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**HOUSEHOLD HEADS, NON-ECONOMIC FACTORS AND  
GRAIN PRODUCTION IN CHINA IN THE 1990s**

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**Abstract**

The omission of relevant independent variables in the estimation of agricultural production functions gives rise to mis-specification and biased estimators. Using disaggregated household survey data, this study finds that official positions and education of household heads are important determinant of grain output in rural China and should be incorporated into the production functions. The impact of non-economic factors on grain output is caused mainly by the imperfections in the market for farm inputs and collective ownership of large productive assets for farm production. Policy implications are drawn for further reforms in China's grain markets and rural administration system.

**(JEL: Q12, P26)**

## **Introduction**

In the conventional approach to the study of agricultural productivity in China, insufficient attention has been given to the role played by the quality of labour and land (Lin 1992 ; Fan 1991). Using disaggregated household survey data, some recent studies of China's grain production have incorporated the quality of labour and land into their models (Wu and Meng 1995; Sicular 1995; Nguyen, et al, 1995). In these models, average education and experience of all household labour have been used as proxies for labour quality and land fragmentation (or plot size) has been used as a proxy for the quality of land. This paper analyses the importance of the contribution of the characteristics of household-heads to China's grain output.

Since the implementation of the household responsibility system in the late 1970s and early 1980s, grain production in China has been undertaken mainly by individual households. As the decision makers for family production and investment, household-heads' education and experience are expected to play a significant role in China's grain production. Household-heads are also critical in terms of the social connections between the family and the outside world. Here, the role played by household-heads is distinguished from others. Education and experience of household heads are separated from the rest of the family labour and enter the model directly. Another important issue associated with household heads in terms of grain production is their occupation. Wu and Meng (1995) found that the effect of re-allocation of family labour from farm to non-farm activities on grain production is negligible. On the assumption that household head plays a special role in grain production, it would be interesting to test

empirically the effect of the shift of household head from farm to off-farm occupations on grain production.

In a centrally planned economy at transition, decision making by local officials may still be important in determining farm incomes and output. According to Rozelle and Boisvert (1994), local officials in rural China remain responsible for many economic decisions. Several authors have suggested that officials (who are usually also household-heads) in rural China may have benefited disproportionately from the economic reforms. One reason could be that officials were able to obtain more than average size of land in the process of decollectivization and were able to sign favourable contracts to deliver their products to the collectives (Yan 1992). Another reason is officials' privileged access to state rationed material inputs such as chemical fertilisers, pesticides, and diesel fuel (Feder, et al. 1992). Oi (1986) suggests that officials have the advantage of access to a large network of personal connections and thus have better access to market information and outlets. Commenting on the characteristics of individuals that have done well out of rural reforms, Oi wrote, 'Contacts and enterprise are the distinguishing characteristics, not youth and education' (Oi 1986, p.100). It is, however, not possible to tell from the studies of Oi and Yan whether the officials were able to benefit disproportionately from the reforms because of their greater endowment of human capital from better education or as a result of their official positions. If the former is the case, despite officials benefiting disproportionately from the reform, one could argue that reforms have been a success because material rewards are now based on economic rather than non-economic factors.

As far as grain production is concerned, local officials may benefit from their official positions with better access to the supply of chemical fertiliser, new seeds and farm machines which in many cases are still owned by collectives. They may also have more access to information on new farm technology and management. A test of the relations between household grain output and both official status and human capital variables should reveal more information about government intervention in China's grain production and the extent of market liberalisation in China's grain economy.

In this paper, Section 2 describes the data and study areas. The model is specified in Section 3 and the results are discussed in Section 4. Conclusions and policy implications are drawn in Section 5.

## **2. Study Areas and Data**

Data for the present study came from a sample survey of 1041 rural households conducted in 1994 and 1995. The survey was designed and conducted jointly by the Chinese Economy Research Unit of the University of Adelaide, Australia and the Ministry of Agriculture in China. The following data are collected: crop production and uses; population, education and experience of household heads and other household members; occupation (including official status) of household-heads; various direct inputs for grain production, including sown areas and number of plots, labour working days, chemical fertilisers, and other variable inputs; capital stock owned by households. The capital equipment owned by households could be used for both grain and other farm and off-farm activities. Compared with many other datasets used for the estimation of grain production functions in China, this dataset has two

distinguished features in addition to the large sample size. First, it has direct land, labour and other variable inputs used for grain production only, including farm working days which are an accurate measurement of labour input in agriculture. Second, the dataset contains detailed information on human capital variables and occupation of household-heads which are not usually available for such a large sample size.

The households under survey were sampled from five provinces of China:

Guangdong, Jilin, Jiangxi, Sichuan and Shandong. Of 1041 sample households, 215 were from Guangdong, 201 from Jilin, 205 from Jiangxi, 200 from Sichuan and 220 from Shandong. Although the selection of sample provinces and counties was biased slightly toward major grain producing areas, the sample provinces can be regarded as representative of rural China, except the very poor north-west. The five provinces are located in different parts of China. Guangdong, Shandong and Jilin provinces are located in the more developed coastal areas of the Eastern China, with Guangdong in the rich Pearl Delta down in the south, Jilin in the industrial area of the Northeast and Shandong in the north China. Sichuan and Jiangxi are poor inland provinces, with Sichuan located in the south-west and Jiangxi in the middle south. The basic economic statistics of the five provinces, as compared with whole China, are presented in Wu (1995). The model estimation in this study is supplemented by the field work undertaken by the author in two of the five provinces: Jiangxi and Sichuan provinces in 1995 and 1996.

The data from 1994 and 1995 are pooled together to increase the sample size. Of 1041 sample households in each year (there are more than 2000 observations in the two

years), there are about 100 household-heads who have official positions (township or village officials). All of them but seven are village officials. By our definition, village officials include village head, secretary of the Communist Party's village branch, and village accountant. Other less important village officials, such as the directors of village women's federation and Communist youth, are not defined as village officials. Some households did not provide detailed information on education, income, experiences and some other farm inputs. Finally, a total of 1646 observations from the two years are used for model estimation.

### 3. A Model of Grain Production in China

Let  $Y$  denote output,  $X_1 \dots X_k$  denote inputs, a Cobb-Douglas production can be specified as:

$$(1) Y = \alpha_0 X_1^{\beta_1} X_2^{\beta_2} \dots X_k^{\beta_k}$$

In a cross section study, although all households may face common technological possibilities, household preference, ability to acquire and process information and many other household specific characteristics have very important impacts on the household production decisions. Human capital theory suggests that the household management skill, schooling education and experience should be the critical inputs of household production (Schultz 1960; 1994). After the economic reforms in the late 1970s and early 1980s, grain production has been undertaken by the households. A closer relationship between returns on education and educational investment by the communities and households in rural China is therefore expected. When the

relationship between education investment and return are viewed as a production function, the rural economic reforms introduced in the late 1970s and early 1980s would have altered the rate of private returns on education investment in rural China. Nevertheless, as the rural economic reforms are still under way, state and local government interventions, such as grain and cotton quotas (see Sicular 1995), and non-economic factors, such as the official positions held by household heads, may still contribute to the process of household grain production in China. Exclusion of these important variables would lead to misspecification when either cross section or time series data are used for the estimation of production functions for China's agriculture. Thus misspecification cannot be resolved simply by the use of White's procedures.

Based on the work of Mincer and Polachek (1974), the proposed model incorporates human capital variables and non-economic variables into a Cobb-Douglas production function. The Cobb-Douglas specification is chosen here not only due to its popularity, but more importantly because the function seems to describe Chinese agricultural technologies well (Lin 1992; Fan 1991; Wan and Anderson 1990). As the previous studies (Griliches 1977, Byron and Manaloto 1990) suggest that the relationship between incomes and human capital factors is log-linear, the function can be specified as follows:

$$\begin{aligned}
 (2) \text{ Log } Yg_i = & \mathbf{a}_0 + \mathbf{a}_1 \log S_i + \mathbf{a}_2 \log Ct_i + \mathbf{a}_3 \log Cf_i + \mathbf{a}_4 \log LD_i + \mathbf{a}_5 \log K_i \\
 & + \mathbf{a}_6 Sh_i + \mathbf{a}_7 Sh_i^2 + \mathbf{a}_8 Sm_i + \mathbf{a}_9 Sm_i^2 + \mathbf{a}_{10} Ah_i + \mathbf{a}_{11} Ah_i^2 + \mathbf{a}_{12} EAm_i \\
 & + \mathbf{a}_{13} Am_i^2 + \mathbf{a}_{14} J2_i + \mathbf{a}_{15} J3_i + \mathbf{a}_{16} Q_i + \mathbf{a}_{17} \log P_i + U_i ;
 \end{aligned}$$

In (2),  $Y_g$  is total grain output produced by a household, measured in Jin (1 jin=0.5 kg). The output is weighted rice-equivalent output and the weights are based on the parity price ratio of agricultural and industrial products in China (see Table 1).  $S$  is the sown area of households for grain production measured in mu, with 15 mu being equal to 1 hectare.  $Ct$  and  $Cf$  are total farm inputs for grain (except chemical fertiliser) and input of chemical fertiliser for grain respectively in Chinese yuan. Considering the importance of chemical fertiliser to the growth in China's grain output, chemical fertiliser in the current study is separated from total farm inputs.  $K$  is the total capital stock owned by households measured in yuan. Here  $K$  is used as a proxy for household farm capital stock which is expected to affect household grain production. In practice it would be difficult to separate household farm machines from other machines, as some of the farm machines, such as tractors, are used for non-farm purposes, and vice versa.  $Ld$  is working days for grain production measured in adult person days. The working days by 'semi-labour', defined as those under 16, are discounted by multiplying a coefficient<sup>1</sup> of 0.7, and  $i$  is an index identifying a particular household in the sample. Following Sicular (1995), grain quotas  $Q$  (measured in 1000 jin) enters the function as an independent variable. Community inputs are not included in the model as a separate independent variable. Nevertheless, the fees paid by the households for the use of collective assets, such as tractors and draught animals, are a part of total farm inputs for household grain production.

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<sup>1</sup> It is an usual practice to convert semi-labour time into full adult labour time by a factor of 0.7 in China (Handbook of Agricultural Technical Economics 1986).

Quality of land in the model is measured by land fragmentation. In the model, the extent of land fragmentation is represented by plot size  $P$ , which equals the farm size to be divided by the total number of plots. A positive relationship between plot size and grain output is expected. The quality of labour is measured by the schooling, experience of both household heads and other labourers of the household, as well as the occupation of household heads. In the model,  $Sh$  is schooling years for household-heads,  $Sm$  refers to the average schooling years received by all the workers except the head.  $Ah$  and  $Am$  are the ages of household heads and average ages of other household workers. The squared terms of the education and experience are included in the model to allow for the change in marginal products of education and experience.

The occupation of household heads are divided into two broad categories: farm and non-farm activities, depending on the number of working days.  $J3$  is a dummy variable denoting whether the household heads' main occupation is in farm or non-farm activities.  $J2$  is a dummy variable for the official status of household heads, with 1 representing village or township officials. A year dummy,  $dy$  is also added to the model to catch the effect of weather.

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#### 4. Discussion of Results

The results of the regressions are summarised in Table 2. The production function with full specification is estimated first and the results are presented in the middle column of Table 2. Nevertheless, the relationship between squared terms of average education and grain output contradicts the assumption of diminishing marginal returns for school education. By removing those independent variables which are less significant to grain output and replacing the semi-log with a log relationship between output and average education, we obtained a revised model for estimation. The results estimated from the revised model are shown in the right column of Table 2.

Again, we removed the least significant variable *LSM* and obtained a new set of estimators. The final specification and estimations are shown in Table 3. In all the specifications discussed above, dummy variables for intercepts are included in the estimation and they are not reported. White's consistent covariance matrix is used to adjust the problems with estimation caused by heteroscedasticity. Experiments were also conducted with the dummy variables affecting the slopes through their effects on land, capital stock, chemical fertiliser and total other inputs; but none of the coefficients were significantly different from zero and they were dropped from the equation. The following discussion is based on the results shown in Table 3.

Given the use of the cross section observations, the model fits the data well. All the parameters which are statistically significant have the expected signs and R squared is as high as 0.86. Not surprisingly, land is the most important input for grain production. The higher output elasticity for land and variable capital and low output elasticity for labour reflect the reality of high labour land ratio in Chinese agriculture.

The positive coefficient for labour working days indicates that even in a country like China where substantial surplus labour does exist in agriculture, the marginal production of labour for grain production would not be zero as suggested by Lewis (1954), owing to the fact that grain production, particularly paddy rice production, requires intensive labour input during the sowing and harvesting seasons (Meng and Bai 1988). Considering the important contribution made by human capital variables to grain output discussed below, labour input with education and skills may not be replaced simply by the larger quantity of unskilled labour input. The observed zero or negative output elasticity for agricultural labour in some other studies (e.g. Nguyen and Wu 1993, Wan and Anderson 1990) could be caused by the use of number of workers instead of farm working days. The latter is obviously a far more accurate measure of labour input in agriculture. The relationship between output and labour input in the labour surplus economies is a topic for further research.

The positive sign for plot size confirms the results of previous studies on land fragmentation in China by Fleisher and Liu (1992) and Nguyen et al (1995) and the effect of grain quotas on grain output is consistent with the study by Sicular. The reasons for the positive contribution made by quotas to grain productivity is explained by Sicular (1995).

The results in Table 3 indicates that the education of household-heads has a significant effect on grain output but that the marginal return of education of household-heads on grain output is declining. The significant effects of education of household-heads on grain output may have been related to the fact that with the increased use of chemical

fertiliser and other modern inputs in agriculture in recent years, grain production has become more and more dependent on basic school training. The insignificant relationship between grain output and average education of other labour is consistent with the observation in the surveyed provinces that major decisions on grain production have been made by household heads. Moreover, many younger and educated labourers have lost their interest in grain production and have transferred or are transferring from farm to off-farm activities. Consequently, grain production becomes more and more dependent on the labour and technical inputs from household heads. In a typical household in Southern Jiangsu where many labourers had been employed by rural enterprises, grain production was undertaken mainly by household-heads on a part-time basis (Cheng 1993). The results suggest that the effect of education on grain output may depend, to some extent, on the interest and commitment of individuals. If one has little interest on grain production, the effects on her (his) education on grain production may have to be discounted. The results justify the separation of education and experience of household-heads from the rest of the household labourers.

The results in Table 3 also show that the experience of household-heads (proxied by age) have little effect on grain production. This may have been related to the fact that with the increased use of chemical fertiliser and other modern inputs in agriculture in recent years, the past experience of household-heads in farming production and those experience obtained under collective farming becomes less and less relevant.

However, as far as the younger labourers are concerned (who usually have little practical experience in farming), their productivity is affected by farming experience

gained recently and so their experience is more relevant to productivity. We may have observed the phenomenon of diminishing return of age on grain productivity.

Experiments were also conducted to estimate the production functions with the education and experience of household-heads not separated from the rest of the family labour. In the functions estimated, average education and experience of household labourers include those for household heads. The results of the regressions are shown in Table 4. For all the specifications in Table 4, *ST* and *AT* are the average education and experience for all household labourers, including household-heads. Based on the diminishing marginal returns for average education, we select the model with log form for average education (the far right column of Table 4). The results in Table 4 indicate that average education, not experience, is related to grain output. The comparison of results in Table 4 with those in Table 3 reveals that the significance of average education for all labourers for grain production in a household (see Table 4) would have been caused by the education of household-heads alone. As long as household-heads are dropped from the average, the average education of other household labourers becomes no longer significant in explaining grain output. Thus to avoid biased estimation, it is important to separate the human capital variables of household-heads from other household labourers.

The impact of occupation of household heads on grain output is related to the fact that, unlike their offspring, when household heads shifted to off-farm activities, they usually found employment nearby. It is therefore possible for them to work on their land in the morning and evening, and on holidays (Cheng 1993). The above discussion also suggests that the contribution of household heads' education to grain output is

mainly for gathering information, planning, and production decision making, which could be more important than their actual time spent on farm.

Grain production of village and township officials have clearly benefited from their official positions. It is important to note that the significance of the relationship between grain output and official positions does not imply that officials have better access to preferential low state quota procurement and thus receive higher prices from their grain sales, nor is the relationship related to land quality. In this study, degree of land fragmentation acts as a proxy for the quality of land contracted to each household. On examination, the data show no systematic relationship between the extent of land fragmentation and the status of household-heads. Whether the household-head is an official or not does not determine the extent of fragmentation of the household's land. Land in China was contracted to the households in the late 1970s and early 1980s and since then only minor adjustments were made to the land contracts in the survey areas. It is therefore possible for the then officials to have access to better land, but more difficult for today's officials to re-allocate the land among households for their own benefits without causing public resentment.

It was found on field work by the author in both Jiangxi and Sichuan that many village and town officials usually do have privileged access to state subsidised inputs such as chemical fertiliser and new seeds. Moreover, as farm machines and draft animals in many regions are still owned by collectives, officials may have better access to these production inputs and it is also possible for them to use these inputs and irrigation at a lower price. It was also observed that with close connections with technical supporting

stations at the township level,<sup>2</sup> they could receive better and more timely technical supports than others.

## **Conclusion and Policy Implications**

This study found that, despite economic reforms in rural China, non-economic factors continue to determine grain production in the five major grain producing provinces of China. In addition to the gains from their investment in human capital, there is an association between official position and grain output. Thus both economic and non-economic factors matter in China's grain production. There is no systematic relations between official positions and better quality of land. The positive effects of official position on grain output are more likely to be caused by the collective ownership of some large farm equipment and privileged access to state subsidised farm inputs, public goods such as irrigated water and technical information and supporting services. It is also likely that grain producers other than local officials have relatively less access to state subsidised farm inputs, mainly chemical fertiliser, pesticide and new seeds, provided in return for the delivery of grain to the state at lower than market prices. These results have a number of implications. The first relates to reform of input markets. The grain market reforms in the last 10 years have focused on the marketing of grain, as grain marketing has an important impact on state budget,

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<sup>2</sup> In rural China, there are a number of technical support stations at the township level financed by the local budget. The ones concerning grain production include agricultural technical extension station, soil and fertiliser station and hybrid seed station.

welfare of grain consumers and income of grain producers. The current study suggests that to improve the efficiency for grain production, more substantial reforms are required in the markets for farm inputs and provision of farm technology.

In a semi-reformed rural economy where political reforms lag behind, town and village officials are normally appointed by the governments above and nearly all the village officials work for the fellow villagers on a part-time basis. In the major grain producing areas, wages of these officials mainly depend on the payment of fees for the land use from individual households. Consequently, the formal payments received by village officials vary with regions and time. It is generally difficult for village officials to increase the amount of land use fees paid by households. In a disastrous year, the public work undertaken by an official in a year is less likely to be compensated adequately. Even in a normal year, the formal payment to village officials in many regions of China may not be sufficient considering the time spent and the difficulties with the village work. It was found in the survey that many village officials complaint about the nearly impossible work of family planning and quota purchase of grain from farm households. In addition, there is generally no pension or other insurance for village officials. The benefits brought about by the official positions may have been a form of compensation for the low payment to village officials.

There are however problems associated with this kind of compensation which is illegal and not transparent. To raise grain productivity on a sustainable basis, all grain producers shall be given equal access to technical supports and use of collective assets, if there is still a need for some important farm equipment to be owned by collectives. The subsidised schemes for the supply of farm inputs for grain production

may only benefit those who have official positions and special connections. Better results could have been achieved if the state used the same subsidies to raise quota prices for grain. On the other hand, the wage payment to village officials shall be increased to give sufficient incentive to village officials. That is, the indirect compensation shall be replaced by direct compensation. One option would be the creation of one or two full-time positions for village officials and the reduction of the total number of village officials (currently there are about three to five part-time village officials who are paid from the land use fees). Thus further reforms are needed not only for the marketing of farm goods and farm inputs, but for the administrative framework in rural China.

Education of household-heads have significant effects on grain output. The results of the study indicate that the farm experience gained by household-heads long time ago has little relevance today in terms of household grain output. With the increased use of chemical fertilisers, new seeds and other modern inputs, grain production becomes more and more capital-intensive and hence quality labour inputs (labour with more education and skill components) could be less likely to be replaced simply by more input in labour quantity. More attention should be given to the further education and training for those household-heads in their forties and fifties who are usually the major decision makers in China's grain production and marketing and who are less likely to move out of grain production completely. On the assumption that the increases in domestic grain production is essential for food and economic security in China, more investment in education and technical training is required. The recent decline in school enrolment rates (The Statistics of China's Rural Economy 1985 to 1994) needs

to be addressed urgently, if the state is serious to meet its objective for continuous increase in grain output.

Care must be exercised when one attempts to generalise results from this study to poor Northwest part of China. The effects of human capital investment on grain production may depend on other factors, such as the availability of modern inputs, water irrigation and soil conditions. The interaction between education and these factors are topics for further research.

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23.

**Table 1. Grain Aggregation Weights Based on Parity Prices Ratios for Grain Products**

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<b>Crop</b>	<b>Weight</b>
Rice	1
Wheat	1.319
Corn	0.9569
Millet	1
Sorghum	1
Soybeans	2.216
Tubers	0.22

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Source: Statistical Yearbook of China, 1987, p.585.

**Table 2. Determinants of Grain Output**

	Full Specification	Specification with Log <i>sm</i>
Intercept ( <i>C</i> )	5.220*** (19.40)	5.439*** (28.15)
Land Area ( <i>LS</i> )	0.636*** (19.14)	0.641*** (20.81)
Total farm inputs ( <i>LCT</i> )	0.086*** (3.60)	0.086*** (3.68)
Chemical fertiliser ( <i>LCF</i> )	0.074*** (3.60)	0.071*** (3.72)
Farm working days ( <i>LLD</i> )	0.094*** (4.09)	0.092*** (3.94)
Capital Stock ( <i>LK</i> )	0.034*** (5.24)	0.034*** (5.19)
School of head ( <i>SH</i> )	0.019** (2.27)	0.017** (2.03)
School of head squared ( <i>SH</i> <sup>2</sup> )	-0.001* (-1.79)	-0.00078 (-1.41)
Average education ( <i>SM</i> )	0.777* (1.78)	
Average Education squared ( <i>SM</i> <sup>2</sup> )	-0.00004 (-0.86)	
Average education ( <i>LSM</i> )		0.021 (1.06)
Age of head ( <i>AH</i> )	0.334 (0.54)	
Age of head squared ( <i>AH</i> <sup>2</sup> )	-0.000041 (-0.604)	
Average age ( <i>AM</i> )	0.017*** (2.68)	0.103 (1.54)
Average age squared ( <i>AM</i> <sup>2</sup> )	-0.00022*** (-2.69)	-0.00013 (-1.47)
Dummy (official)	0.101*** (3.86)	0.099*** (3.90)
Dummy (off-farm job)	0.037 (0.96)	
Grain quota ( <i>Q</i> )	0.014*** (3.88)	0.015*** (4.02)
Plot Size ( <i>LP</i> )	0.029** (2.04)	0.029* (1.89)
Year Dummy ( <i>DY</i> )	0.262 (0.14)	
No. observations	1646	1603
Adjusted R-squared	0.866	0.865
F-Statistic	485.745	644.968

Notes: (1). \*\*\* indicates significantly different than zero at 1%, \*\* 5% and \* 10% level of confidence. (2). Figures in brackets are t-ratios. (3). All standard errors and significant levels are adjusted using White's method.

**Table 3. Determinants of Grain Output**

	Final Specification
Intercept ( <i>C</i> )	5.362*** (27.63)
Land Area ( <i>LS</i> )	0.636*** (21.02)
Total farm inputs ( <i>LCT</i> )	0.084*** (3.74)
Chemical fertiliser ( <i>LCF</i> )	0.073*** (4.00)
Farm working days ( <i>LLD</i> )	0.093*** (4.07)
Capital Stock ( <i>LK</i> )	0.034*** (5.18)
School of head ( <i>SH</i> )	0.023*** (2.91)
School of head squared ( <i>SH</i> <sup>2</sup> )	-0.0011** (-2.04)
Average age ( <i>AM</i> )	0.016*** (2.62)
Average age squared ( <i>AM</i> <sup>2</sup> )	-0.00023*** (-2.80)
Dummy (official)	0.099*** (3.89)
Grain quota ( <i>Q</i> )	0.014*** (3.90)
Plot Size ( <i>LP</i> )	0.032** (2.17)
No. observations	1646
Adjusted R-squared	0.8665
F-Statistic	712.69

Notes: (1). \*\*\* indicates significantly different than zero at 1%, \*\* 5% and \* 10% level of confidence. (2). Figures in brackets are t-ratios. (3). All standard errors and significant levels are adjusted using White's method.

**Table 4. Determinants of Grain Output**

	Specification 1	Specification 2	Log <i>ST</i> and <i>AT</i>
Intercept ( <i>C</i> )	5.482*** (21.78)	5.582*** (34.71)	5.551*** (33.04)
Land Area ( <i>LS</i> )	0.638*** (20.26)	0.636*** (20.90)	0.641*** (20.80)
Total farm inputs ( <i>LCT</i> )	0.086*** (3.67)	0.089*** (3.95)	0.086*** (3.76)
Chemical fertiliser ( <i>LCF</i> )	0.072*** (3.73)	0.072*** (3.92)	0.072*** (3.86)
Farm working days ( <i>LLD</i> )	0.093*** (4.06)	0.092*** (4.02)	0.092*** (3.96)
Capital Stock ( <i>LK</i> )	0.035*** (5.35)	0.035*** (5.43)	0.035*** (5.37)
Average education ( <i>ST</i> )	0.0096*** (2.72)	0.011*** (3.06)	
Average Education squared ( <i>ST</i> <sup>2</sup> )	-0.0001 (-1.25)	-0.0001 (-1.30)	
Average education ( <i>LSM</i> )			0.068*** (3.27)
Average age ( <i>AT</i> )	0.0033 (0.78)		
Average age squared ( <i>AT</i> <sup>2</sup> )	-0.000022 (-0.899)		
Dummy (official)	0.10*** (3.90)	0.097*** (3.89)	0.102*** (4.07)
Dummy (off-farm job)	0.034 (0.88)		
Grain quota ( <i>Q</i> )	0.014*** (3.93)	0.014*** (3.95)	0.015*** (3.99)
Plot Size ( <i>LP</i> )	0.032** (2.16)	0.032** (2.17)	0.03** (2.02)
Year Dummy ( <i>DY</i> )	0.0099 (0.58)		
No. observations	1646	1646	1631
Adjusted R-squared	0.866	0.866	0.866
F-Statistic	625.36	818.4	877.3

Notes: (1). \*\*\* indicates significantly different than zero at 1%, \*\* 5% and \* 10% level of confidence. (2). Figures in brackets are t-ratios. (3). All standard errors and significant levels are adjusted using White's method.

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