Livelihoods and Farm Efficiency in Rural Georgia♠

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ABSTRACT

This paper contributes to the literature on the role of on rural livelihood strategies in rural growth and poverty reduction. It distinguishes between livelihood diversity strategies that contribute to sustainable growth in household incomes, and those that mainly have a 'coping' function. It suggests that typically, the contribution of livelihood diversity to growing household income is through relaxing dependence on credit for access to capital. In this scenario, livelihood diversity would lead to higher technical efficiency in agriculture via investment and thereby to higher household incomes. Survey data from Georgia are introduced and used to test these hypotheses using a Bayesian stochastic frontier approach. The findings are relevant to defining more clearly the scope and aims of policies to stimulate the rural non-farm economy in developing and transition countries.

Key words: Livelihoods analysis; survey data; incomes; efficiency; Bayesian stochastic frontier approach

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Introduction

The rural non-farm economy has become an important area of research in development studies (Ellis, 2000). While traditionally rural areas were equated to farming, it is now clear that this is, and probably always was, erroneous. Rural households in Africa derive up to between 40 and 45 % of their income from non-agricultural sources. In developing Asia this share is about 30 %, in Latin America 40 % (Barrett et al, 2001; Deininger and Olinte, 2001). Recently, empirical research on he topic has come to include the transition economies in Central and Eastern Europe and the former Soviet Union (e.g. Swain, 1999; Davis and Pearce, 2000; Buechenreider and Knuepfer, 2002).

This paper addresses the rural non-farm economy and households' livelihood diversity in the post-Soviet country of Georgia. In the next section, a distinction often made in the literature between 'uphill' and 'downhill' diversification strategies is explored, and an approach is proposed to empirically investigate which type is pertinent in a particular rural setting. Hypotheses for empirical investigation are suggested. Features of the rural non-farm economy in Georgia are described in section 3, based on a recent nationwide rural household survey. Section 4 presents an assessment of the livelihood diversity guided by the hypotheses. Section 5 concludes.

2. Types of Livelihood Diversity

With the recent acknowledgement of the non-farm rural economy also came a change in the appreciation of the economics of diversification (Reardon *et al.*, 1998; Ellis, 2000). Since the late 1970s, diversification of rural incomes is increasingly seen as a way to alleviate income inequality and poverty problems, as an alternative development path for rural areas (Lanjouw and Lanjouw, 1995), or as a next stage in economic development, after urban areas have become congested and industry reaches back into the countryside again (Start, 2001).

But while diversification may represent a sustainable growth path, it may also limit or reverse economic growth where it reduces specialization and efficiency gains (Wuyts, 2001). Similarly, although the early belief was that diversification would generally reduce inequality and poverty (Bryceson, 1999), several studies have shown that that 'pro-poor' diversification depends on a number of conditions, which often do not obtain. A general finding over geographical areas in Africa appears to be that, in the lower income range, households that engage in both agricultural and non-agricultural activities are richer, both in income flows and in endowments of assets (Piesse *et al*, 1999). On the other hand, Deininger and Olinte (2001), studying data from Colombia, find that specialisation in either farm or non-farm activities increases in wealth and in income levels.

This distinction between diversification types that do or do not lead to either growth or poverty reduction is often captured in the literature by reference to ‘demand-pull’ and ‘distress-push’ (or 'coping' and 'accumulation') diversification (*e.g*. Reardon *et al*, 1998; Davis and Pearce, 2000; Haggblade *et al*, 2002). The distinction, although imprecise, captures two alternative livelihood strategies.

Distress-push diversification is commonly described as following from constraints-related motives, while demand-pull diversification is driven by opportunities to capture new opportunities (Barrett *et al*, 2001). The former is related to ‘necessity’, the latter to ‘choice’ (Ellis, 2000). Distress-push diversification typically occurs in an environment of risk, of market imperfections, and of hidden agricultural unemployment. It implies engaging in economic activities that are less productive than agricultural production could be on a full-employment basis (Wuyts, 2001), motivated by the need to avoid falling total household income in the face of adversity. Distress-push diversification is typically resorted to by the less-endowed and lower-income households.

Demand-pull diversification, on the other hand, is characterised as a response to evolving market or technological opportunities, which offer the opportunity of increasing total labour productivity and household incomes, and accumulate financial and asset wealth. It is more typical of better-endowed households. Because of their higher levels of capital (social, human, financial, and physical), they are typically in a better position to capture evolving market or technological opportunities.

The distinction is clearly relevant to a correct assessment of the economic significance of ongoing diversification processes. Demand-pull diversification, leading to wealth accumulation through income growth, may represent a sustainable rural growth path, and a way out of poverty for rural areas. Distress-push diversification may provide a floor in household incomes, but is not likely to have the potential for supporting long-term income growth. Policy relevant research into defining and distinguishing between the two would help develop an understanding of the defining differences. Policies promoting diversification options - for instance, supporting rural enterprise development - could then be clearer about the possible developmental achievements of the rural non-farm economy, either as locus of sustainable growth or as safety net. This may help a more effective design of such policies and more realistic expectations of what they can achieve.

An analytical problem is that the defining features of the demand-pull / distress-distinction, while arguably relevant and useful, are difficult to clearly spell out, so that empirical work on the issue is surrounded by conceptual questions. While we cannot address these fully in this paper, there are two characteristics of the alternative types of Livelihood Diversity that appear uncontroversial: 'distress-push' or 'coping' Livelihood Diversity occurs with stagnant or falling labour productivity and household incomes, while the reverse is true for 'demand-pull' or 'accumulation' Livelihood Diversity. We may express this as alternative hypotheses on Livelihood Diversity types, as follows:

Hypothesis 1: Livelihood Diversity is associated with higher farming efficiency
Hypothesis 2: Livelihood Diversity is associated with higher per capita income levels

In both cases, rejection of the hypothesis on the basis of data on a particular rural economy would be empirical evidence that 'distress-push', 'coping' Livelihood Diversity is the dominant process. If the hypothesis cannot be rejected, this indicates that 'demand-pull', 'accumulation' Livelihood Diversity is prevalent.

3. Data

We test these hypotheses using a 2002 rural household data set from Georgia, a landlocked and mountainous country in the Trans-Caucasus bordering on Armenia, Azerbaijan, Turkey and Russia with a 5.5 million, ethnically diverse population. The setting is pertinent to our subject, as rural livelihoods in the post-Soviet Republic have been changing dramatically over the last decade, with both new threats and new opportunities emerging.

In Soviet times, Georgia was a relatively industrialised Union Republic. Following the break-up of the Soviet Union in 1991, the first five years of Georgia's independence saw deep structural changes in the economy. Soviet-era linkages with other post-Soviet states were severed or transformed and the domestic economy restructured. GDP declined by an estimated 20 % in 1992-1997 during the 'transitional recession', exacerbated by ethnically motivated armed conflict during 1991-1995. The share of agricultural employment in total employment doubled, while recorded agricultural output declined by 75 % during the same years. While much small-scale household production of food emerged, most of it remained unofficial as land and farm structure reforms, officially started in 1992, only gathered speed in 1996-1997. In 2001, average per capita GDP was 591 US$. Agriculture accounted for 28 % of output and 50 % of employment. Serious droughts struck in 1998 and again in 2002 (World Bank, 2002).

The survey covered 1,000 rural households in all parts of the country, and was designed to be nationally representative. It included a mix of households with different economic activity profiles, including farming, wage employment, non-farm entrepreneurs, and migration workers. Data were collected on household demographics, labour market status, incomes sources and outlay categories, asset wealth, and details on farming activities. They were collected in April - May 2002, and refer to the calendar year 2001.

The data show that the Georgian rural economy is varied: livelihood diversity is the norm rather than the exception. Table 1 gives households' shares of income sources from, and labour allocation to various economic activities, as well as the incidence of involvement in them.

Table 1: Rural Economic Activities in Georgia

Economic activities	% of households involved in activity	Labour hrs allocated to activity (average)	% income from activity (average)
Agriculture	69	2,048	35
Other farm-based	4	n.r.	0
Non-farm enterprise	17	1,267	10
Wage employment	44	357	28
Migration labour	22	379	12
Financial assets	8	n.a.	4
Social transfers	33	n.a.	12

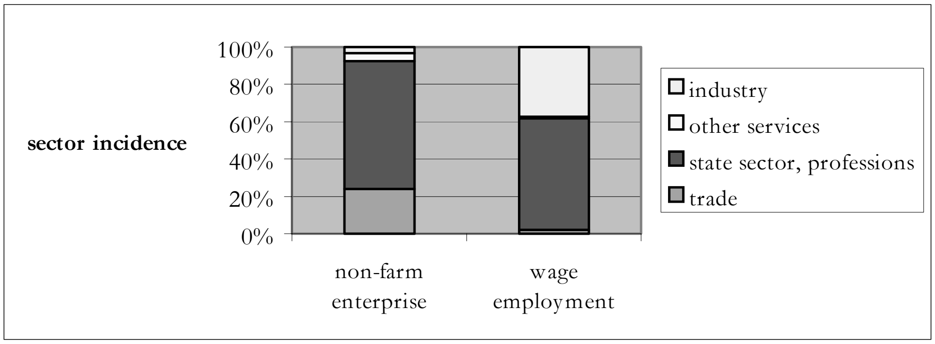
Notes: Survey sample size: 900 households; n.r. = not reported; n.a. = not applicable

Source : survey sample

About 70 % of Georgian rural households are in farming, with wage employment the second most frequent activity for 44 % of households. In income terms, agriculture and wage employment are about equally important shares in total income on average, even though labour time allocated to agriculture is six times larger. This points to low labour productivity in agriculture in line with its small scale. On average, households work only 0.7 hectare of land, have less than one head of cattle plus some poultry, and very limited capital assets. Other survey findings show that credit is relatively unimportant, as over four fifths of households did not take up credit in 2001, and the amounts taken up were small and mostly used for consumption purposes.

Figure 1 provides a breakdown by sector of wage employment and own enterprises reported by rural households.

Figure 1: Composition of the rural non-farm economy in Georgia

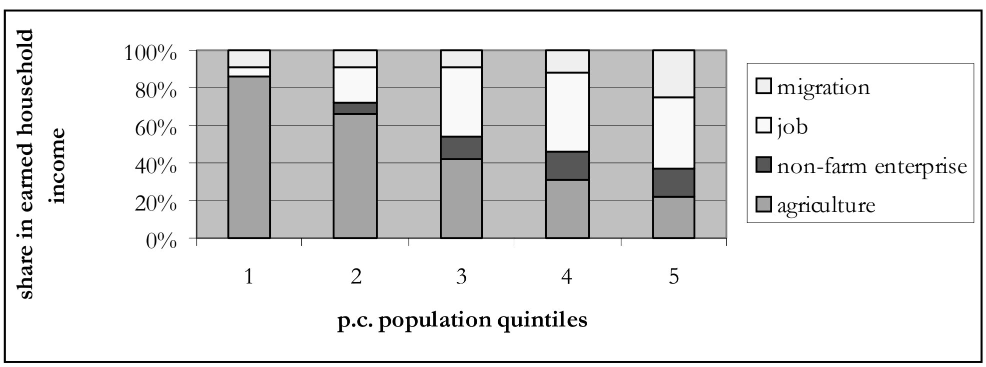


Source: survey sample

Figure 1 shows that most non-farm jobs are in the state sector (including teachers, agronomists, farm managers, doctors and local government) and in industry (e.g. wood, textile, food and clothes). Most non-farm enterprises operated by households are in small-scale trade or in professions in e.g. transport, tourism and communication.

It is worth noting that these averages hide considerable variation over income levels in involvement in the various economic activities by income level. This is shown in a bar graph of the composition of income over income levels in Figure 2. Non-agricultural income increases over income quintiles.

Figure 2. Earned Income Non-Farm Shares in Rural Georgia



Note: earned income excludes assets income and social payments. Non-agricultural farm-based activities were negligible and not included in the Figure.
Source: Survey findings

The background is thus one of farming as the most common occupation, providing the largest share of income on average, but with low returns to labour, with serious constraints in land and (physical and financial) capital, and as the most important source of income for particularly the poorer households. There are simultaneously substantial other sources of income, particularly in wage employment, and often within the same household: the average household has access to income from two sources. We now turn to an examination of the impact of additional income sources on farm efficiency as well as the impact of livelihood diversity, so defined, on household income.

4. Estimation

To test our first hypothesis, we use a subset of 412 households involved in both farming and non-agricultural activities. We employ a Bayesian stochastic frontier (BSF) approach to estimate technical efficiency. The Bayesian approach has several advantages over the more traditional Classical approach to stochastic frontier estimation (Koop *et al.*, 1997; Kleit and Terrell, 2001, Dashti, 2003, and O'Donnell and Coelli, 2003). We estimate a translog production function and impose monotonicity and quasi-concavity at 95 percent of the sample data.

With a stochastic frontier it is normally assumed that the error term is composed of two elements: a random error capturing statistical noise (v) and a one-sided non-negative error (u). By decomposing the error term into these two components the frontier production function can be expressed as

$$y_i = x_i^{'}\beta + v_i - u_i$$

where $u_i \geq 0$, $i=1\ldots N$ (i indexes farms), y_i is the logarithm of farm level output, x_i is a vector of the logarithm of inputs including an intercept and cross products and β is a vector of coefficients, v_i is an *iid* error term with mean zero and constant variance assumed to be independent of u_i. As y_i is the log of output, technical efficiency r, of the i-th farm is $r_i = exp(-u_i)$. Following normal practice in the Bayesian frontier literature we estimate farm specific technical efficiency assuming that u_i is exponential (e.g, Koop *et al.*, 1997).

The approach used to estimate our model is the Markov Chain Monte Carlo (MCMC) method of Gibbs sampling (Casella and George, 1992). We follow the approach introduced by Koop, Osiewalski and Steel (1997) and estimate their Varying Efficiency Distribution (VED) and Common Efficiency Distribution (CED) models. These two model specifications allow us to examine the impact of including non-conventional (i.e., exogenous) inputs in the production function (CED) or as explanatory variables of inefficiency (VED). As Kumbhakar and Lovell (2000) observe, the choice of model specification depends on whether it is assumed non-conventional inputs influence the structure of production or whether they influence efficiency.

To implement these models it is necessary to choose a prior for the median of the efficiency distribution. In keeping with the Bayesian frontier literature (e.g., Koop *et al.* 1997, and Kleit and

Terrell, 2001) we employ 0.875 as our choice of informative prior. Our results were found to be robust to the choice of informative prior for the type of values typically employed in the literature.

To assess the convergence of our models we estimated each specification several times to ensure that the results derived were consistent. We conducted 50,000 Gibbs sampler iterations of which the first 10,000 draws were "burn-in" draws. We split the remaining iterations into two equal samples and compared our parameter estimates. Over a number of runs of the data we found all our parameter estimates to be consistent to three decimal places.

We have four conventional inputs; land, labour, capital and livestock. In addition we have available a number of non-conventional (i.e., exogenous) inputs, all of which are spoecificed as binary variables. The one we are interested in in this context is 'involvement in non-agricultural activity'. To control for other effects, we also add variables for age, education, loan uptake, and location. We measure these by binary variables; we determined suitable cut-off points on the basis of variable distributions. In keeping with existing applications in the literature assume that these inputs impact on farm level technical efficiency. For the CED model these variables are included within the frontier production function. When we estimate the VED model these variables are used to explain our estimates of technical inefficiency.

Formally, our CED translog production function takes the following form:

$$Y_i = \alpha_i + \sum_{j=1}^{J} \beta_j X_{ji} + \tfrac{1}{2} \sum_{j=1}^{J} \sum_{k=1}^{K} \beta_{jk} X_{ji} X_{ki} + \sum_{m=1}^{M} \delta_m Z_m + v_i - u_i$$

where $\beta_{jk} = \beta_{kj}$ $(k \neq j)$ and subscript i represent the i-th farm and i = 1.....412. Output in our model is represented by Y, conventional inputs are represented by X $(j=1\ldots.J)$ and the non-conventional inputs by Z $(m=1\ldots M)$.

Our VED production function takes a slightly different form:

$$Y_i = \alpha_i + \sum_{j=1}^{J} \beta_j X_{ji} + \tfrac{1}{2} \sum_{j=1}^{J} \sum_{k=1}^{K} \beta_{jk} X_{ji} X_{ki} + v_i - u_i$$

where we now simultaneously model the mean of farm level inefficiency posterior distribution as being $exp(\sum_{m=1}^{M} \delta_m Z_m)$. In both the VED and the CED production functions, we take the double-log specification, so that all variables have logged values of original observations.

To simplify the examination of our results, prior to estimation we normalised our sample data by dividing throughout by the sample mean of each variable. Thus, our β_i estimates are equal to $\frac{\partial LnY}{\partial LnX_i}$. This also allows us to check if the monotonicity condition is satisfied, by examining the parameter estimates. The production function estimates, that is the Bayesian posterior means are reported in Table 2.

Table 2: Stochastic Production Frontier Results (CED and VED)

	CED		VED	
Efficiency	*Mean*	*StDev*	*Mean*	*StDev*
Intercept	7.140	0.049	7.190	0.030
Land	0.089	0.022	0.093	0.022
Capital	0.051	0.016	0.054	0.015
Labour	0.056	0.024	0.051	0.023
Animals	0.550	0.025	0.549	0.024
Land*Land	-0.004	0.020	-0.003	0.019
Land*Capital	0.033	0.017	0.034	0.017
Land*Labour	0.014	0.023	0.013	0.023
Land*Animals	-0.014	0.024	-0.015	0.024
Capital*Capital	-0.005	0.007	-0.004	0.007
Capital*Labour	0.025	0.014	0.024	0.014
Capital*Animals	-0.043	0.015	-0.043	0.015
Labour*Labour	0.002	0.010	0.002	0.010
Labour*Animals	-0.006	0.018	-0.004	0.017
Animals*Animals	0.088	0.009	0.088	0.009
+ge	0.008	0.036		
Education	-0.034	0.037		
Non-Ag Activity	0.066	0.036		
Loan	0.013	0.043		
Location	0.042	0.043		
Inefficiency			*Mean*	*StDev*
Intercept	0.096	0.031	0.127	0.033
Age			-0.121	0.257
Education			0.243	0.253
Non-Ag Activity			-0.414	0.247
Loan			0.045	0.287
Location			-0.100	0.292
	Standard Deviation		*Standard Deviation*	
Normal Component	0.323	0.015	0.319	0.013

Source: survey data and authors' calculations

As we can see in Table 2, for both model specifications all the inputs have the correct sign (i.e., positive) and are statistically important. A striking feature of these results is that animals make by far the largest contribution to output. This is not unexpected as our sample of farms is relatively homogenous regarding size, capital and labour.

Another interesting feature of the results is that for both model specifications we observe decreasing returns to scale, since the sum of elasticities is less than one. We can speculate that increasing the scale of production may require more capital inputs, which is expensive relative to labour. Hence, although increases in scale lead to increased output they only do so at even higher input costs and as such marginal benefits are less than marginal costs.

Turning to our non-conventional inputs, we find for both model specifications that the only variable that is statistically important is 'involvement in non-agricultural activities'. We can see that for the VED model it has a negative impact on technical inefficiency and for the CED a positive impact on output. All other variables are statistically less important. This lack of explanatory power is not unusually in this type of study. For example, Coelli *et al.* (2003), employing a very extensive set of non-conventional inputs in their frontier study of Bangladesh rice farmers, found minimal statistical evidence to explain the observed levels of technical inefficiency.

The results suggest that involvement in non-agricultural activities is indeed associated with higher efficiency in farming. This supports the conjecture that the income from such activities may well be used to loosen a constraint (which in this setting could well be a credit constraint) in farming, allowing to households to invest and become more efficient in farming. In terms of our conceptual framework, Georgian households would be engaged in 'accumulation' livelihood strategy. Although this is what the data suggest, we stress that the evidence is indirect, as we are forced to use cross-section with reference to a hypothesis on households' dynamic behaviour.

Next, we turn to the hypothesis that involvement in non-agricultural activities is associated with higher household income. Figure 2 already suggested that more non-farm income is associated with higher total incomes. Also, since the findings on farm efficiency appear to indicate that households engage in 'accumulation' livelihood diversity on average, the expectation is that farm/non-farm livelihood diversity is indeed associated with higher incomes.

We now test this hypothesis explicitly and formally, controlling for other factors. We regress income levels on variables capturing non-farm involvement by these farming households, controlling for a number of household characteristics. We employ the entire sample after data cleaning. Since the logarithm of (non-zero) incomes is a good approximation of a normal distribution, we use a double log Ordinary Least Squares estimation of the form

$$y_i = x_i^{'}\beta + e_i$$

where $i=1\ldots.N$ (i indexes households), y_i is the logarithm of household i's income, x_i is a vector of household characteristics including an intercept, β is a vector of coefficients and e_i is a *iid* error term. As control variables we included variables known from the empirical literature to control households' income levels: household size and dependency ratio, location (peri urban / remote rural), average age of adult household members, the highest level of education in the household, ethnicity (a fifth of the sample is non-Georgian). Our key variables are those for involvement in wage employment, non-farm enterprise, migration labour, and agriculture, plus cross products for involvement in agriculture and non-farm economic activities. Continuous variables in x_i are logged, so that β's can be interpreted as elasticities (percentage changes in y_i associated with a percentage change in x_i at the sample mean values of y_i and x_i). Table 3 presents the results.

Table 3: Livelihood Diversity and Household Income levels

	Variable		coefficient		
	mean	SD	B		s.e.
(Constant)			0.4193		6.8092
Georgian	0.79	n.a.	0.4064	***	0.0910
Location	0.22	n.a.	0.0183		0.0984
dependency ratio	0.36	0.31	-0.1777		0.2154
household size	3.88	1.79	-0.6806	***	0.0984
Age	47.3	12.9	2.5374		3.6777
Age squared	n.a.	n.a.	-0.3166		0.4917
Education	5.02	1.90	0.2376	**	0.1057
nonfarm enterprise	0.17	n.a.	0.5420	***	0.1700
Wage employment	0.44	n.a.	0.7920	***	0.1453
migration labour	0.22	n.a.	0.1771		0.1562
Agriculture	0.69	n.a.	0.6507	***	0.1438
agriculture*wage employment	0.28	n.a.	-0.0537		0.1637
agriculture*nonfarm enterprise	0.10	n.a.	-0.6317	***	0.2056
agriculture*migration labour	0.14	n.a.	-0.0369		0.1859

All continuous variables are in logs; dependent: ln(per capita income); n=924; Adjusted R^2 = 0.21

Source: survey data and authors' calculations

The results show that on average, ethnic Georgians and households with better educated members have higher per capita incomes, while larger households have lower per capita incomes. All variables for access to the four income sources have positive signs as expected, and all are significant except migration labour, which is typically a lowly remunerated activity. Households with farm-non-farm livelihood diversity, as captured by the cross product variables, tend to have lower incomes - although this finding is significant only in the case of non-farm enterprise.

5. Conclusions

This paper considered the role of on rural livelihood strategies in rural growth and poverty reduction. It has added to the relevant literature in three ways. It presented data on he rural non-farm economy in Georgia, part of the post-Soviet republics, where few studies on rural development have been done to date. It finds that livelihood diversity is the norm, with about two thirds of Georgian rural households in farming and about half having some income from wage employment. Both income sources are on average equally important as shares of total household incomes, with additional income derived from non-farm enterprises, remittances, and social transfers. Household typically have little land, few capital assets and uptake of credit is limited.

This study has also built on a distinction made in the literature between 'coping' and 'accumulation' livelihood diversification strategies. An attempt was made to link this distinction to an empirical assessment of the nature of rural households' livelihood diversity. It was found that in the Georgian context, livelihood diversity is associated with increased agricultural productivity, and tends to be pursued by household with lower per capita incomes. These findings are in line with livelihood diversity as an 'accumulation' strategy. Livelihood diversity appears to relax constraint to achieve greater technical efficiency in farming. Livelihood diversity also seems to be 'pro-poor' in the sense that uptake of livelihood diversity strategies is among the lower-income households, even when controlling for other factors relevant to household income levels.

A technical contribution of this paper is the application of Bayesian stochastic frontier approach for estimating farm efficiency, incorporating measures for livelihood diversity. This method captures the relation between livelihood diversity and farm efficiency well, while controlling for a number of conventional factors determining technical efficiency.

One area of future work clearly is further development of the distinction between 'coping' and 'accumulation' livelihood diversity. In particular, the various factors underlying households motivations to pursue diversification - for instance, income risk and resource constraints - would merit closer study. Another issue relevant in this perspective is the difference in objective between livelihood strategies, i.e. diversification as aim versus diversification as specialization-in-progress. Also the dynamic aspects require further work, tracing the implication of asset accumulation or depletion for livelihood portfolios, and understanding households' investment choices. To simplify, we have here assumed that investment will be in agricultural production, making it more efficient;

but modifying this assumption seems worthwhile in the context of complex rural livelihoods. It is hoped that the empirical work presented in this paper will be helpful in developing a more fully fledged conceptual framework of livelihood diversity strategies that is empirically testable.

This would potentially have implications for rural policies aimed at supporting the rural non-farm economy and livelihood diversification. While a plethora of studies in this area have now been published, it is often not clear what the potential of non-farm income sources for growth and poverty reduction are. An important distinction in the analysis of income sources and their dynamics is between those supporting sustainable income growth and those supporting a minimum subsistence income level. It would be important to establish which of the two is the main aim of livelihood diversity, and to design rural non-farm economy polices accordingly. This paper is a first step.

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