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INDIVIDUAL FARMING IN THE NEW EU MEMBER STATES:

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Abstract

This paper is motivated by the fact that (part-time) individual farming is commonly observed among rural households in a number of transition economies but it is not clear *prima facie* if such resource allocation is optimal. A conceptual model of household labor allocation between individual farming and off-farm wage employment is developed. The model explicitly accounts for the role of household endowments in labor allocation as the analysis is conditioned on the status of factor markets. The hypotheses are empirically tested using 1998 data from a country-representative survey of rural households in Hungary, an advanced transition country, which only recently became EU member state. Results provide evidence that capital market imperfections still remain. Implications for the policies related to agricultural sector restructuring, employment and rural development are discussed.

Key words: households, individual farming, labor allocation, diversification, transition economies, international integration
JEL classification: D1, J2, P2, R2

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INDIVIDUAL FARMING IN THE NEW EU MEMBER STATES: THE CASE OF HUNGARY

1 Introduction

The process of international integration in Europe has resulted in the most significant expansion in the history of the European Union (EU). Hungary and seven other advanced transition economies (TEs) became members of the EU and thus joined the group of peripheral member states characterized by relatively large rural populations and importance of the agricultural sector. As with incumbent peripheral EU members, a number of measures related to market liberalization and rural development need to be designed and implemented in the new member states (NMS) so that appropriate structural funds could be allocated and efficiently utilized. Furthermore, to the extent that market failures and deficiency of endowments could prevent rural households from efficiently using their resources, policies that improve this situation would play an important role to maximize the gains associated with agricultural sector restructuring and the emergence of new individual farms in TEs.

Trends and changes in both urban and rural sectors of TEs since 1990 have resulted in a set of economic and social conditions that strongly affected the attractiveness of both rural and urban areas as places to live and work, and consequently the labor reallocation and rural–urban migration. Industrial downsizing and the high cost of living have reduced the opportunities in the urban labor markets, while whole new service industries, the development of a managerial upper class, and new suburban housing have contributed to retaining or attracting the highly skilled categories of the labor force. Agricultural restructuring and declining availability of social services are rural push factors reducing the opportunities in the rural labor markets, but the low cost of living, possibilities for self-

provisioning, available housing, and social network ties have attracted dislocated urban workers and retained longer-term rural residents. Parallel to dissolving or reorganizing large production co-operatives, the numbers of small individual farms have grown being often a part-time activity and a means of subsistence of the rural population. A feature of employment in agriculture is often underemployment and hidden unemployment (Lewis, 1954; Harris and Todaro, 1970; Deininger and Olinto, 2001). This hidden and sometimes highly localized underemployment is reflected only inadequately, if at all, by basic indicators such as unemployment rates and deserves a more thorough investigation.

Our analysis based on household production model, casts light on the labor allocation and income diversification decisions of rural households in TEs using the case of Hungary as illustration. In this context, the characteristics influencing household's employment opportunities and ability to shift resources to and manage individual farm are studied with an emphasis on the role of household endowments. The hypotheses are empirically tested using 1998 country-representative household survey data from rural Hungary. Results of the analysis have potentially important implications for the policies related to agricultural sector restructuring, employment programs and generally for efficient resource allocation in TEs.

The paper also contributes to the understanding of the nature of and factors affecting rural households' income diversification through combining farming with off-farm wage occupations a pattern most commonly observed in TEs (Chaplin, Davidova, and Gorton, 2004). Such analysis is important as in recent years attempts have been made to transpose West European model of agricultural diversification to the associated countries of Central and Eastern Europe under the EU's Special Accession Programme for Agriculture and Rural Development (SAPARD). There also are potentially important rural development and welfare implications of the ongoing CAP reforms not only for the existing EU members but

for the NMS as well (Rizov, 2004). Thus the analysis of household labor allocation would cast light on the feasibility and the likely outcomes of fully implementing such EU policies.

The paper is organized as follows. In the next section an overview of "pull" and "push" factors affecting resource allocations of rural households in Hungary is presented. In section 3 a simple conceptual model of labor allocation of rural households is set up to analyze the observed patterns. In section 4 the estimation methodology and the variables used in regressions are described. Section 5 reports estimation results and section 6 concludes the paper by pointing out some policy implications.

2 Pull and push factors in rural Hungary

Economic reforms in Hungary resulted in deep structural changes affecting agriculture and rural areas through a plethora of pull and push factors. Within a concise time span, resources were shifted from co-operative farm organizations to individual farms. Since 1990, the area of individual farms expanded from 12 percent to 54 percent in 1998. The area of co-operative farms dramatically fell from 62 percent to 20 percent during the same period. Corporate farms stabilized their share in land use at 26 percent (Ferenczi, 1999; Mathijs and Varanken, 2004).

This redistribution of factor use and ownership was guided by a series of transformation laws and regulations under which co-operative farms had to transform into 'new' co-operatives, joint-stock companies or individual farms by decision of the assembly of members. In the compensation process individuals could get a considerable part of the co-operative (34 percent) and state (40 percent) farmland. Landless members and employees also received land allotments in possession (15 percent from co-operative farms and 6 percent

from state farms).[1] The share of private ownership averaged about 85 percent of the agricultural land, while the state ownership fell to about 15 percent.

The transformation laws and regulations, by separating employment from membership status had important impact on the labor market which resulted in a dramatic fall, with almost two thirds, in the official agricultural employment figures (Macours and Swinnen, 2000; EBRD, 2002). In the large successor farm organizations the share of full-time working members and partners fell to around 30 percent of their labor force. The share of part-time working members and partners became negligible and the share of non-working members rose, exceeding 65 percent of the total membership mass. As a result, full-time employees compose the largest proportion in the labor force of co-operative farms and there is no significant difference between members or partners and non-member employees, with respect to wages.

Furthermore, economic policies in Hungary inducing comprehensive liberalization of prices and hardening of budget constraints resulted in increased labor costs, leading to a substantial change in labor market behavior, nationwide. This change was accommodated by rapid liberalization of wage regulations. Economic agents no longer had any incentive to hoard underutilized labor and unemployment rose sharply and even more so in rural areas. Many low skilled workers left the formal labor market through early retirement and part-time employment schemes (Bilsen and Konings, 1998; Korosi, 1999; Swinnen, Dries, and Macours, 2004).

Under these circumstances, the main alternative to wage employment in rural areas had become self-employment in individual farming. Official Hungarian statistics report that during the period of analysis there were 1.2 million farms (holdings larger than 0.15 hectares), but only about 260 thousand people officially were employed in agriculture.

[1] The rest of the land of state farms remained state property with possibility for leasing by individual farmers,

Furthermore, the total population of rural areas in Hungary was 2.3 million implying that there was one farm for every second inhabitant in the countryside. These figures suggest the presence of a large informal farming sector engaged in by an excess-supply rural labor force as a low-return survival (subsistence) strategy, with little prospects for economic advancement (Cartwright and Swain, 2002; Kollo, 2001).

Data from the 1994 and 2000 agricultural censuses in Hungary, however, show a declining trend in the number of individual farms, as the decrease has been 20 percent in total, for the six-year period. Important observation is that smaller farm holdings, with size below 5 hectares have generated this drop in numbers (with 32 percent) while larger size categories, above 5 hectares have shown significant increase in numbers. In the same time, however, the number of units smaller than a farm holding (less than 0.15 hectares) also grew quickly as more than 800 thousand mini-plots existed in 2000. It seems that there is a tendency of small farm holdings either shrinking to garden-level cultivation or expanding to more viable and larger commercial farms (Rizov and Mathijs, 2003).

The results from our 1998 country representative rural household survey[2] further show that more than 90 percent of the households have allocated some labor in individual farms despite that only 8.5 percent are full-time engaged in individual farming. The average household size in the sample is approximately 2 adult members in working age (16-60 years). The economic activities of households in the sample are outlined in table 1.

- Table 1 here -

Numbers reveal that the vast majority of households are involved in diversity of economic activities and that the outcome of this – the total household income - reflects the role of allocative decisions in income maximization. There is no *prima facie* evidence,

for a period up to ten years.

however, against the competitive market hypothesis: households engage in both individual farming and in off-farm wage employment and the incomes of households engaged in part-time or full-time farming do not seem to systematically differ. It is not possible yet to discern whether households turn to individual farming for extra employment due to absence of opportunities elsewhere or because of higher returns to their endowments. It is not also clear if capital market imperfections prevent households from specializing exclusively in individual farming.

Ferenczi (1999) analyzing the same data has found a sharp upward trend concerning labor allocation to individual farming as a function of farm size. In the category below 5 hectare, 55 percent of respondents have primary activity outside their farms; in higher farm-size categories this share is diminishing, down to 15 percent. In farm-categories above 50 hectares, respondents do not report any employment outside their individual farms.

Examining regional data at NUTS-II level[3] shows that the spatial differences in measures of labor demand and relative job-finding probabilities also play an important role in household labor allocation. The regions that suffered most during transition were generally characterized by a high share of heavy industry or agriculture, poor infrastructure, poorly educated labor force, poorly developed services and trade, and relatively large shares of the Romany ethnic group among the population. In 1998, about 40 percent of all unemployed in Hungary lived in the economically weak eastern and north-eastern regions while the regions with most agricultural character accounted for the highest self-employment rates, especially in farming, other things equal (Fazekas and Ozswald, 1998; Kollo, 2001).

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[2] The survey was organized by the Policy Research Group, K.U. Leuven with the financial support of the Phare-ACE programme of the European Commission. The sampling methodology and definitions were adopted from the Hungarian Central Statistical Office (HCSO).

[3] NUTS-II classification level comprises seven regions in Hungary: Central Hungary, North Transdanubia, West Transdanubia, South Transdanubia, South Plain, North Plain, and North Hungary (Eurostat, 1999).

Central Hungary, including the agglomeration of Budapest, is the most economically advanced region. North Transdanubia, although in many respects similar to North Hungary, concentrates more vivid entrepreneurial activities, which bring the region, together with South Plain to the top positions in terms of per capita GDP (following Central Hungary). North Hungary and North Plain, located in the eastern part of the country, rank among the least developed regions with the lowest per capita GDP. These two regions include many rural territories and areas with declining industries. Agriculture is concentrated mainly in the (Great) Plain regions. In South Plain almost 17 percent of employed work in agriculture, while in North Plain and South Transdanubia the share is just over 10 percent (Eurostat, 1999).

3 Labor allocation - a simple conceptual model

The household production model (Bertrand and Squire, 1980; Singh, Squire, and Strauss, 1986) provides an appropriate framework for analyzing labor allocation decisions of rural households, facing two main income-generating alternatives: full-time individual farming and full-time off-farm wage employment.[4] Third alternative is the part-time individual farming, which is a combination of the two activities above and is commonly observed in Hungary as well as in other TEs.

The household income derived from these activities, with output prices normalized to unity and prices of labor and capital denoted w and r, respectively, can be written as: $y^T=y^T(w,r,l^T,a,y^N,e)$, where y^T denotes total income, l^T is total labor, a is a vector of (farm) capital assets and y^N is unearned income transfer, such as rents and social payments. Further,

[4] For an application of the household production model in transition context see Rizov and Swinnen (2004). Note that working in a new co-operative farm, as an employee, is not essentially different from any other wage employment (see also section 2).

e denotes a vector of household human capital characteristics, which translate into managerial ability as well as influence reservation (and market) wages.[5]

In off-farm wage employment, household members can work for a market wage, w and earn income: $y^W=wl^W$, where l^W is wage labor. Similarly, in the context of Hungary households may allocate labor in the new co-operative or corporate farms and work for wages there.

In individual farming households can earn (relatively more risky) income by producing output according to a concave production function, q: $y^F=q(l^F,k,e)-(k-a)r$, where l^F is farm labor input, k is farm capital input, and other variables are as defined before.[6] Managerial ability is a fixed factor with which individuals are endowed and for which there is no market (Bell and Zusman, 1976). The impact of managerial ability on the marginal products of farm labor and capital is positive (e.g., Huffman, 1980; Fafchamps and Quisumbing, 1999).

The household maximizes a concave joined utility function: $u(y^T,l^L)$, arguments of which are total income and leisure, l^L.[7] This is an optimization problem whereby available household total time, l is allocated between production and leisure subject to a time constraint: $l^L=l-l^T$ such that $l^T=l^W+l^F$, and an income constraint: $y^T=y^W+y^F+y^N$ such that $p^Ss+p^Nn\leq y^T$, where s is staple food, n - non-staple good, and p^S and p^N are staple and non-staple prices, respectively. The non-negativity constraints, $k\geq 0$, $l^F\geq 0$, $l^W\geq 0$ have to hold as well and all households are assumed to work in at least one activity ($l^L<l$).

[5] Human capital increases productivity in individual farming through its managerial ability effect. In the same time, human capital directly positively affects individual's employment opportunities (Becker, 1965; Sahn and Alderman, 1988; Foster and Rosenzweig, 1993; Yang, 1997).

[6] If markets are missing resources employed in farming will equal household endowments, i.e., $k=a$. Furthermore, because hired labor is not commonly used in individual farms in Hungary as well as in other TEs, it is not included in the notation. Alternatively, it is assumed that household and hired labor are perfect substitutes and cost of hiring labor can be accounted for through y^W, which will be negative in the case of net hiring of labor.

[7] We do not explicitly consider savings in this static, by nature, model. Extending the model to include savings would complicate the notation without contributing relevant insights. For example, Rosenzweig and Wolpin

Since the household is a price taker, it maximizes utility so that the marginal product of labor is set equal to its price, which in turn equals the marginal rate of substitution: $q_{l^F} = w = u_{l^L} / u_{y^T}$ with subscripts denoting derivatives. The corner solutions are either, full-time off-farm wage employment or full-time individual farming. The optimality condition for full-time off-farm wage employment is: $q_{l^F} < w$ at l^F=0 and the optimality condition for full-time individual farming is: $q_{l^F} > w$ at l^W=0. Under the perfect market assumption, in equilibrium, labor supply is: $l^S=l^F+l^W$ and farm labor use at market wage, assuming interior solution, can be written as $l^F=l^F(w,r,e)$.[8]

In the case of interior solution, with time divided between wage employment and individual farming, as managerial ability increases the allocation of labor shifts towards individual farming, which follows from the assumptions that managerial ability increases the marginal product of labor in individual farming, and that the return to managerial ability in wage employment, outside one's own farm (business) is small (see e.g., Hallagan, 1978; Sadoulet, de Janvry, and Benjamin, 1998; Rizov and Swinnen, 2004). More specifically, managerial ability contributes directly to increasing output for given amount of labor (and capital), and also increases the optimal amounts of labor (and capital) applied on-farm. Thus managerial ability contributes to higher earnings in individual farming both directly and indirectly. However, due to specificity of human capital characteristics such as education and experience positively affecting both managerial ability and off-farm wage opportunities there will be a trade off so that if returns to labor in off-farm wage employment increase more than

(1993) offer an analysis on how credit constraints impact on saving and investment decisions of rural households.

[8] Efficient allocation of productive resources and hence separability of production decisions and consumption preferences only requires that *n*-1 markets be perfect, where *n* is the number of production factors (de Janvry, Fafchamps, and Sadoulet, 1991; Gavian and Fafchamps, 1996). Thus non-tradability of managerial ability should not prevent efficient allocation where factor markets are perfect.

in farming, labor use in individual farms will decline if labor markets are perfect (Soon, 1987; Yang, 1997; Rizov and Swinnen, 2004).

However, transition is characterized by significant market imperfections introducing substantial risk and uncertainty in the economy. It is shown by number of studies that risk importantly impacts on labor allocation decisions (e.g., Block and Heineke, 1973; Barrett, 1996).[9] Under price uncertainty Barrett (1996) shows that there is a gap between the marginal value product of farm household labor and the wage rate which is proportional to the covariance of marginal income, v_y and output price, p, i.e., $q_{l^F}\,\mathrm{Cov}(v_y,p)=\mathrm{E}[v_y(w-\mu q_{l^F})]$, where $v(.)$ is indirect utility function and $\mu=\mathrm{E}[p]$.[10] Analysis of this relationship, under the assumptions that farm households are income-risk averse and that the staple food is normal good, yields: (i) if the household is net seller of foot it will underemploy labor, and (ii) if the household is net buyer of foot it will overemploy labor. These results are in line with findings of Bezemer (2004) for TEs.

Thus, when markets are incomplete, or household and hired labor are not perfect substitutes in production, or farmers are risk averse and risks are high, household's on- and off-farm labor allocation decisions will not be independent any more. The amount of labor used will depend on household's preferences, assets (technology), size and composition. Then it may be optimal for the household to allocate more labor on-farm than the amount where $q_{l^F}=w$. The wage that balances labor supply and demand under such circumstances is defined as shadow wage, w^*. The allocation of household labor to different income-generating activities will depend through w^* on total household labor, l^T, unearned income, y^N, and productive assets, a (Fafchamps and Quisumbing, 1999; Rizov and Swinnen, 2004).

[9] See also Bezemer (2004) for an analysis of the impact of risk on the behavior of agricultural enterprises in TEs.

[10] Epstein (1975) shows that using $u(.)$, a variable indirect utility function, $v(.)$ can be formulated by duality which is homogenous of degree zero in p^S, p^N, y^T and thus invariant to unit of measurement. After normalizing

Then a reduced form farm labor use equation can be estimated by replacing w^* with a function of the household's endowments.

The comparison of the settings with and without perfect markets yields a number of testable hypotheses. First, if markets are perfect and $w^*=w$, labor use in each income-generating activity should depend only on prices and abilities in that activity, not on household assets and household size and composition. Second, if markets are perfect, household assets, a, should only have an income effect on household labor supply, and both a and the unearned income, y^N should have no impact on the farm labor use. In contrast, if capital and labor markets are incomplete, a and y^N may substantially raise returns to farm labor and hence induce more household farm labor use (e.g., Strauss, 1986; Ahituv and Kimhi, 2002; Dessing, 2002).

4 Estimation methodology and variables

Labor use estimation

In the Hungarian sample 143 households or 9 percent report that none of their work time is allocated to individual farming. The dependent variable is thus censored. In principle, households that allocate some labor to individual farming may be systematically different in terms of unobservable characteristics from those households that do not. Predictions of the farm labor use based on estimates obtained only from a sample of households that allocate labor to individual farming may be bias due to sample attrition.

Given that OLS estimates of labor allocation may be biased and inconsistent if not corrected for this selection bias, a two-stage (TS) model is applied (Heckman, 1976, 1979).[11] First, probabilities of selection into individual farming are estimated (probit equation) in

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prices and income by p^N, $v(l^L,p,y)$ is obtained where $p=p^S/p^N$ and $y=y^T/p^N$. It is also assumed that the household exhibits Arrow-Pratt income risk aversion such that $v_{yy}<0$.

order to obtain inverse Mills' ratios (λ). Second, the farm labor use is estimated. The selection of households into farming can be modeled as:

$$Z = \alpha X + \nu, \quad (1)$$

where $Z = 1$ if the household allocates some labor to farming and $Z = 0$ otherwise. X is a vector of exogenous explanatory variables. Each farming household has the (log-linear) labor use equation:

$$Y = \beta X + \xi, \quad (2)$$

where Y measures labor use. Given that $\nu, \xi \sim N(0,\sigma^2)$ with correlation ρ, equation (2) can be estimated as:

$$E[Y \mid Z = 1] = \beta X + \rho \sigma_\xi \lambda_\nu + \omega, \quad (3)$$

where $\lambda_\nu = \phi(\alpha X) / \Phi(\alpha X)$, and ϕ and Φ are the standard normal *pdf* and *CDF*, respectively, for the farming households. Farm labor use is thus estimated including λ as an explanatory variable. If λ is significant, then the censored sample (i.e., farming households only) is biased and TS model must be used with λ correcting for the bias. Otherwise, the OLS estimator is appropriate.

Discrete choice analysis

We consider the three choices faced by the household as discussed in the conceptual model, full-time wage employment, part-time individual farming, and full-time individual farming. The most used estimation technique of multiple discrete choice dependent variables is the

[11] Tobit model is an alternative to the TS model. For comparison, we have estimated a Tobit model, however, the likelihood ratio test suggested that the TS model should be preferred (Greene, 1997).

multinomial logit (ML) model (McFadden, 1974, 1984).[12] An important assumption with the ML is that error terms are independently and identically distributed (iid).

If the three choices, j are recorded in the dependent variable Z, and the vector of explanatory variables is X, we can estimate a set of coefficients $\beta^{(j)}$, j=1,2,3 corresponding to each choice:

$$\Pr(Z = j) = \frac{e^{X\beta^{(j)}}}{\sum_{k=1}^{3} e^{X\beta^{(k)}}}, \; j = 1,2,3 \,. \tag{4}$$

To identify the model, $\beta^{(1)}$ is set equal to zero. Thus, the remaining coefficients $\beta^{(2)}$ and $\beta^{(3)}$ measure the change relative to the Z=1 choice. Then equations (4) become:

$$\begin{aligned} \Pr(Z = 1) &= \frac{1}{1 + \sum_{k=2}^{3} e^{X\beta^{(k)}}} \\ \Pr(Z = j) &= \frac{e^{X\beta^{(j)}}}{1 + \sum_{k=2}^{3} e^{X\beta^{(k)}}}, \; j = 2,3 \end{aligned} \,. \tag{5}$$

The log-odds (relative likelihood) ratios are:

$$\ln\left[\frac{\Pr(Z = j)}{\Pr(Z = 1)}\right] = X\beta^{(j)}. \tag{6}$$

In order to compare outcomes, we can normalize on any other choice probability as well and obtain:

$$\ln\left[\frac{\Pr(Z = j)}{\Pr(Z = k)}\right] = X(\beta^{(j)} - \beta^{(k)}). \tag{7}$$

From the independence of disturbances assumption, it follows that the odds ratio $P^{(j)}/P^{(k)}$ does not depend on the other choices.[13]

[12] An alternative to the ML logit model is the ordered logit (and probit) model if we consider the household choices unambiguously ordered. In such case there is extra information in the data that can be exploited. We have estimated an ordered logit model and found that results are similar to the reported in the paper.

[13] However, the independence of choices is not always the case. Hausman and McFadden (1984) suggest a test of the independence of irrelevant alternatives (IIA). We have applied this Hausman-type test in our estimations and found that IIA assumption did hold.

Variables

Following our conceptual model and estimation methodology outlined in previous sections we specify two dependent variables, a continuous farm labor use variable and a discrete choice variable with three alternatives. The farm labor use is measured by the log of working days, in a typical year, allocated in individual farming.[14] The categorical dependent variable representing the three household choices equals one when no household member allocates labor to individual farming and all members in working age work for wages; it equals two if household members allocate labor to both individual farming and wage employment; the third choice is when household members work only on their individual farms full-time.

In selecting explanatory variables we follow the results from the conceptual model. Since the shadow cost of labor, w^* is not observable, we use in the regressions variables measuring factors that influence total labor use if markets are imperfect, i.e., household size and composition, unearned income, and physical-capital assets. Thus, the explanatory variables used measure both supply and demand characteristics including household human capital and physical capital endowments and socio-economic environment characteristics.

Human capital characteristics of the household such as average age (AGE) and education (EDU) of adult household members are measures of life-cycle effects, entrepreneurial motivation and managerial ability. To account for nonlinear effects on farm labor use, the squared terms of these variables (AGE2 and EDU2) are also included. A background variable (RURAL) measuring the rural experience of the household and its preferences for farming is used for identification in the two-stage model. This is a dummy variable, which equals one if the household has always lived in rural areas and zero otherwise.

The total number of adult household members (ADULTS) includes both members in working (20-60 years) age and members in non-working age. The coefficient of the variable representing the category of household members in working age (WORKMEM) as a share of ADULTS indicates the efficiency of that category, relative to the excluded category of younger and older household members. Household assets are measured by the total own land (LAND), the total equivalent number of machinery owned (MACHIN), and the total number of buildings owned (BUILD).[15] The unearned income (NINCOME) represents two categories of income: pensions/social payments (PENSION) and rental income. Under standard assumptions, these variables are expected to have a negative effect on the household labor supply.

The share of food expenditures, including food consumed on-farm, in total household expenditures (FOODSH) is used to control for the effect of price risk and household risk aversion. According to our conceptual model a higher values of FOODSH should be associated with more household labor allocated to farming.

Regional fixed effects at the NUTS-II classification level (see section 2) are included to control for (demand-side) location-specific changes in natural and economic environment. Table 2 provides definitions and summary statistics of the variables used in regressions.

- Table 2 here -

[14] Labor hiring is very rare - only 7 farms from the total sample hire one or more full-time workers, and only 85 farms hire labor at all, most often for only 1-2 man-months.

[15] During the period of analysis sales markets for farm assets were missing or ill functioning and the main farm assets owned by households were obtained as a result of privatization and land reform, therefore they could safely be considered exogenous. Furthermore, in the estimations I performed a number of robustness tests by stepwise excluding potentially endogenous explanatory variables. These tests confirmed that the selected explanatory variables are appropriate and the results reported here are robust to various restricted specifications. Results of these additional regressions can be obtained from the author.

5 Estimation results

Estimation results from both the TS (Heckman) model and the ML model are reported in table 3 and table 4, respectively. We discuss first the results associated with the farm labor use estimation. The comparison of one-stage Tobit model results with the TS model results suggest that the decision to undertake individual farming is different from the decision of labor use in that activity, given participation. The likelihood ratio test[16] is well above the χ^2 critical value and shows that households are actually inhibited to engage in individual farming. This test result can also be seen as consistent with the presence of threshold effects created by fixed costs, associated with the choice of this income-generating activity that households have to incur up front.

- Table 3 -

Human capital variables play an important role. Age does positively affect the decision to allocate labor to individual farming up to about 66 years. Past this age the effect is negative. Conditional on having become a farmer, age positively affects the amount of labor used in farming. Education also has a significant positive impact on both the decision to allocate labor to farming and the amount of labor used on the individual farm. This effect becomes negative at about 8 years of schooling indicating that higher general education provides incentives for households to opt out of individul farming. The possibility of households to do so could be considered an indirect evidence for relative competitiveness of the labor market.

Household size is only a significant positive determinant of the amount of labor used on the individual farm but does not affect the decision of allocating labor to individual

[16] Likelihood-ratio test statistics was computed as $\chi^2=2(\ln L_{2S}-\ln L_T)=2(-2011.6+2215.6)=408.0$, where $\ln L_{2S}$ and $\ln L_T$ stand for the log-likelihood of the two-stage model and Tobit model, respectively. This comparison suggests that the two-stage model should be preferred.

farming. This result provides evidence against the perfect labor market assumption. If the labor market was complete, production decisions should have been separable from household characteristics affecting labor supply (Benjamin, 1992). The fact, however, that the decision to allocate labor to farming is independent of household composition implies only moderate (demand-side) labor market imperfections, which can also be explained by the small scale of individual farm operations, limited by forces other than the labor market (Feder, 1985).

Ownership of farm-capital assets such as land, machinery and buildings affects positively both the decision to engage in individual farming and the amount of labor allocated on-farm. Effects are similar in both the selection and allocation equations. These results are again consistent with the imperfect factor market hypothesis and the presence of threshold effects. Households that do not own capital assets are reluctant to engage in farming if markets for capital rental and sales are unreliable and incomplete.[17] In this context, ownership of capital assets can be treated as sunk cost required for starting up an individual farm (Rosenzweig and Wolpin, 1993).

The unearned-income variable has negative impact on the decision to allocate labor to individual farming. This possibly implies that leisure is a normal good as commonly assumed. In contrast, the impact of additional unearned income, as well as the share of pensions, on the amount of labor used on the individual farm is positive and significant indicating imperfect credit market. Thus, availability of liquid assets can relax the capital constraints of the farming households (e.g., de Janvry and Sadoulet, 2001; Rizov et al, 2001).[18]

[17] The effect of land owned is particularly strong in the selection equation but diminishes once the selection decision is taken. A possible explanation is that land rental market in Hungary is relatively complete and the growth of individual farms through leasing in land is feasible (Rizov and Mathijs, 2003).

[18] Swinnen and Gow (1999) provide an overview on credit constraints in transition agriculture and their implications for credit programs and government policies.

Interestingly, households that spend larger share of their total expenditures on food allocate and use more labor in farming. This result supports the hypothesis that the food security considerations are important and that price risk and risk aversion do impact on household factor allocation decisions during transition (Bezemer, 2004).

Regional effects are important and consistent with the characterization of the regions in Hungary. These effects, on both labor allocation to and labor use in individual farming are most substantial in the agricultural regions, South and North Plain, as well as in the economically stagnated region of North Hungary, where formal-sector employment opportunities are most limited.

Next, we analyze determinants of the decision to become a full-time individual farmer compared to the decisions to allocate only a proportion of household labor to individual farming or not to engage in farming at all. We use a discrete-choice dependent variable with three categories and estimate a ML model as described in section 4. The results are reported in table 4. In this analysis we cast additional light on the issue of diversification versus specialization of rural households and the factors affecting the decision.

- Table 4 -

Interestingly, the coefficients have the same signs and similar magnitudes as in the first-stage selection equation of the TS model. Column 1 examines the probability of being a part-time farmer relative to full-time wage employment. Part-time farmers group represents the largest proportion of the sample (85 percent) and is of particular interest because under this alternative households diversify their sources of income as opposed to the other two alternatives where households specialize either in full-time individual farming or are full-time wage employees.

Human capital variables are important determinants of the part-time-farming choice and the directions of the effects are the same as in the TS model. However, the turning point

in the effect of age here is lower, at about 59 years; past this age both employment opportunities and the motivation to undertake individual farming diminish. The positive coefficient of education changes sign at a higher level of about 10 years of schooling. Clearly, most likely to become part-time farmers are households with moderately high education. In addition, part-time farmers also have relevant experience gathered through permanently residing in rural areas. The effects of physical capital and finance variables and of the regional differences are very similar to the results obtained in the first-stage selection equation of the TS model.

In column 2, the determinants of the odds of becoming a full-time farmer, relative to being a full-time wage employee are reported. To make comparisons with the part-time individual farming choice, we must compare the coefficients in column 2 to the corresponding coefficients in column 1. Doing so indicates that the human capital variables such as age and education are less important in determining who becomes a full-time individual farmer, compared with the choice of part-time farming. However, physical capital and finance variables play here a more important role as both the magnitude and the significance of coefficients increase. The coefficient of unearned income has become positive and significant indicating that credit constraints inhibit farmers to specialize. Interestingly, food security considerations are of less importance to full-time individual farmers, compared with part-time farmers.

By and large, results obtained indicate the presence of threshold effects and the importance of household endowments in shifting resources to and operating a larger individual farm. It seems that important differences between the part-time farmers and the full-time farmers lie in the human capital characteristics. Part-time farmers are in general younger and possess better general education. Another noteworthy result is that credit

constraints and food security considerations are important determinants of the choice of part-time farming versus full-time farming.

6 Conclusion and policy implications

In this paper a conceptual model of the allocation of household labor between individual farming and off-farm wage employment in the context of TEs is developed. The analysis is motivated by the fact that individual farming, most often part-time, is commonly observed in a number of TEs and specifically in Hungary. This situation raises the question if such (part-time) individual farming is a result of optimal resource allocation that can secure returns required to sustain investment and offer long-term development prospects or it is due to market imperfections and lack of opportunities elsewhere. The model explicitly accounts for the role of observable and unobservable factors such as capital endowments and managerial ability in the allocation of household labor. The analysis is conditioned on the status of the factor markets such that in the case of perfect markets household endowments should not affect allocation decisions.

Estimation results from both two-stage (Heckman) and discrete choice multinomial logit models indicate that the human capital characteristics such as age and education positively affecting managerial ability of rural households and thus households' allocation of labor to individual farming. However, at some relatively high level, about 8 years, of schooling the contribution of education to off-farm wages is more important. Furthermore, the probability of engaging in individual farming declines at higher ages consistent with the life cycle hypothesis.

The result that labor allocation is largely invariant to household size and composition taken together with the effects of human capital provide evidence for moderate competitiveness of the labor market in Hungary during the period of analysis. This finding is

important for a number of agricultural transition and rural development policies relying on flexibility of labor market as an adjustment mechanism. With respect to other factor markets, specifically those for farm assets and credit, the results show that there are still important imperfections as demonstrated by the significant positive relationships between the factor endowments and the labor allocation of rural households.

Clearly, "pull" and "push" factors induce rural households to turn to individual farming and/or off-farm wage employment. In an environment of imperfect markets characterizing TEs, households engage in individual farming if endowed with sufficient productive resources. However, if higher-return and less risky income generating opportunities exist in wage employment, more household labor will be diverted off-farm. Food security considerations related to the high price risk during transition is another factor affecting the choice of part-time farming versus full-time wage employment.

Our analysis suggests that (i) improving the functioning of capital asset, insurance, and credit markets; (ii) investing in human capital, relevant to managing farm business; and (iii) taking steps to help improve the asset endowments and food security of the poorer segments of the rural population, would enable rural households to allocate resources in various activities according to their comparative advantage. Such measures would allow households to make full use of the opportunities emerging with the market liberalization, privatization and restructuring of agriculture in TEs while in the same time would lead to an optimal diversification at community level.

The implications of the analysis for introducing various rural development measures in the NMS and their integration into CAP are important. The support redistribution resulting from the CAP reforms would affect farming populations in the NMS in a major way. Specifically, capital constrained farmers by benefiting from commodity production support would be able to specialize in farming related activities and extend their operations. In the

same time, a significant proportion of the part-time farming and underemployed rural households by facing more stable consumer prices and higher food security are likely to leave the sector and start up into non-agricultural entrepreneurial activities or wage employment. Structural funds initiatives could further stimulate this process and contribute to rural community development and the welfare of rural households.

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Table 1: Household characteristics and economic activities

Characteristics	***Household labor allocation choices***		
	Full-time wage employees	***Part-time farmers/wage employees***	***Full-time farmers***
Number	143	1338	137
Percent	8.8	82.7	8.5
Age	52.8	49.7	54.9
Education	8.8	9.2	8.8
Members (16-60)	1.8	2.0	1.8
Annual net income, HUF	549,330	682,528	614,117

Note: Data do not contain income information for each individual household member. Annual net income is calculated on the bases of total household expenditures ($1~HUF180).

Table 2: Definitions and summary statistics

Definition of variables	***Full-time wage employment (93)***	***Part-time farming (1195)***	***Full-time farming (107)***
	Mean (St. dev.)	***Mean (St. dev.)***	***Mean (St. dev.)***
Household labor used in individual farming, days/year	0	179.36 (121.12)	327.01 (101.05)
AGE is average age of the adult household members	53.51 (14.40)	49.22 (13.72)	54.91 (14.44)
EDU is average number of years of education of the adult household members	8.82 (2.75)	9.27 (2.41)	8.89 (2.22)
RURAL is a dummy variable equal to one if household resided always in rural areas and zero otherwise	0.81 (0.39)	0.89 (0.32)	0.95 (0.21)
ADULTS is total number of adult household members (older than 16 years)	2.39 (1.69)	3.18 (2.21)	2.58 (1.52)
WORKMEM is share of household members in working age (16-60), percent	0.75 (0.56)	0.69 (0.33)	0.70 (0.35)
LAND is total area of land owned, hectares	0.83 (2.50)	4.44 (17.14)	5.29 (17.04)
MACHINS is total equivalent number of farm machinery owned [(1)]	0.26 (1.32)	0.40 (1.39)	0.72 (1.49)
BUILDS is total number of farm buildings owned [(2)]	2.35 (0.86)	2.28 (1.00)	2.40 (1.01)
NINCOME is total unearned income, X 10^{-3} HUF	253.41 (998.47)	94.08 (436.21)	262.19 (505.82)
PENSION is share of pensions and social payments in the total unearned income, percent	0.65 (0.46)	0.62 (0.41	0.63 (0.46)
FOODSH is share of food expenditure in the total household expenditure, percent	0.51 (0.18)	0.54 (0.16)	0.52 (0.16)

[(1)] Weighted index of 9 items with following weights: truck=1, tractor=1, cultivator=0.5, combine=2, feed combine=2, sowing machine=1, spraying equipment=1, milk processor=1, grape press=0.5.
[(2)] Index of 6 buildings items: cattle stables, pig houses, poultry houses, sheep shelters, storage facilities, and fixed greenhouses.

Table 3: Estimation of labor use in individual farming

Dependent variable: Log of the work days allocated to individual farming per year						
Variables	***Selection (1)***			***Allocation (2)***		
	Coefficient (z)			***Coefficient (z)***		
AGE	0.048	(3.75)	**	0.017	(3.17)	**
AGE2 (10^{-2})	-0.036	(5.21)	**	-0.001	(0.91)	
EDU	0.133	(3.69)	**	0.059	(3.11)	**
EDU2 (10^{-1})	-0.085	(2.82)	**	-0.037	(4.42)	**
RURAL	0.052	(3.23)	**	-		
ADULTS (log)	0.014	(0.53)		0.502	(9.21)	**
WORKMEM (16-60)	0.083	(1.43)		0.168	(3.99)	**
LAND (log+1)	0.328	(3.38)	**	0.156	(6.22)	**
MACHINS (log+1)	0.176	(2.79)	**	0.164	(5.56)	**
BUILDS (log+1)	0.045	(1.03)		0.037	(2.15)	*
NINCOME (log+1)	-0.035	(3.77)	**	0.040	(2.95)	**
PENSION	0.147	(1.38)		0.317	(4.23)	**
FOODSH	0.273	(2.97)	**	0.258	(3.77)	**
North Transdanubia	-0.017	(0.57)		-0.012	(0.30)	
West Transdanubia	0.101	(1.31)		0.017	(0.35)	
South Transdanubia	0.129	(1.96)	*	0.147	(3.04)	**
South Plain	0.319	(4.53)	**	0.231	(5.56)	**
North Plain	0.317	(4.55)	**	0.462	(9.03)	**
North Hungary	0.220	(2.92)	**	0.396	(7.74)	**
Intercept	-0.585	(1.51)		3.316	(4.04)	**
λ				0.744	(4.51)	**
Log-likelihood						-2011.63
Number of observations						1395

Note: ** and * indicate that the effect of a variable is significant at the 1or 5 percent level, respectively.

Table 4: Discrete choice analysis of labor allocation

Dependent variable: Wage employment, part-time farming, full-time individual farming						
Variables	***Part-time farming (1)***			***Full-time farming (2)***		
	Coefficient (z)			***Coefficient (z)***		
AGE	0.068	(3.93)	**	0.036	(1.82)	
AGE2 (10^{-2})	-0.058	(4.24)	**	-0.028	(1.58)	
EDU	0.179	(3.24)	**	0.094	(3.11)	**
EDU2 (10^{-1})	-0.088	(2.69)	**	-0.062	(2.39)	*
RURAL	0.023	(4.07)	**	0.095	(5.70)	**
ADULTS (log)	0.015	(1.17)		0.047	(1.29)	
WORKMEM (16-60)	0.039	(1.60)		0.068	(1.44)	
LAND (log+1)	0.167	(3.96)	**	0.225	(4.51)	**
MACHINS (log+1)	0.142	(2.70)	**	0.188	(3.04)	**
BUILDS (log+1)	0.042	(1.04)		0.061	(1.80)	
NINCOME (log+1)	-0.067	(2.79)	**	0.037	(2.06)	*
PENSION	0.202	(1.70)		0.160	(1.47)	
FOODSH	0.289	(2.76)	**	0.119	(1.29)	
North Transdanubia	0.078	(0.99)		-0.080	(1.14)	
West Transdanubia	0.086	(1.22)		0.109	(2.12)	*
South Transdanubia	0.112	(2.07)	*	0.172	(3.33)	**
South Plain	0.299	(4.03)	**	0.275	(4.81)	**
North Plain	0.298	(4.41)	**	0.251	(5.07)	**
North Hungary	0.184	(3.95)	**	0.247	(3.64)	**
Intercept	-0.812	(2.09)	*	-1.069	(2.35)	*
Pseudo R^2						32.52
Log-likelihood						-2144.66
Number of observations						1395

Note: The reference choice is full-time wage employment. ** and * indicate that the effect of a variable is significant at the 1or 5 percent level, respectively.

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