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The relationship between farm size and productivity: empirical evidence from the Nepalese mid-hills

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Contributed paper prepared for presentation at the 106th seminar of the EAAE

Pro-poor development in low income countries:
Food, agriculture, trade, and environment
25-27 October 2007 – Montpellier, France

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Abstract

This paper examines the farm size and productivity relationship using data from Nepalese mid hills. The household data used has been drawn from a survey conducted by the author and financed by the Norwegian University of Life Science. The analysis uses models both allowing for and not allowing for village dummies(as cluster controls), the ratio of irrigated land (as proxy for land quality), and other socio-economic variables such as households, belonging to caste groups, and family size (as proxy for access to resources). The result supported the almost 'stylized fact' of inverse relationship (IR) between farm size and output per hectare. Total cash input use and labour hours per hectare were found to be higher on small farms. The findings of regression equations allowing for village dummies and other socio-economic variables do not support the explanation that the IR between farm size and productivity is due to variation in regions as well as access to resources. Nevertheless, family size and caste dummies show some effects on farm value added. The paper further investigates returns to scale in Nepalese agriculture, applying the Cobb-Douglas (CD) production function. The result shows constant returns to scale. Labour input seems more influential in farm production, followed by manure, in the sample farms. The overall result shows that the IR between farm size and output per hectare is perhaps due to the result more of other inputs used by small farms rather than diseconomies of scale.

***Key words**:* inverse relationship; farm size; productivity; returns to scale; Nepal
JEL Classifications: *Q15, O13*

1. Introduction

Relationship between farm size and productivity in developing countries is one of the oldest issues in the academic arena for analyzing the agrarian structure. The debate on farm size and productivity relationship intensified, when Sen (1962, 1966)[1] observed inverse relationship between farm size and output per hectare in Indian agriculture, suggesting that small farms are

[1] Several studies mention that Chayanov was the first who discovered inverse relationship in Russian agriculture in the twenties (Bhalla and Roy 1988).

more productive compared to large ones. This relationship is explained by the relative advantage of using more family labour by small farms that may reduce the monitoring and supervision costs of hired labour. These findings show that equity does matter for efficiency in the agricultural sector, and raise the question of redistributive land reform in most agrarian countries. Since then, a lot of empirical studies have re-examined the problem from different angles using various statistical techniques in order to test Sen's finding, and inverse relationship (IR) has been perceived as a "stylized fact" of rural development[2]. In favour to the IR, Sen argues that the opportunity cost of a day's labour by family members might be well below the daily wage rate of hired labour. Feder (1985) shows that small farmers have high labour/land ratios, and could achieve higher yield per hectare. Moreover, the IR is typically explained by the failure of rural markets for credit, labour and land, as well as by the difference in labour endowments between small and large farms. Family labour has more incentives than hired labour to work intensively, because it is residual claimant of the output. This fact is analysed in relation to reduction of unequal distribution of landholdings, assuming that redistribution of land will lead to a positive effect on farm productivity.

Despite a number of studies favouring the IR, it has failed to reach a consensus. On the contrary, IR hypothesis argues that the earlier adoption of new technology by large farmers has reduced or even reversed the yield advantage of small farmers (Fan and Chan-Kang, 2003). Some show that IR has disappeared in small regions of India (Bhalla and Roy, 1988; Newell et al., 1997). They argued that the causes of IR might be the regional variations in underlying land quality. Bhalla and Roy (1988) further concluded that the stylized fact of an IR between farm size and output per hectare might be in larger part due to the omission of soil quality variables from the estimated equations. Likewise, Cornia (1985) analysed the relationship between factor inputs, yields, and labour productivity for farms of different sizes in 15 developing countries. These results showed a positive relationship between farm size and productivity in Bangladesh, Peru and Thailand. Deolalikar (1981) also observed that the IR could be rejected at a higher level of agricultural technology. Several economists put their views that the IR remains valid for traditional agriculture. As a result, small farms in most developing countries were perceived as more efficient than large farms before the 1980s. On the other hand, rapid technological changes

[2] See, Berry and Cline (1979), one of the most important and highly cited literatures, Bardhan (1973), Carter(1984), and more recently Barett (1996), Heltberg (1998) and Lamb (2003).

and the expansion of commercial farming have changed the perception of efficiency toward small farms, suggesting that the IR diminished, when the agricultural sector moved towards modernization through the adoption of more capital intensive technology. Such transformation will pay more attention on other inputs such as fertilizer and modern variety of seeds rather than the importance of farm labour. Small farmers, in this regard, might be unable to compete, especially as the rapid sequence of new technological inputs require investments that go beyond their capacity.

A large share of available literature regarding the relationship between farm size and productivity was observed in India in comparison to other South-Asian countries. Based on my knowledge, there are few empirical studies examining the relationship between farm size and productivity at farm level in Nepal. One recent study done by Bhandari (2006) shows a positive relationship between land inequality and productivity, rejecting the argument that in Nepal, small farms appear to be more efficient than large farms. The author has well summarized the overall development of land reform in Nepal in relation to productivity and poverty reduction. However, the study is mainly focused on the districts of the southern plain area(i.e. *Terai*), where yield is supposed to be higher because of better soil quality and regular irrigation facility. In order to obtain this result, the author used macro level data applying a simple bivariate regression between the Gini index of each district and land productivity. His finding is solely based on rice yield without considering any other crops nor land quality in the model. Hence, this paper attempts to make a further empirical contribution in this literature, using farm level data from Nepalese mid-hills. The following article deals with the issues of the relationship between farm size and productivity taking into consideration village dummies as cluster controls, ratio of irrigated land and other socio-economic variables (i.e. caste dummies and family size) showing that the difference of inverse relationship between farm size and productivity is more likely to be negligible if farmers have better access to resources (i.e. credit, advanced technologies, irrigation and market information). The latter is explained as incomplete factor markets that lead to family owned farm and household with better access to resources being more efficient.

The paper is organized as follows: Section 2 dealing with the data sources, methodology, farm characteristics, and descriptive statistics. The theoretical approach and econometric models for farm size-productivity relationship, and their results are explained in Section 3, while Section

4 shows the empirical results of the CD production function and returns to scale. Finally, conclusions and policy implications are given in Section 5.

2. The data

The data for the study were collected from Mardi Watershed Area of Kaski district in the western hills of Nepal. A cross section random sample survey of 250 farm households was undertaken during the period June to August 2002. The survey was organized as a part of an MSc dissertation with financial support from the Norwegian University of Life Science. The survey area lies with the region of Annapurna Conservation Area Project (ACAP) covering three Village Development Committees (VDCs i.e. lowest administrative body of Nepal) of the entire area of Mardi Watershed. The random sampling method was applied to select sample households, where the detailed information about the study area before sample selection was received from the branch office of ACAP in Mardi Watershed area.

Mardi Watershed area covers 63 square kilometres ranging from 900 meters to 5000 meters above the sea level. The study area is relatively higher rainfall zone of Nepal, where the average annual rainfall on the ridges is about 4700 mm and 4000 mm in plains, and the temperature in the study area is the range between 20-30 degrees in the summer and 7-18 degrees in winter. According to the 2001 census, total population of the study area is 10220 with a total of 2117 households. This area is rich in diversity of caste, ethnicity and culture, as well as climatic variations and multiple cropping system. The area also covers different types of landscapes including sloping rainfed in the upland to irrigated and fertile land in the valley. The major crops grown in the area are rice, maize, wheat, millet, and other seasonal vegetables. Animal traction (i.e. oxen) is the only technology used for land preparation. Having seasonal transportation facility and proximity to business centre (i.e. Pokhara), the study area represents both characteristics of subsistence and to some extent of commercial farming. The study area was therefore, regarded as the best area for addressing the farm size- productivity relationship.

The survey collected detailed information of farm and non-farm activities, as well as demographic characteristics. The data set provided the detailed information of both tradable and non-tradable inputs and output.

Cropland(or net sown area) has been considered in terms of holding either own or rented or sharecropping land by the farmers. The average land holding including forestland/fallow land of the surveyed households is 0.56 hectares (10.74 ropani[3]) and 0.50 hectares for cropland only.

Land in terms of holding size is relatively scarce in Nepal. Average size of land holding has decreased from 1.12 hectares in 1981 to 0.80 hectares in 2001 (CBS, 2002). It is widely believed that the alleged inverse relationship would be weaker in low average farm size, because of homogenous farms relying mostly on family labour (Heltberg, 1998). Nevertheless, small farms can also employ hired labour and therefore face supervision cost too. The data show that hired labour constituted about 26 percent of the total labour force in the area during the survey year.

In spite of the IR as weaker assumption in the presence of lower average farm size, no such evidence for higher agricultural growth rates has been found in countries with higher average farm size. IR was even observed on farms averaging 0.43 hectares in China. It is, then, assumed that the alleged relation between farm size and productivity may not be weaker due to small farm size in the study area. Heterogeneity in farming system in the study area may have been supportive for the IR assumption even with a lower average farm size. In the paper, IR hypothesis is considered as plausible due to the existence of socio-economic differences in terms of access to resources among the caste groups, and variations in the villages and land quality.

Table 1: Descriptive statistics of the study area

Variables	Mean	Standard Deviation
farm income/hectare(NRs*.)	78878.25	37734.23
Log of total cash input per hectare[4]	9.54	0.54
Log of labour hour	7.81	0.46
Log of farm income/hectare	11.17	0.48
Log of cropland	-0.90	0.69
Ratio of irrigated land	0.56	0.25

Source: Field Survey 2002

* 1US$= 72.57 Nepalese rupees at the time of data collection.

Descriptive statistics of the survey area are presented in Table 1. Farm income is the value added of total farm products including livestock income in the survey year. Cropland is the net

[3] *Ropani* is local measurement unit in Nepal. One *ropani* is equivalent to 0.05 hectare. People having 10.74 *ropani* farm land in an average are considered as medium class family in Nepal. However, it depends on the quality and the location of farm land.

sown area during the survey year, and the ratio of irrigated land is calculated with respect to total cropland.

3. Inverse relationship between farm size and productivity

The conventional model used for testing inverse relationship is the simple equation such as:

$$\ln Y = \alpha + \beta \log(A) + \varepsilon \qquad (1)$$

where Y is the value of output, and A represents total crop land. The coefficient of β should be negative for inverse relationship, if Y is net output per hectare, and less than unity, if Y is total output. However, on theoretical grounds, neo-classical theory assumes that β should be zero, implying that farm size and productivity are uncorrelated (Bhalla and Roy, 1988). The occurrence of a negative relation assumes the failure of factor markets. It is widely assumed in the literature that the failure of factor markets in developing countries is pervasive due to high transaction costs. The IR hypothesis is, therefore, a plausible assumption under factor market imperfections (Heltberg, 1998). Under imperfect factor markets, farm productivity, in addition to soil quality, may be influenced by several other socio-economic variables such as households belonging to caste groups and family size.

In the econometric model for testing IR hypothesis, it could, therefore, be plausible to include socio-economic variables in the regression equation, as output per hectare is the function of farm size and socio-economic characteristics, like household belonging to caste groups, family size, and village dummy, assuming that such characteristics do matter in the production decisions in most rural economies, and thereby affect the farm productivity.

It is widely discussed on the ground of political economy, especially in Nepal and India, that the caste system is one of the hurdles for the overall development, where the so-called higher caste groups have relatively better access to resources and a vital role for decision making in the formulation of national policies as well as the implementation of development programmes. On the other hand, the so-called lower caste groups are economically and socially deprived. Social inclusion such as reservation of a quota of government jobs, in the education sector and in decision making process for deprived groups is now a common issue within the political arena. In

[4] It includes total cash inputs like fertilizer, ,seeds, farm equipments and value of hired oxen.

this paper, it is, therefore, assumed that caste groups do matter on productivity due to differences in resource accessibility including credit, irrigation, technology and market information. It is often assumed that in regression of output per hectare with respect to farm size using village dummies as cluster controls, IR may disappear between farm size and productivity. Moreover, the use of total cash input and labour hours per hectare as dependent variable with farm size can be a better measurement of productivity differentials. This paper, thus, applies both types of equation total output per hectare with and without village clusters and other socio-economic variables in order to test the consistency of hypotheses between farm size and productivity.

$$\ln Y_i = \alpha + \beta \log(A_i) + Z_i \gamma + \varepsilon_i \qquad (2)$$

where Y_i is total output per hectare, and A_i denotes the total crop land either owned or rented or sharecropped during the survey year. Z_i denotes a vector of control variables like village dummies, ratio of irrigated land, family size and households belonging to caste group, and α, β and γ are parameters to be estimated, while ε_i is an error term. An inverse relation requires β to be negative.

The paper also attempts to propose the equation of total cash input and labour hours per hectare, as a function of farm size in order to find out whether smaller farms have higher labour and land ratio. The IR is often dealt with the use of relative inputs which is closely associated to the issue of whether, on small farms, land and input ratio is higher than the large ones. The proposed model is as follows;

$$\ln I_i = \alpha + \beta \log(A_i) + Z_i \gamma + \varepsilon_i \qquad (3)$$

where I_i is total cash input or labour hours per hectare. An inverse relation needs β to be negative, showing that input and labour hours per hectare decreases as farm size increases.

The empirical estimation of regression equations such as total output per hectare, labour hours and cash input per hectare with respect to farm size is presented in Table 2. The results show that the coefficients(i.e. elasticities) of total output, labour hours and cash input per hectare with respect to farm size are statistically significant at 99% confidence level with negative sign, which implies declining output, labour hours and cash input per hectare as farm size increases.

This result supports the argument that small farms use inputs more intensively than large farms and achieve higher productivity (Berry and Cline, 1979; Carter, 1984; and Newell et al., 1997). However, this result contrasts with Bhandari (2006), where he found positive correlation between land inequality and land productivity[5] in Nepal. The author concluded that his result was more suggestive rather than conclusive due to three limitations viz. no consideration of soil quality and relative input use, and measured only aggregate production of rice yield in *Terai* region in his econometric analysis.

Table 2: Regression results for output and labour hours per hectare with cropland[a]

Independent variable	Dependent Variables		
	Log of output/hectare	**Labour hours/hectare**	**Log of cash input/hectare**
Log of cropland	-0.21***	-0.40***	-0.43***
	(0.042)	(0.033)	(0.051)
Constant[6]	10.96***	7.41***	7.13***
	(0.047)	(0.037)	(0.058)
R^2	0.10	0.38	0.22
$F_{(1, 248)}$	28.50	151.66	71.36
No. of observations	250	250	250

[a]standard errors are given in parentheses.

***significant at 1% level.

The IR is often explained with four hypotheses i. e. risk, imperfect or incomplete labour markets, diminishing returns to scale and the possibility of unobserved variations in land quality (Newell et al.(1997). The following possible explanations based on the available and relevant literature, could be relevant to the Nepalese context:

The first is the imperfect and incomplete labour market. Labour market imperfections examined in earlier studies by Thapa (2003), and Abdulai and Regmi (2000) conclude that imperfect or incomplete labour markets are pervasive in Nepal. They observed labour heterogeneity between family and hired labour as well as male and female labour, especially in hilly regions; family labour was found more productive than hired labour because of the higher incentive to work on their own farm. The IR in this exercise could be due to labour heterogeneity. However, the present paper will not investigate labour heterogeneity.

The second is the possibility of unobserved variations in land quality. This could be relevant in the study area because of its landscape. The study area has wide variation in terms of land quality, and the types of crops that depend on soil quality and irrigation facility like rice and

[5] The author used a simple bivariate regression between the Gini coefficient of each district and land productivity (only rice crop). The coefficient of correlation between land inequality and land productivity was 0.612(p<.001).

[6] In all regressions, constant terms are included but not reported.

wheat are grown on irrigated low land. The IR could be the other way round in rice and wheat crops. It is often believed that a crop like millet is relatively more labour intensive in comparison to wheat and rice, and per hectare input could be higher for such a crop. Therefore, the IR could be the result of variations in land quality and types of crop. Due to limitation of crop specific data, this paper tries to seek further empirical analysis incorporating village dummies as cluster control, ratio of irrigation land as proxy for land quality and some other socio-economic variables.

The final explanation is decreasing returns to scale. It is often believed that the existence of decreasing returns to scale is more likely to possible in land scare region. Farmers normally preferred first to use high yield land, and then extended their farm land on relatively lower yielding area, when land became scarce. Increasing returns to scale is more likely to have existed in land abundant areas, and decreasing returns to scale is relatively in low soil quality and land scarce regions. CD production function will be used to get more insights in returns to scale in the Nepalese agriculture.

Results from extended regression equations including 2 village dummy variables(as cluster control), ratio of irrigated land(as proxy for land quality) and other socio-economic variables i.e. households belonging to caste groups and family size (as proxy for capturing the access to resources i.e. access to credit, irrigation, technology and market information etc.) are given in Table 3. The paper assumes that IR may not be a plausible assumption if farmers have better access to resources.

The coefficients of the regressions of both output and labour hours per hectare with respect to crop land are negative and are highly significant, reflecting that the proxy variables do not change substantially the IR between farm size and productivity. The outcome thus rejects the hypothesis at least in the sample farms that IR could disappear after the inclusion of village dummies and other socio-economic variables in the model. The existence of relatively low variations among the villages in the study area in terms of cropping pattern system, soil quality and labour supply may explain why the extended equations do not reject the IR hypothesis.

Nonetheless, the coefficients of the proxy variables can give some insights about the differences among villages and caste groups. The coefficient of family size is significant with positive sign, suggesting that farm productivity may be relatively high, if farmers use more family labour. Likewise, the coefficient of higher caste dummy is clearly shown the differences

Table 3: Regression results for output and labour hour per hectare with cropland and other socio-economic variables[b]

	Dependent Variables	
Explanatory Variables	**Log of output per hectare**	**Log of labour hour per hectare**
Log of cropland	-0.31***	-0.46***
	(0.046)	(0.03)
Family size	0.05***	0.04***
	(0.012)	(0.010)
Ratio of irrigated land	0.03	0.05
	(0.12)	(0.10)
Dummy: VDC2	-0.13*	-0.20***
	(0.07)	(0.05)
Dummy: VDC3	-0.12*	-0.16**
	(0.07)	(0.05)
Dummy: Higher caste group	0.40***	0.07
	(0.07)	(0.05)
Dummy: Medium caste group	0.06	0.01
	(0.08)	(0.06)
Constant	10.4***	7.21***
	(0.14)	(0.12)
R^2	0.34	0.46
F(7, 242)	17.59	30.06
Number of observations	250	250

[b]standard errors are given in parentheses.

***significant at 1% level.

** significant at 5% level.

* significant at 10% level

in resource accessibilities among the caste groups. The significant and negative sign of village dummies also reveal some inter village variations in terms of productivity. The ratio of irrigated land is not significant. This could be due to low variations between irrigated and non-irrigated plots in the sample farms because of the study area belonging to the higher rainfall zone that often reduces the productivity differences between irrigated and non-irrigated land.

Although, the regression equations(2 & 3) do not support the hypothesis that the existence of IR is more likely due to the exclusion of land quality and resource accessibility among the farm holders, the results reveal at least some difference in resource accessibility among caste groups. Family size seems an influential factor for both farm size-productivity and labour/land ratio, implying an existence of incomplete labour markets in rural Nepal that often show family labour more productive than hired labour.

4. Returns to scale

This section sheds further light on the farm size-productivity relationship, applying the Cobb-Douglas production function in order to find the impact of other factors of production. It is often discussed in the literature that from the gross relationship between farm size and productivity, it may not be plausible to make a conclusion for the technological economies and diseconomies of scale. On the contrary, the production function can give better insights between the specific factor input and productivity.

The alleged IR between farm size and productivity often deals with the theory of diminishing returns to scale. The paper tries to fit a Cobb-Douglas(CD) production function to find the returns to scale in Nepalese agriculture. The CD production function is as follows;

$$\log Y = \beta_0 + \beta_1 \log I + \beta_2 \log L + \beta_3 \log M + \beta_4 \log K + \beta_5 \log A + \mu$$

where Y is value of farm output, I is net area irrigated per hectare of total cropland, L is total labour hours both family and hired per hectare used in farm production, M is total quantity (in kg) of manure per hectare used in farm production, K is cash input per hectare, A is cropland, and μ is an error term[7].

CD production function is most widely used specification for function. The estimated coefficients (β_i) are partial output elasticities with respect to production of land, labour, cash input, manure and net area irrigated. These partial elasticities are defined as the ratio of the percentage change in output to the percentage change in input. The higher elasticity of particular input is referred as having relatively larger impact on output. Cobb-Douglas form imposes the assumption that all partial elasticities of substitution equal to one at every point in the input space. The summation of the elasticities for all explanatory variables is an estimation of returns to scale. However, in this CD production function, other variables are defined in per hectare. So the coefficient of cropland(β_5) is obviously referred as the sum of factor elasticities (see Bardhan, 1973). If the coefficient of cropland (β_5) is not significantly different than unity, returns to scale

[7] The error term captures the effects of all omitted variables assuming zero mean and unit variance.

are constant; if it is significantly above (below) unity, there are increasing (decreasing) returns to scale.

In general, all production inputs are not possible to observe as well as to measure in the same unit. In this production function, the variable I is considered as technical progress parameter, which assumes that irrigated land has higher possibilities of improving land productivity and crop intensity. Based on the data available, all irrigated plots are assumed to be homogenous (i.e. less variations in land productivity) that may not seriously affect the result. The labour input (L) is the total hours both hired and family as well as male and female used for farm production. This input is aggregated in one unit assuming that it is close to homogenous, in the sense that farmers may hire labour in case of not enough family members to fulfil household labour demand.

The variable M stands for the total kilogram of manure used for farm production. This is the principal and most common source of fertilizer in the study area. In addition, manure normally does not have any market value due to not having any transaction in the market. So this input is calculated in quantity not in cost. Farmers normally use small quantity of chemical fertilizer and modern varieties of seeds. Total cash spent for buying chemical fertilizer, modern varieties of seeds, farm equipments and cash for oxen hire[8] is aggregated in one variable as cash input(K). Several studies have included land fragmentation in the CD production function considering as source of production inefficiency in agriculture (Bardhan, 1973). Due to limitation of data, the paper assumes that there is less effect of land fragmentation on farm productivity. The study area has mostly similar structure and distribution of farm land (i.e. both rainfed and irrigated land) among the sample households, which may not affect the overall result by the exclusion of land fragmentation in the model.

Table 4 presents the result of Cobb-Douglas production and returns to scale, where the dependent variable is the log of the value of farm output. The coefficients of all factor inputs are statistically significant with an exception of net area irrigated per hectare. The coefficient of cropland (β_5) is not significantly different from unity, showing the evidence of constant returns to scale and significant at 10% level[9]. As for the coefficients of different factors of production, labour is observed more influential than other factor inputs (0.42), followed by manure (0.25).

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[8] Oxen are normally hired with male labour. But this cost covers only the total cost paid to hire oxen.

[9] I tested the coefficient of crop land (i.e. $\beta_5 = 1$) in STATA and F value(3.14) is significant at 10% level (P_{value}=0.08).

Table 4: Regression results of Cobb-Douglas production function[b]

Explanatory variables	Coefficients
Log irrigated land/hectare	0.21
	(0.16)
Log of cash input/hectare	0.13**
	(0.04)
Log of labour hours/hectare	0.42***
	(0.07)
Log of manure(in kg.)/hectare	0.25***
	(0.04)
Log of cropland	1.09***
	(0.05)
Constant	5.54***
	(0.54)
R^2	0.72
$F_{(5, 244)}$	125.23
No. of observations	250
Returns to scale	CRS
	($F_{(1, 244)}$ is 3.14)

[b]standard errors are given in parentheses.

***significant at 1% level.

** significant at 5% level.

The findings support the stylized fact that small farms are more productive than large farms because of their intensive use of both labour and cash inputs than large farms. The results from extended regression analyses do not support the hypotheses that the IR is due to variation of regions as well as access to resources. However, the analysis does not reject completely about the differences in resource accessibility among caste groups as well as family and hired labour.

5. Conclusions and policy implications

The paper analysed the relationship between farm size and productivity, applying data from a cross section household survey of Nepalese mid hills, and tested the almost 'stylized fact' of the inverse relationship between farm size and productivity. Output per hectare was used, and evidence found consistent and stable in both. The results of extended regression equations incorporating village dummies as cluster controls and ratio of irrigated land (as proxy for land quality) and other socio-economic variables such as household belonging to caste groups and family size(as proxy for access to resources) do not support the hypotheses in this model that the IR is due to variations in regions as well as access to resources among farm holders. The paper also estimated total cash input and labour hours per hectare in order to measure the productivity differentials. The results are significant and consistent with the models of output per hectare, reflecting that small farms use more input and labour unit per hectare than do large farms. The coefficients of family size both in output and in labour hours per hectare reveal the importance of family labour on farm productivity in most part of rural areas..

The paper further applied the CD production function in order to find returns to scale and the impact of factors of production in the Nepalese agriculture. The evidence found constant returns to scale at 10% level of significance in hilly region of Nepal, rejecting the hypothesis that the IR is due to decreasing returns to scale. This result could be more of an inverse correlation between size and other inputs than of scale of diseconomies as mentioned by Bardhan (1973). Among the different factors of production, labour input seems more influential than other factors of production followed by manure. The coefficient of cash input shows that the impact of tradable inputs is still insignificant in the sample farms.

Since there are very few studies on farm size and productivity relationship conducted in Nepal, results from this paper could be useful for further empirical studies. Further studies need to explore the impact of land fragmentation and distance of farm land from the homestead on farm productivity, as well as crop specific productivity in order to identify the best suitable crop for increasing productivity in the different agro-ecological zones.

Policies need to be identified for countries like Nepal, where the average farm size is relatively low and the majority of farmers own less than one hectare of farm land, on high yielding crops in dealing with demand and supply side of the products through investment in infrastructure and technologies that can increase the use of tradable inputs both for small and large farms in all agro-ecological zones of Nepal, rather than land redistribution.

Acknowledgement

I would like to thank Margaret Loseby, Attilio Coletta and Guido Agostinucci of the University of Tuscia, Viterbo(Italy) for valuable comments and suggestions. Comments from two anonymous reviewers are highly appreciable to revise this paper. Thanks to the Norwegian University of Life Science for providing fund for the master study in Development and Natural Resource Economics and conducting field survey.

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