	**0.029**	**0.014**	0.033
ed1	-0.194	0.154	0.210	-0.226	0.173	0.193	-0.113	0.123	0.357	-0.020	0.119	0.867
migrant	**6.505**	3.084	0.035	**6.760**	3.165	0.033	**6.551**	3.086	0.034	**5.160**	**2.993**	0.085
ownland	0.145	0.092	0.113	0.052	0.113	0.642	-0.162	0.148	0.272	**0.156**	**0.091**	0.086
landtitle	0.846	0.917	0.356	**2.067**	1.004	0.039	0.628	0.927	0.498	0.375	0.803	0.640
natass1	0.001	0.001	0.173	**0.003**	0.001	0.001	0.000	0.001	0.626	**0.002**	**0.001**	0.000
natass3	0.000	0.001	0.910	**-0.004**	0.002	0.068	-0.001	0.001	0.288	0.001	0.001	0.347
natass4	-0.004	0.006	0.515	-0.068	0.067	0.307	**-0.008**	0.004	0.071	-0.007	0.005	0.124
natass5	0.000	0.0004	0.997	-0.000	0.000	0.335	0.000	0.000	0.853	-0.000	0.000	0.817
popdens	-0.002	0.005	0.651	-0.010	0.007	0.135	-0.002	0.003	0.509	-0.006	0.004	0.102
distance	0.059	0.054	0.275	0.042	0.081	0.604	0.040	0.048	0.400	0.050	0.050	0.308
roads	-0.245	0.217	0.260	0.093	0.229	0.684	0.039	0.153	0.797	-0.215	0.153	0.161
busassets	**-0.00006**	0.00003	0.048	-0.000	0.000	0.690	**-0.001**	0.000	0.002	**-0.00003**	**0.00002**	0.080
livestock	**0.00009**	0.00002	0.000	-0.000	0.000	0.922	-0.000	0.000	0.502	**0.00004**	**0.00002**	0.047
credit	0.447	0.601	0.457	-0.285	0.671	0.671	0.477	0.446	0.285	0.624	0.446	0.162
training	-0.171	0.658	0.795	0.385	0.673	0.568	-0.821	0.520	0.114	-0.113	0.470	0.809
techass	0.124	1.015	0.903	-0.377	1.130	0.739	1.320	0.836	0.114	0.165	0.788	0.834
socap1	**3.031**	1.277	0.018	2.221	1.371	0.105	**2.143**	1.249	0.086	**1.963**	**1.125**	0.081
socap2	-0.701	0.611	0.251	0.241	0.748	0.748	-0.209	0.477	0.662	-0.394	0.496	0.427
socap3	**-2.700**	1.336	0.043	-1.358	0.957	0.156	**-1.994**	0.772	0.001	**-1.837**	**0.707**	0.009
socap4	0.800	0.786	0.309	0.857	0.910	0.347	**1.179**	1.729	0.026	0.790	0.537	0.141
Diagnostics of Fit	**Mean predicted probability**	**Actual Proportion**	**% Difference**	**Mean predicted probability**	**Actual Proportion**	**% Difference**	**Mean predicted probability**	**Actual Proportion**	**% Difference**	**Mean predicted probability**	**Actual Proportion**	**% Difference**
	0.159	0.165	4.4	0.097	0.078	19.6	0.217	0.238	9.7	0.343	0.325	5.2

Table 7. Multinomial Logit model, Wisconsin households (livelihood strategy #2 is comparison group)

Cluster	1 Diversified producers			3 Livestock producers			4 Coffee producers			5 Own business			6 Remittances		
No of HH	**222**			**98**			**242**			**58**			**91**		
Explanatory variables	**Estimate**	**Std. error**	**p-value**	**Estimate**	**Std. error**	**p-value**	**Estimate**	**Std. error**	**p-value**	**Estimate**	**Std. error**	**p-value**	**Estimate**	**Std. error**	**p-value**
intercept	-3.659	1.946	0.060	-5.798	2.283	0.011	-3.782	1.866	0.043	-3.823	2.604	0.142	-7.064	2.286	0.002
deprat	-0.089	0.349	0.799	-0.014	0.411	0.972	0.101	0.335	0.763	-0.049	0.533	0.927	0.187	0.375	0.617
hsize	0.034	0.055	0.539	-0.063	0.064	0.322	-0.065	0.055	0.235	0.053	0.075	0.477	0.018	0.064	0.773
mhh	-0.432	0.518	0.404	0.076	0.644	0.906	-0.056	0.529	0.916	-0.332	0.724	0.646	**-1.438**	0.543	0.008
femadults	-0.011	0.015	0.483	0.011	0.017	0.534	-0.001	0.015	0.938	-0.010	0.021	0.644	-0.019	0.017	0.275
age	0.014	0.014	0.286	0.019	0.015	0.207	**0.029**	0.013	0.027	-0.000	0.019	0.984	**0.038**	0.015	0.014
ed1	-0.037	0.103	0.719	-0.086	0.115	0.451	0.138	0.100	0.167	0.169	0.127	0.185	**0.258**	0.113	0.022
migrant	-0.026	0.027	0.333	-0.013	0.324	0.685	0.014	0.024	0.568	0.012	0.030	0.692	**-0.132**	0.054	0.014
land	**0.422**	0.081	0.000	**0.421**	0.081	0.000	**0.390**	0.081	0.000	**0.420**	0.081	0.000	**0.387**	0.081	0.000
landtitle	**1.170**	0.503	0.020	**1.887**	0.542	0.001	0.477	0.504	0.344	0.835	0.617	0.176	**0.971**	0.558	0.082
natass1	0.000	0.001	0.812	0.000	0.001	0.694	0.001	0.001	0.175	-0.001	0.001	0.410	-0.000	0.001	0.831
natass2	0.000	0.001	0.938	-0.000	0.002	0.936	0.002	0.002	0.189	0.000	0.002	0.839	-0.001	0.002	0.713
natass3	0.001	0.001	0.217	0.002	0.001	0.120	-0.000	0.000	0.618	0.000	0.001	0.872	0.001	0.001	0.159
popdens	**0.007**	0.003	0.022	**0.011**	0.004	0.002	**0.011**	0.003	0.001	**0.012**	0.005	0.013	0.005	0.004	0.168
distance	-0.003	0.005	0.531	-0.001	0.005	0.797	**-0.014**	0.005	0.003	-0.010	0.010	0.129	-0.007	0.006	0.217
capdist	-0.002	0.008	0.846	-0.003	0.010	0.790	**0.019**	0.008	0.018	0.003	0.013	0.843	0.006	0.010	0.512
roads	-0.103	0.098	0.293	**0.287**	0.136	0.035	**-0.579**	0.114	0.000	**-0.369**	0.177	0.037	-0.118	0.117	0.311
busassets	0.001	0.217	0.997	-0.000	0.218	1.000	0.001	0.217	0.997	0.001	0.217	0.997	0.001	0.217	0.997
livestock	-0.000	0.000	0.122	-0.000	0.000	0.124	**-0.0001**	0.00002	0.022	-0.000	0.000	0.124	-0.000	0.000	0.184
credit	-0.500	0.355	0.159	0.299	0.406	0.462	**0.798**	0.339	0.019	-0.124	0.495	0.801	-0.142	0.417	0.733
socap1	-0.169	0.900	0.851	-0.137	0.932	0.883	0.914	0.862	0.289	0.465	0.968	0.631	0.407	0.954	0.670
socap2	-0.333	0.350	0.342	-0.571	0.412	0.166	-0.479	0.340	0.159	-0.224	0.485	0.644	-0.680	0.425	0.109
socap3	1.362	0.948	0.151	1.040	1.163	0.371	0.130	1.023	0.899	**2.571**	1.069	0.016	1.229	1.078	0.254
socap4	-0.035	0.793	0.965	0.716	0.812	0.378	0.277	0.691	0.688	-0.393	1.221	0.748	**1.538**	0.761	0.043
Diagnostics of Fit	**Mean predicted prob.**	**Actual prop.**	**% Diff.**	**Mean predicted prob.**	**Actual prop.**	**% Diff.**	**Mean predicted prob.**	**Actual prop.**	**% Diff.**	**Mean predicted prob.**	**Actual prop.**	**% Diff.**	**Mean predicted prob.**	**Actual prop.**	**% Diff.**
	0.252	0.269	6.7	0.123	0.119	3.3	0.292	0.293	0.3	0.066	0.070	5.7	0.109	0.110	0.9

Determinants of household well-being

Rural household livelihood strategies can have major impacts on outcomes such as levels of well-being, rates of poverty, and an area's growth potential. In the asset-base framework, livelihood strategies reflect conscious household decisions about allocation of their primary productive resources, mainly labor and land. But, as shown above, the specific strategy adopted by households depends on other assets, including natural, human and social capital, and location specific assets. A major issue is whether the assets themselves cause improved well-being, or it is only through adoption of a livelihood strategy. Livelihoods are closely related to household well-being, but the nature of causality is open to question: do better-off households engage in certain strategies because they are better off, or does the strategy "cause" the household to become better off? To shed light on this question, household income was hypothesized to depend on the household's livelihood strategy and asset portfolio.

To assure proper identification, we excluded from the well-being regression asset-related variables that can reasonably be assumed to affect income only through their influence on livelihood strategies. In addition to the effects on income of individual assets, we investigated a number of interaction effects, in order to identify possible synergies and/or substitution between pairs of assets. These interaction effects included land ownership and credit, farm size and market access, farm size and education, market access and education, and land ownership and soil fertility. The regression results for equation 2 are presented in table 8 and show how livelihood strategies, individual assets as well as asset interactions impact on rural household well-being[6].

Livelihood strategies

After controlling for other assets, the livelihood choice is a relatively limited determinant of household well-being. In the Wisconsin sample, households that are able to follow a livelihood strategy based on extensive livestock farming earn significantly higher incomes, which allow them to rise above the extreme poverty line (but not above the poverty line).

[6] The measure of well-being is total household income defined as the sum of the net value of crop and livestock production (revenues minus costs), off-farm salaried work, own business and transfers. Own production, whether consumed by the household or sold, is included in the calculation of household income.

Table 8: Determinants of well-being (structural model results)

Dependent variable	**Log annual household income per capita**			
	IFPRI households		**Wisconsin households**	
Explanatory variables	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**
intercept	7.449	2.77	7.273	1.69
Livelihood Strategies				
LS 1	0.074	0.13	-0.299	-0.42
LS 2	0.637	1.13		
LS 3			**1.454**	1.94
LS 4	0.263	0.50	-0.240	-0.42
LS 5	0.133	0.31	1.944	1.42
LS 6			-0.182	-0.20
Natass2			0.785	1.50
Natass3	-0.364	-1.33	**-0.617**	-1.86
Natass4	-0.001	-0.91		
Natass5	**0.387**	1.93		
deprat	**-0.181**	-2.17	-0.114	-0.88
hsize	-0.011	-0.45	-0.033	-1.52
ed1	0.045	1.00	**0.181**	3.65
age	-0.159	-0.85	**-0.593**	-2.30
migrant	**0.941**	2.06	0.003	0.27
femadult	-0.453	-1.12	-0.008	-1.57
training	-0.001	-0.01		
techass	0.087	0.43		
busassets	**0.000**	2.38	0.000	0.19
livestock	0.000	0.96	**0.000**	2.77
ownland	-0.002	-0.16	**0.016**	2.91
distance	-0.162	-1.19	**-0.006**	-1.70
road	0.007	0.17	**0.080**	2.23
capdist			0.000	0.03
socap1	-0.063	-0.28	**0.433**	1.93
socap2	-0.007	-0.06	-0.059	-0.45
socap3	**-0.410**	-1.97	0.015	0.04
socap4	-0.002	-0.01	0.213	0.72
ed1*distance	**0.007**	1.91	**0.001**	1.79
ownland*credit	0.002	0.22	**0.008**	2.42
land*distance	0.036	0.51	0.061	0.98
land*ed1	-0.001	-0.62	**-0.002**	-4.36
ownland*soil	0.000	0.78		
N	315		525	
R^2	0.254		0.345	

Human capital

Even though the estimated coefficient of the average level of household members' education is not statistically significant for the poorest agricultural households in the hillsides (most likely due to low variation combined with low average values in the IFPRI sample), the results based on the Wisconsin data suggest an elasticity of household well-being to years of education of around 0.9. Other research suggests that in Honduras every year of additional education increases income by about 10%, with upper secondary education having the highest returns.[7] Acquiring professional skills (agriculture-related or not) allow people to sell their labor at a higher price.

Household dependency has a strong negative impact on well-being with an elasticity of about -.2. Older household heads are associated with lower levels of well-being (elasticity of about -.6). Hillside households (IFPRI sample) whose members spend more time migrating have higher levels of well-being, but the income-migration elasticity is low (< .1).

Physical assets

Soil fertility has a strong and significant impact (elasticity of about .4) on well-being in the hillside areas where most livelihood strategies are agriculture-based. The results for the Wisconsin households suggest an elasticity of well-being to land ownership of about .35.

The interaction between the amount of land owned by the household and access to credit exerts a positive effect on income. This suggests the existence of a synergy effect between owned land and credit, i.e. land ownership (physical capital) and credit (financial capital) are complementary assets. On the other hand, the negative and significant coefficient of the interaction between the amount of land farmed by the household and the average level of formal schooling is suggestive of a substitution effect, i.e. schooling can to some extent compensate for a lack of market access and vice versa.

The impact of land on household well-being depends critically on two factors: its productivity and its location. The amount of non-land physical assets owned by the

[7] Source: Presentation by Guillermo Perry and Felipe Jaramillo at the Third Regional Conference on Central America "Economic Growth and Issues in Bank Resolution" sponsored by The Central American Monetary Council and the International Monetary Fund and hosted by the Central Bank of Honduras on July 8-9, 2004 in San Pedro Sula.

household (machinery, equipment, transportation) has a positive effect on income of hillside households (elasticity around .4), most likely because it increases labor productivity. Livestock is also a significant asset but with low well-being elasticity (around .05).

Location-specific assets

The significant and negative coefficient of the market access variable, together with the positive coefficient for road density in the Wisconsin sample confirm the negative influence of isolation on well-being. The positive interaction effect between the education and market access variables suggests that, in terms of their effect on household well-being, good market access can compensate to some extent for less education.

Social capital

Participation in community organizations has a positive effect on household well-being. The negative and statistically significant coefficient for household participation in financial organizations may reflect the fact that these organizations mostly focus on the poorest (basic grains-dependent) hillside households. The qualitative analysis at the community level confirms the quantitative finding of a positive and significant coefficient for external organizations obtained in a reduced form of the income regression (not reported). Some of these organizations play a key role in promoting sustainable agricultural practices among hillside farmers while others are crucial for making the necessary marketing contacts to enable farmers to switch to more remunerative livelihood strategies.

VII. Summary and conclusions

In this paper we developed and applied an appropriate conceptual and analytical framework to better understand how prospects for growth and poverty reduction can be stimulated in rural Honduras. Anchored in an asset-base approach, our framework uses a combination of economic geography, quantitative household analysis and qualitative methods at the community level to generate a number of key findings with important strategic implications.

Rural areas and households in Honduras are characterized by significant heterogeneity in terms of their endowments of natural and other types of assets. This heterogeneity is particularly stark in hillside areas. Natural assets define agricultural potential and absolute advantage of a given area, and together with socio-economic conditions determine its comparative advantage. Economic potential is thus determined by the interaction between natural assets and other asset types. As a result of this heterogeneity across space and households, economic potential has a strong spatial pattern in Honduras, with most high potential areas located close to the main cities and along the Northern Coast. Public investments in human and physical assets in Honduras have been skewed towards the so-called "T of Development" which comprises 55 counties located along the fertile north coast and the central corridor area, connecting the cities of Tegucigalpa in the south and San Pedro Sula in the north. Outside the "T", public investments (particularly road networks and other infrastructure) have been concentrated where agro-ecological conditions are favorable for export agriculture such as coffee (concentrated on small and medium-sized farms in the west) and bananas (mostly on large plantations in the northern valleys). Most other rural areas have been relatively excluded from public investments. This, together with highly heterogeneous conditions in rural areas, has resulted in poverty being highest and deepest in the hillsides and hillside areas.

Hillsides and hillside areas account for the majority of land area and often have agro-ecological constraints that make them less suitable for agriculture. The rural poor tend to have small and fragmented land plots. Production is often limited to a single rain-fed growing season. The poorest of the rural poor live in isolated areas with poor market access and few roads. These factors constrain potential gains from adopting improved technologies and limit opportunities to diversify agricultural production systems. As a result, many people are locked into strategies based on production of basic grains and small livestock for subsistence needs in areas that are not suited for such strategies. Under these circumstances, achieving sustainable agricultural growth is challenging.

But rural poverty can be high even in areas with relatively favorable biophysical and socio-economic conditions. For example, hillside areas along the Guatemalan and Salvadoran borders in western and southwestern Honduras have relatively good access to infrastructure (e.g., relatively well-developed road infrastructure in coffee producing

areas), favorable bio-physical conditions and good economic potential, but also high rates of poverty. In particular, the Copán area has substantial tourism potential, but despite good locational conditions, measures of well being are lagging far behind potential. Persistent high rates of poverty show that this potential is not being realized -- and the extent to which it is being realized, the poor are not participating. Most hillside households have limited assets on which to base their livelihood strategies. Moreover, high inequalities in asset distribution constrain how the asset-poor can share in the benefits of growth, even under appropriate policy regimes. In the specific example of the counties bordering Guatemala and El Salvador, lack of feeder roads within these mountainous counties increases transaction costs and makes it difficult for poor households to participate in the market economy. Thus, public investments are needed to strengthen the asset bases of the poor before they can benefit from growth-related spillovers.

Based on our analyses in the previous sections of this paper, we offer the following conclusions and policy recommendations:

1. ***Hillsides and hillside areas should be a major target of national rural poverty reduction strategies***

In section 2 we show that most of the poor are found in rural areas and that the vast majority of the rural poor live in areas classified as hillsides or hillside areas. The analysis in section 6 reveals that most rural poor in these areas are also extremely poor. This should make hillsides and hillside areas a natural target of national rural poverty reduction strategies.

2. ***Within the hillsides and hillside areas, public investments should focus on high poverty rate-high poverty density areas since investments there should reach significant proportions of the country's rural poor***

Based on our geographical analysis in section 5, we determined that many hillsides and hillside areas in Honduras show both high rates of poverty and high population densities (leading to high poverty densities). For example, the western areas around Copán, the southern areas in Valle and Choluteca, and the Province of Comayagua have both high poverty rates and high poverty densities. By targeting these areas, significant proportions of the rural poor can be reached. The problem of leakages to the non-poor in

these areas will be minimized because of high poverty rates. The geographic correspondence between high poverty rates and high poverty density means that there is little tradeoff in targeting high poverty areas for poverty-reducing interventions. Since several of these areas have relatively good-quality infrastructure and access to markets, they make good candidates for poverty-reducing investments.[8]

3. Agriculture-based growth should form an integral part of the rural development strategy for hillsides and hillside areas

In section 2 we showed that over the past 25 years, agriculture has not been a strong engine of growth in rural Honduras. In section 6 we found that land and labor productivity are particularly low in the hillsides and hillside areas and that off-farm work (even if it is mostly limited to agriculture-related work) is more remunerative than primary production of basic grains on the own farm. This result points towards the critical importance of income from off-farm work for many households in hillsides and hillside areas that have insufficient land to meet their basic food security needs given their use of traditional production technologies. On the other hand, households with a certain minimum landholding size tend to stay on their farms. The emphasis on food security of most hillside households combined with low land and labor productivity locks these households into a cycle of poverty. Breaking this cycle, freeing up more labor for off-farm work and achieving broad-based agricultural growth require substantial increases in the productivity of both land and labor. The analysis in section 6 suggests that labor productivity can be increased through the provision of physical assets such as agricultural tools and machinery. Land productivity will have to be raised through increased adoption of improved land-saving production technologies. The econometric analysis in section 6 also shows the importance maintaining soil fertility for increasing incomes.

[8] On the other hand, low population densities in the eastern part of the country lead to much lower poverty densities and a tradeoff between poverty rates and poverty densities. Even though these areas were not part of our study, it is likely that because of the high poverty rates in some of these areas, investments need not have a complicated explicit targeting mechanism; leakages to the non-poor are reduced in areas with higher rates of poverty. But because population densities are low, investments in these areas should be spatially targeted to specific population clusters, or the types of investments should be selected based on low per unit costs of delivery over space. For example, investments like health-related services should obviously be targeted to population clusters. Others, such as education should be located to guarantee a reasonable degree of access, even in low population density areas.

4. Public investments in access to land alone have limited impact on household income and therefore should be combined with investments in human and financial capital

Land ownership has a strong direct effect on well-being, and it also increases the likelihood that a household follow a more diversified livelihood strategy that is more remunerative than basic grains farming. We also showed that access to land combined with access to credit has a significant and positive effect on household income; and that households with land titles are more likely to follow more remunerative livelihood strategies that are not basic grains-based and therefore earn higher incomes. Therefore, efforts to facilitate access to land need to include titling programs and be combined with investments aimed at improving the financial and human asset bases of rural households.

5. Investments in infrastructure are urgently needed in the hillsides and hillside areas

Livelihood strategies based primarily on agriculture will not be adequate for many households in hillside areas. However, non-agricultural activities are relatively rare in rural Honduras because of the physical distances from urban centers and towns and the lack of good road infrastructure and transport services. Our econometric analyses in section 6 show that better market access and higher road densities have a string direct effect on income levels. The same analyses also show that, to a certain extent, improved market access can compensate for low levels of education. Investments in rural infrastructure therefore deserve high priority in Honduras' rural development strategy.

6. Need to capitalize on the full potential of the migration phenomenon

Temporary and permanent migration within Honduras and abroad are part of the livelihood strategies of rural households in hillside areas. The primary causes of migration are poverty and land degradation, not lack of land access per se. For example, people from hillside areas in the west and south–where soils have been exhausted and eroded – frequently migrate to the north and northeast regions. Our results in section 6 indicate that migration is significantly less common among low-income households that follow livelihood strategies based on basic grains production. We also found evidence that households with more migration assets have higher income (all other factors equal). A

major question therefore is: how to capitalize on the full potential of the migration phenomenon? Currently remittances mostly serve as a source of finance for food and other goods which can be expected given that poverty is deep among hillside households (Jansen et al. 2006). But remittances are a potential source of finance for market-oriented productive activities and household diversification. To maximize returns from migration, the government should consider providing basic training to assist prospective migrants, assist community-based initiatives aimed at investing remittances in a productive way, and improving financial systems to lower the transaction costs and risks associated with remittances.

7. Stimulating the formation of social capital is important for increasing the welfare of rural households

Participation in community organizations has a both a direct and an indirect positive effect on income (the latter through increasing the likelihood of a household following a more remunerative livelihood strategy). Moreover, our community-level analysis confirmed that in the absence of formal institutions in isolated rural areas, these organizations can fill a critical role and are a potentially important factor in stimulating more remunerative, market-oriented production activities.

8. Efforts to curtail rural population growth are important

Our analysis in section 6 indicates that households with higher dependency ratios earn lower incomes. Public programs aimed at reducing fertility rates in rural areas therefore seem important.

9. Move from geographically untargeted investments in single assets to a more integrated and geographically based approach of asset enhancement with proper complementarities

In our final conclusion and recommendation we argue that while some public investments in household assets programs should be national in nature (such as education and health), others (such as investments in infrastructure, and productive and social capital assets) require more local adaptation and must be carried out in tandem, according to specific needs of regions and households. Household-level heterogeneity limits the

appropriateness of “cookie-cutter approaches” to policies and programs designed to foster broad-based growth. Investment strategies should be formulated on broad regional bases, but options within regions should be tailored to local asset bases and other conditions.

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