AGRICULTURAL PRODUCTION ORGANIZATION IN TRANSITION ECONOMIES AND THE ROLE OF HUMAN CAPITAL: EVIDENCE FROM ROMANIA

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Abstract:
This paper examines the production mode choices of rural households with an emphasis on the role
of human capital in the agricultural transformation process. Farm restructuring in Central and Eastern Europe has resulted in a broad range of farm types, such as co-operatives, partnerships, individual farms and combinations of those. The fact that resources are allocated into different production organization modes is attributed to the utility maximization strategy of heterogeneous agents deriving income from uncertain sources in the face of absent or imperfect factor markets. Empirical results from a multinomial logit model estimated with data from two-year nation-wide survey of Romanian farm households support the hypothesis that the outcome of the transformation
process depends primarily on both the human capital characteristics of and economic risks faced by
the households.

Key Words: human capital, production organization, agricultural transition, Romania

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1 INTRODUCTION

Under central planning, agricultural production was organized in large-scale collective and state farms. Economic reforms involved both the privatization of agricultural production assets and the restructuring of state and collective farms. Farm restructuring has resulted in several farm types, such as co-operatives, partnerships, individual farms and various combinations of them. A broad range of farm types can be found in most transition countries, but their relative importance differs considerably across the region (Swinnen et al., 1997). One of the countries with most variety in agricultural production organization is Romania, where besides the main farm organization types are also observed hybrid forms such as combination of individual farming and association farming
and part time farming (MAF et al., 1997; Rizov et al., 2001).

The incentive of a farm household to adopt a particular production organization is determined by the trade-off between the advantages and disadvantages characterizing each of the

farm types. For example, advantages of individual farming include lower transaction costs associated with reduced inefficiencies due to the right of co-determination. Potential disadvantages
include the loss of economies of scale in risk management, input purchasing, and marketing. Further, there might be "exit costs" for co-operative members to leave the collective farm, and "entry costs" to start up an individual farm. These costs are affected by land reform, privatization and transformation regulations (Mathijs and Swinnen, 1998).

While the role of human capital during transition has been mentioned, no studies formally modeled or empirically estimated its impact on the agricultural production organization in transition
economies. In the development literatur e, the role of human capital is emphasized in the "agricultural ladder" hypothesis (Spillman, 1919; Rao, 1971, Higgs, 1973; Reid, 1976). At the bottom of the ladder, agents with a low level of human capital are employed as landless hired workers. The next step up the ladder involves cultivating some land either individually under a sharecropping contract or under some other form of co-operation. For this, agents need to have a higher level of both farming skills and capital. The ladder's top rang is the owner-operator. In related work, Hallagan (1978), Newbery and Stiglitz (1979) and Allen (1982) have developed screening models where different contracts are offered by landlords as way of screening tenants of
different skills.

This framework is useful for understanding the post-communist agricultural transformation process. New landowners face the choice of managing their land and acting as entrepreneurs, leasing their land (and labor) to other farms, or looking for alternative options to allocate their assets. The present paper develops a general model where the fact that resources are allocated into
different production organizations can be attributed to a utility maximization strategy of households
with different asset portfolios, both in terms of quality and quantity. Households that become individual operators are expected, relative to ones choosing co-operative farming, to possess greater
business acumen as well as conventional labor force skills and greater access to financial capital, which minimizes their production risk exposure. The process is complicated by factor market imperfections characterizing transition.

The generalization we introduce through our model includes (i) allowing agents to be risk averse in general and considering their risk premiums explicitly and (ii) allowing for different efficiency or farming skill levels across agents. The theory developed here provides an explanation
of several production organization issues in transition agriculture such as the existence of hybrid modes of organization and the co-existence of different modes of organization. Furthermore, we examine empirically the production organization choices of rural households using unique two-year
household survey data from Romania, a country characterized by a variety of farm types.

The paper is organized as follows: In section 2, the analytical framework is developed. In section 3, empirical tests are carried out using multinomial logit model. The estimation results are reported in section 4, followed by a discussion and conclusion in section 5.

2 ANALYTICAL FRAMEWORK

Assumptions

Human capital determines the farming, and in general managerial, skills of rural households.[1] The market for managerial skills in agricultural production is imperfect due to two fundamental information problems. First, human capital, and thus managerial skills, vary widely across potential individual farmers, but cannot be judged *ex ante* (Johannisson and Senneseth, 1993; Knight, 1957).

Second, due to the high nature dependence of agricultural production, it is very difficult to measure managerial input *ex post* (Allen and Lueck, 1998; Binswanger and Rosenzweig, 1986; Feder, 1985).

As a result, Akerlof's (1970) "lemon dilemma" applies to the market for managerial skills in agricultural production.

The output from the household endowments of capital and labor depends, in general, on the farming efficiency or skills of the agent(s) managing the farm operation, on the economic risks under which household(s) operates, assuming the agent(s) is risk averse. Five modes of production organization are modeled: individual farm operation, co-operative farming, hybrid form of farming where individual farmers participate in a co-operative, part-time farming, and absentee landowners not engaged in farming at all.

The stochastic output of the household, produced over a crop cycle, depends on the factor intensity measured by the labor input in farming (l) and the farming efficiency or skill level (e) of the party(s) managing different production organizations. In individual farming both labor input and managerial skills, determining farming efficiency, will be supplied by the household. In contrast, in co-operative farms the labor supplied is of wage type and usually is more narrowly specialized. Agricultural production also requires capital and several variable inputs such as machinery, seeds, fertilizers and pesticides. The use of these inputs depends on the level of technology and availability, which we assume fixed across the production organization modes.[2] Thus what we call the production function may alternatively be thought of as the reduced profit function and can be written as:

$q=ef(l)$, (1)

where e is the efficiency or skill factor that is determined by the agent(s)' human capital endowment and l is the labor input in farming.[3] f is the production function for an agent(s) with efficiency factor e=1, and is assumed to be linearly homogenous, increasing, concave and twice differentiable in l. It is further assumed that $f(0)$ is a positive constant equal to the required rate of return on the physical assets employed.

When the agent solely manages the farm (as it is in the case of individual farming) the efficiency factor e would equal e_I, corresponding to the individual farmer efficiency level. When farming is organizer in a co-operative most of the managerial and allocation decisions would be carried out collectively and the efficiency factor e would equal e_A, which is assumed to be a constant and exogenous to the individual farmer's efficiency level. In a hybrid mode of production organization, the managerial functions and thus the effects of efficiency factors, are divided

between individual farming and co-operative farming, in proportions corresponding to the asset shares allocated to these production modes. Thus, if the individual farm share of assets is r and that
of the association farm is $(1-r)$, the efficiency factor e for the use of household assets is given by:

1 Human capital also affects agent(s)'s off-farm employment opportunities.

2 As in our analyzes here we are interested explicitly in the ability and effort of agent(s) as determinants of production
organization in agriculture we have suppressed the capital inputs in our notation and consider them fixed. Moreover, this assumption is very reasonable for the economies in transition. However, in the empirical analysis we control explicitly for capital endowments.

3 With the current state of technology, we assume the same level of labor intensity both in individual farms and in cooperative
farms. The monitoring and moral hazard problems are associated mainly with application of farming skills
and making managerial decisions, so that the factor intensity can be considered the same across the farm modes.

$$e=[(1-r)e_A+r?e_I]=[e_A+r(?e_I+e_A)], \quad (2)$$

where ? is a multiplicative risk factor in individual farming, with a mean value of 1: E?=1. Thus in
general, the output q of the household assets is given by:

$$q=ef(l)=[e_A+r(?e_I+e_A)]f(l). \quad (3)$$

Note that in equation (3) e reduces to e_A when r=0 (association fa rming mode) and to $?e_I$ when r=1
(individual farming mode).[4] Also note that when the household labor input is zero (with the managerial input being exogenous to the household as well), the production organization reduces to
an absentee ownership mode.

The household maximizes the expected utility, EU, of its income Y, given by:

$$Y=R_A+r?e_If(l)+(1-l)w \quad (4)$$

As a labor supplier, household has a fixed amount of total labor per period, which is normalized to 1 and a market determined opportunity cost w per unit of labor from working in the casual market where it can sell as much labor as it wants. Thus the household has a market determined reservation utility level, $U_M=U(w)$.[5] Similar assumptions apply to the utility maximization of the household as a capital asset (land) owner. U in both situations is assumed to be
increasing, concave and twice differentiable in its arguments. Note that the concavity assumption implies that in both aspects the household is risk averse.

Household optimal organization

We consider a two-stage decision problem of the household. In the first stage, the land owning household decides (binding decision) with respect to the share r of assets allocated to individual farming. The decision of the household is subject to expected utility EU, from the allocation being
no less than its reservation utility, U_M. The second stage takes r as given and the household chooses
its farm labor, l. Using backward induction, we first analyze the second stage of the decision problem for arbitrary r and then we consider the first stage decision where the optimal share r^*, is chosen.

✍ *The choice of farm labor input l*: For given r, the household as labor supplier chooses l, so as to maximize its expected utility, EU: $\text{Max}_l=EU[(1-r)e_Af(l)+r?e_If(l)+(1-l)w]$. The first order

condition with respect to l is: $EU'[(1-r)e_A f_l + r?e_I f_l - w]=0$ or

$(1-r)e_A f_l + (1-p)re_I f_l = w$, (5)

where

$p=1-E?U'/EU'$, (6)

is the marginal risk premium of the household associated with production risk ($0?p<<1$) and f_l is the

derivative of $f(l)$ with respect to l. Equation (5) suggests that in equilibrium, the household has to balance the benefit of increased input, l, against the cost of additional input, w.[6] Thus , we have obtained the standard labor allocation equation where the marginal product of labor in farming is equalized with the price of labor, w. Finally, we can also write l as an indirect function of r so that

$l=l^*(r)$, i.e., that for a given share, r, there is a unique optimal level of l that maximizes household

utility.

✍ *The optimal choice of individual farming share r*: Now we consider the first stage of the decision problem. In this stage the optimal level of share, r, is chosen so as to maximize the household's expected utility: $\text{Max}_r = EU[(1-r)e_A f(l) + r?e_I f(l) + (1-l)w]$, subject to $l=l^*(r)$.

Differentiating with respect to r yields (assuming interior solution, r? (0,1)):

$EU'[-e_A f(l) + (1-r)e_A f_l(l)l_r + ?e_I f(l) + r?e_I f_l(l)l_r - l_r w]=0$, (7)

[4] For simplicity of notation we do not distinguish formally between different types of household labor; l is labor input in

farming and the reminder $(1-l)$, if any, is the off-farm labor.

[5] In general, the wage rate, w, and reservation utility of different labor suppliers would vary with their level of skills and

thus with their human capital.

[6] We assume that the following condition holds: $e_A f(l) > w(e_I)$ for $e_I < e_I$^, where e_I^ is a certain minimum level of skills required for entering the labor market.

where l_r is the derivative of l with respect to r. Collecting terms containing $l_r EU'$ and using equation (5), it can be seen that they add up to zero (implication of the envelope theorem). Then equation (7) simplifies to: $-e_A f(l) + (1-p)?e_I f(l)=0$ or

$(e_{I^*} - e_A)f - pe_{I^*}f=0$, (8)

where $e_{I^*}=?e_I$ and $f=f(l)$ for simplicity of notation.

Further, following Pratt (1964), in order to carry on our analysis, we substitute marginal risk premium, p, with Arrow-Pratt income risk premium, ? .[7] For an agent facing a risky income of the

form, $?B(r,l,\ldots)+C(l,\ldots)$, where ? is the multiplicative risk factor which has an expected value of one and $C(l,\ldots)$ represents terms independent of ?, the following relation holds in equilibrium: $p=?_r/B_r$. The subscripts on the functions denote partial differentiation with respect to the subscript.

In our model $B=r?e_I f$, thus at the equilibrium (i.e., at $r=r^*$ and $l=l^*$),

$p=?_r/?e_I f$. (9)

Using equation (9) in equation (8) and substituting $?e/?r=(e_{I^*}-e_A)$ yields the condition that have to be satisfied by the optimal share, r^*:

$?/?r(ef-?)=0$. (10)

After substituting expressions for e and ? , normalizing the output f of an average farm to be 1, dropping the constant term $e_A f$, and multiplying by –1, the household's objective function, B, can

equal prices between regions during and before the period when the survey was carried out.

0.03% and 40.67%) in the level of individual farming during the communist period in Romania. In counties with more individual farms the farming skills are expected to be more appropriate for present conditions and also the attitudes towards risk more in favor to individual farming modes.

Effect of the transition process on agricultural production organization is proxied by a dummy variable (TIME), which is equal to one for observations in 1998 and zero otherwise. Assuming advancement in economic reforms with time, we would expect positive time effect on individual farming modes. However, the development of markets would also improve off-farm opportunities.

4 ESTIMATION RESULTS

We report in tables 4 and 5 the estimation results for the likelihood of choosing among the five modes of production organization analyzed in the previous sections and the relative importance of factors influencing the decisions. In table 4 the measures of human capital are based on household head characteristics, while in table 5 the average household human capital characteristics are used.

The results of both specifications by and large are robust and consistent with the theoretical model.

The coefficients of the human capital variables have got the expected signs, however, their significance vary between the two specifications. When the household head characteristics are considered, the age is the most important determinant of the production organization choice, while when the average household characteristics are used, education is of the highest significance. In general, it seems that the human capital of the household is more important in making production organization choices than the characteristics of the household head alone. Therefore, we discuss further the results based on the average household characteristics, as reported in table 5.

Column 1 examines the probability of being a hybrid farmer relative to farming only in a cooperative farm. Education variable has a positive coefficient, significant at 0.01 level. Significant (at the 0.10 level) and positive is also the coefficient of the dummy variable showing the diverse experience gathered through commuting for work in town. It is possible that the behavior of hybrid farmers is determined by their general knowledge and connections (social capital), which allows them to cope with production risks better than association farmers.

From farm physical capital variables, OWNLAND and BUILDINGS have got significant and positive coefficients. Availability of a legal title on land has also significant positive effect on starting up an individual farm. This together with the negative (but not significant) coefficients of ADULTS and MACHINERY is in support to the hypothesis that hybrid farming may be a phenomenon occurring due to relatively insufficient appropriate human capital, and thus farming skills, available on-farm relative to the farm physical capital endowment.

Further, the better access to markets, tradition with individual farming and advancement in reforms all play significantly positive role in determining the choice of the hybrid farming, compared with the association farming. These results confirm that even households with moderate

farming skills would be able to cope better with production risks when general economic conditions improve.

The results for the full-time individual farming mode, reported in column 2 are of special interest, as the households that have chosen to farm full-time individually represent the largest proportion (59.28%) of the sample. In addition, the transition from collective to individual farming is in the focus of policies for agricultural transformation in Central and Eastern Europe.

Human capital variables play important role in general. However, the age variable despite having the expected negative sign is not statistically significant. Education has a highly significant positive sign and supports the hypothesis that the individual farmers are characterized by better education implying higher managerial skills. However, it would not imply that an increase in the years of schooling increases the attractiveness of full-time individual farming in a linear manner (point estimate 0.2321) relative to being a part-time farmer (column 3, point estimate 0.3511).[16] As common sense suggests, more diversified work experience, represented by pre-reform commuting for work in town, increases the probability of possessing a higher managerial skills and social capital, thus undertaking individual farming.

The coefficients of the physical capital variables are positive but only machinery and household labor are statistically significant. The availability of legal land title has also a significant positive impact and indicates that better land tenure security decreases risk in farming. Thus, the point estimate here (0.9678) is higher than for the hybrid farming mode (0.7850) implying that farmers use the co-operation as a risk management strategy. Furthermore, having secure access to physical capital decreases the risk of agricultural production in general.

From socio-economic environment characteristics, the variables representing market access and advancement of transition process are significant and positive. The coefficient of tradition with individual farming is not significant despite having the positive sign.

Column 3 shows the results for the probability of becoming a part-time farmer relative to joining an association. To make comparisons to the probability of being full-time farmer, we must compare the coefficient in column 3 to the corresponding coefficient in column 2. Doing so indicates that the human capital variables such as age and education are even more important determinants of the part-time farming choice as the directions of the effects are the same. The age coefficient here is negative and significant indicating that part-time farmers are much younger that all other involved in farming. The positive coefficient of EDUHM in column 3 must be interpreted in similar fashion as with the full-time farmers. As common sense suggests, better education increases the probability of working off- farm relative to being a full- time farmer. In addition, parttime farmers have also more diversified work experience gathered through commuting for work to a town.

The possession of physical capital, such as farm machinery and buildings together with security of land tenure plays a significant positive role in carrying some farming. However, when the number of household members in working age is relatively large it is more likely that some of them find occupation off- farm.

As with the full-time individual farmers, from socio-economic environment characteristics, the variables representing market access and advancement of transition process are significant and positive. The coefficient of tradition with individual farming is not significant.

Column 4 shows the determinants of the odds of being an absentee landowner relative to becoming a co-operative farmer. From a statistical point of view, the most significant of the human capital variables are both age and education. The positive sign of age implies that the group of absentees consists, besides agents with high opportunity costs, of retired people that already left the labor market. Also it is more likely that a household would chose this mode if it migrated from a town and thus had no farm experience. The sign of the age variable might reflect also an increased desire for security as age increases and thus less motivatio n to carry on risky individual farming.

With respect to physical capital variables, it is worth mentioning that all of them have the expected signs but are not significant except land title where the coefficient exceeds its standard error with a factor of four. The availability of legal land title has a positive and statistically significant coefficient meaning that an important condition for existence of the group of absentees leasing their total land out is the security of land tenure.

Finally, the socio-economic environment variables have similar impact as in the case with part-time farmers. In addition to those, the lack of tradition with individual farming plays here a significant role.

16 The reason is that, in general, the log of the odds of being, for example, a part-time farmer relative to becoming a full-time farmer

is $? \; ? ? \; N$

$j \; ij$

FF

j

PF

$_j x \; 1) (\; ? \; ?$, where the superscripts *PF* and *FF* denote part-time farmers and full-time farmers, respectively.

5 DISCUSSION AND CONCLUSION

Our model and empirical analysis show that low skilled households are more likely to adopt cooperative farming mode; those with medium skill levels will be hybrid farmers. Individual farmers will have even higher skills and reservation utility, which is in support to the “agricultural ladder” hypothesis (Spillman, 1919; Reid, 1979). However, households with higher skills can be expected to have higher opportunity costs and thus opt for off-farm employment as well. Absentee landowner group seems to be mixed by including also retired ho useholds but it is confirmed that they possess also high general human capital endowment but no specific farm experience.

In this context, our analysis provides information about the factors that determine production organization choices of rural househo lds. Human capital endowments generally have

significant effect on the choice of production organization. Young and well-educated agents are more likely to start up an individual farm but also to opt for off- farm jobs, fact which is reflected in
the large and significant coefficients for part-time individual farmer group. Considering household
human capital measures, age does not play a significant role in the choice between co-operative, hybrid or individual farming. However, hybrid and full-time individual farmers are somewhat better educated than co-operative farmers. The higher importance of the average education of the household, compared to the education of the household head alone, implies that intra household decision-making is quite democratic and that there is an active exchange of knowledge within the household. Diversified work experience matters for the choice on the co-operative-individual farming continuum. Agents who commuted for work to a town and who did not migrate from elsewhere are more likely to start up their own individual farm. Finally, larger households are more
likely to engage in both individual farming and off-farm work.
Controlling for physical capital endowments shows that those variables also play a significant role in the household's choice of production organization, which suggests that factor markets are missing or ill functioning. Individual farmers, part-time or full- time, distinguish themselves from hybrid and co-operative farmers by owning more farm machinery and by having more secure land titles. Land holdings and farm buildings have most significant impact for choosing hybrid farming mode. This result is in agreement with the human capital effects and the thesis that the farm households endowed with physical capital in excess of their farming capability
will opt for some form of co-operative farming. It is noteworthy that co-operative and hybrid farmers have less secure land title thus facing higher risks.
Finally, the socio-economic environment seems to have played an important role in affecting the required risk premium of agents. The market access is important for opting out of cooperative
farming and starting an individual farm. However, in the same time market access improves off-farm employment opportunities as well. The tradition of individual farming at county
level is only important for becoming a hybrid farmer while the lack of such a tradition implies more
absentee landowners. Overall, with the advancement of transition process the pure co-operative farming mode is likely to be replaced by other modes predominantly hybrid farming as well as individual farming.

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TABLE 1
Distribution of households among five organization modes

1996		***1998***		***Total sample***	
Organization Mode					
Number	***%***	***Number***	***%***	***Number***	***%***
COOP_F	33	4.57	3	0.42	36	2.49
HYBRD_F	115	15.93	147	20.36	262	18.14
FULTM_F	432	59.83	424	58.73	856	59.28
PARTM_F	117	16.20	131	18.14	248	17.17
ABSENTE	25	3.46	17	2.35	42	2.91
Total	722	100.00	722	100.00	1444	100.00

TABLE 2
Means and standard deviations of the explanatory variables

Variable	***Definition***	***Mean (St. Dev.)***
AGEHH	Age of household head	65.81 (11.49)
EDUHH	Number of years of schooling of household head	6.39 (3.25)
COMUTHH	Dummy variable equal to 1 if household head has commuted to a town for work before 1989 and 0 otherwise	0.17 (0.37)
AGEHM	Average age of household members	58.54 (14.79)
EDUHM	Average number of years of schooling of household members	6.75 (2.85)
COMUTHM	Dummy variable equal to 1 if household members have commuted to a town for work before 1989 and 0 otherwise	0.30 (0.45)
MIGRATE	Dummy variable equal to 1 if household migrated from a town after 1989 and 0 otherwise	0.09 (0.28)
ADULTS	Number of household members in working age, between 15	

and 65
3.11
(2.99)
OWNLAND Hectares of land owned by the household 3.15
(2.11)
MACHINERY Equivalent number of machinery owned 0.21
(0.55)
BUILDINGS Equivalent number of buildings owned 2.19
(1.13)
TITLE Dummy variable equal to 1 if household possesses legal
title in 1996 and 0 otherwise
0.38
(0.48)
ACCESS Index measuring the access to markets 10.32
(3.52)
FTRADITION Pre-reform (1985) level of individual farming, % 10.20
(11.17)
TIME Time dummy variable equal to 1 for observations in 1998
and 0 otherwise
0.50
(0.50)
13

TABLE 3

Means and standard deviations of the variables by production organization mode

Production organization mode **(ORG)**

Variable **COOP_F HYBRD_F FULTM_F PARTM_F ABSENTE**

AGEHH 71.80
(7.05)
68.08
(9.12)
65.89
(9.88)
60.72
(16.55)
73.05
(12.01)
EDUHH 4.75
(2.58)
5.58
(2.94)
5.86
(3.00)
7.42
(3.81)
6.39
(3.12)
COMUTHH 0.07
(0.26)
0.10

(0.30)
0.19
(0.39)
0.21
(0.40)
0.08
(0.28)
AGEHM 66.67
(14.17)
61.58
(13.22)
58.77
(13.92)
51.96
(17.19)
66.68
(11.62)
EDUHM 4.53
(2.33)
6.06
(2.74)
6.78
(2.71)
7.90
(3.04)
5.58
(2.94)
COMUTHM 0.11
(0.31)
0.20
(0.39)
0.33
(0.47)
0.36
(0.48)
0.12
(0.32)
MIGRATE 0.10
(0.29)
0.09
(0.29)
0.06
(0.23)
0.05
(0.22)
0.12
(0.32)
ADULTS 1.86
(2.80)

1.33
(2.52)
3.37
(2.97)
3.75
(2.91)
2.08
(2.86)
OWNLAND 2.92
(1.83)
3.67
(2.03)
3.08
(2.11)
2.97
(2.17)
2.63
(2.07)
MACHINERY 0.26
(0.89)
0.11
(0.27)
0.24
(0.59)
0.24
(0.58)
0.07
(0.17)
BUILDINGS 1.83
(1.20)
2.38
(1.05)
1.94
(1.15)
2.24
(1.11)
1.60
(1.30)
TITLE 0.34
(0.47)
0.36
(0.48)
0.38
(0.48)
0.40
(0.48)
0.43
(0.50)
ACCESS 7.36

(4.03)
10.19
(3.51)
10.23
(3.67)
10.71
(3.16)
10.36
(3.50)
FTRADITION 8.49
(11.12)
5.87
(7.50)
11.51
(11.42)
11.41
(11.80)
5.98
(6.94)
TIME 0.08
(0.28)
0.56
(0.49)
0.53
(0.50)
0.50
(0.50)
0.40
(0.49)
Number of
observation by ORG
36
262
856
248
42
14

TABLE 4
Multinomial logit analysis of households' organization probabilities
(with household head human capital)
Dependent variable: Production organization modes **(ASSOC_F, HYBRD_F, FULTM_F, PARTM_F, ABSENTE)**

Variable
HYBRD_F
(1)
FULTM_F
(2)
PARTM_F
(3)

ABSENTE
(4)
AGEHH -0.0410 ***
(0.0159)
-0.0604 ***
(0.0165)
-0.0732 ***
(0.0163)
0.0004
(0.0021)
EDUHH 0.0262
(0.0466)
0.0461
(0.0446)
0.0981 **
(0.0461)
0.0881 *
(0.0480)
COMUTHH 0.2770
(0.4362)
0.7540 *
(0.4173)
0.8381 *
(0.4244)
0.1942
(0.5262)
MIGRATE 0.1842
(0.4699)
-0.1964
(0.4441)
-0.6428
(0.4511)
0.5414 *
(0.2927)
ADULTS -0.0577
(0.0523)
0.0885 *
(0.0501)
0.0942 *
(0.0519)
0.0474
(0.0673)
OWNLAND 0.1820 **
(0.0771)
0.0872
(0.0753)
0.0783
(0.0770)
-0.0716

(0.1023)
MACHINERY -0.4143
(0.4097)
0.6194 *
(0.3803)
0.6800 *
(0.3870)
-0.2725
(0.6133)
BUILDINGS 0.4286 ***
(0.1221)
0.1370
(0.1159)
0.0480
(0.1199)
-0.0846
(0.1552)
TITLE 0.7679 ***
(0.3047)
0.8838 ***
(0.2944)
0.9404 ***
(0.3018)
1.3295 ***
(0.3644)
ACCESS 0.1659 ***
(0.0306)
0.1698 ***
(0.0319)
0.2520 ***
(0.0331)
0.1897 ***
(0.0449)
FTRADITION -0.0446 ***
(0.0149)
0.0111
(0.0141)
0.0085
(0.0144)
-0.0202
(0.0185)
TIME 3.4803 ***
(0.5324)
3.0706 ***
(0.5262)
2.9774 ***
(0.5305)
2.3948 ***
(0.5745)

Constant
Number of observations 1444
Log Likelihood -1315.98
Pseudo R2 0.107

Notes.
1) The outcome "COOP_F" is the comparison group.
2) Figures in parentheses are standard errors. ***, ** and * denote 0.01, 0.05 and 0.10 level of significance, respectively. Thus each column shows the determinants of the log of the ratio of the probability of choosing the organization described at the top of the column to the probability of choosing "COOP_F". Variables are defined in table 2.

TABLE 5
Multinomial logit analysis of households' organization probabilities
(with household human capital)
***Dependent variable: Production organization modes* (COOP_F, HYBRD_F, FULTM_F, PARTM_F, ABSENTE)**

Variable
HYBRD_F
(1)
FULTM_F
(2)
PARTM_F
(3)
ABSENTE
(4)
AGEHM -0.0052
(0.0099)
-0.0010
(0.0095)
-0.0282 ***
(0.0097)
0.0253 **
(0.0130)
EDUHM 0.2006 ***
(0.0563)
0.2321 ***
(0.0541)
0.3511 ***
(0.0558)
0.2237 ***
(0.0702)
COMUTHM 0.5874 *
(0.3438)
0.8992 ***
(0.3367)
1.0214 ***
(0.3316)
0.1456
(0.4558)

MIGRATE 0.2020
(0.6088)
-0.2519
(0.4580)
-0.6717
(0.4646)
0.6532 *
(0.3829)
ADULTS -0.0318
(0.0480)
0.1351 ***
(0.0474)
0.1442 ***
(0.0461)
0.0551
(0.0625)
OWNLAND 0.1452 **
(0.0725)
0.0529
(0.0708)
0.0425
(0.0724)
-0.0817
(0.0973)
MACHINERY -0.2919
(0.3957)
0.6292 *
(0.3708)
0.6896 *
(0.3735)
-0.1744
(0.1583)
BUILDINGS 0.3117 **
(0.1249)
0.2165 *
(0.1227)
0.0422
(0.1195)
-0.1255
(0.5939)
TITLE 0.7850 ***
(0.3050)
0.9678 ***
(0.2959)
1.0528 ***
(0.3020)
1.3611 ***
(0.3650)
ACCESS 0.1386 ***

(0.0328)
0.1536 ***
(0.0318)
0.2428 ***
(0.0340)
0.1861 ***
(0.0460)
FTRADITION -0.0590 ***
(0.0144)
0.0119
(0.0139)
0.0061
(0.0136)
-0.0328 *
(0.0183)
TIME 3.4660 ***
(0.5313)
3.1106 ***
(0.5257)
2.9260 ***
(0.5293)
2.4312 ***
(0.5745)
Constant
Number of observations 1444
Log Likelihood -1411.81
Pseudo R2 0.114

Notes.
1) The outcome "COOP_F" is the comparison group.
2) Figures in parentheses are standard errors. ***, ** and * denote 0.01, 0.05 and 0.10 level of significance, respectively. Thus each column shows the determinants of the log of the ratio of the probability of choosing the organization described at the top of the column to the probability of choosing "COOP_F". Variables are defined in table 2.