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SURVIVAL AND GROWTH OF INDIVIDUAL FARM ENTERPRISES IN TRANSITION ECONOMIES: EMPIRICAL EVIDENCE FROM HUNGARY

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Abstract: The new individual farmers face the necessity to decide on how much of their assets should be allocated to the individual farm, i.e. what should be the size and scale of operation. Starting from the Jovanovic's (1982) learning model we develop a theory an implication of which is that individual farms may begin at a small even suboptimal scale of production and then, if merited by subsequent performance, expand. Those farms that are successful will survive and grow, whereas those that are not successful will remain small and may ultimately be forced to exit from the industry. The samples of individual farmers analyzed throughout this paper are drawn from the 1997 Farm Household Survey in Hungary. Data on several aspects of household' s human capital, the history of farm enterprise such as age and initial (start-up) size of the individual farm, and the market and industry conditions are available. Our estimation results show that older and larger farms are more likely to survive, farm growth decreases with farm age when farm size is held constant and that the learning considerations are important. An increase of human capital can be expected to improve the effectiveness of a farm operator in allocating the farm's resources and adopting new technologies, which should translate into higher growth and survival rates. On the other hand, a farmer's opportunity for employment outside the sector also increases with his human capital, which raises the probability of switching to part-time farming or exiting the farm sector altogether.

Key Words: transition economies, individual farming, enterprise survival and growth
JEL classification: D1, D2, Q1

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1 INTRODUCTION

The importance of individual farming in the economic transition in Central and Eastern Europe has been of interest for policy-makers during the last decade. An in-debt examination of the issues surrounding the dynamics of individual farm enterprises therefore has become evident. After rural households have made their allocation decision to shift assets to and start up individual farming some important questions have to be answered. The new individual farmers face the necessity to decide on how much of their assets should be allocated to the individual farm? What should be the size and scale of operation? From scientific and policy-making point of view there are some more related questions to be answered such as: Do small farms grow faster than large farms? Are they more or less likely to survive?

To date no theory specific to the development of individual farming enterprises in transitional economies has been put forward and empirically tested. Nevertheless, it may be useful to review what theory does exist on firm survival and growth in order to guide the analysis, which follow and to point the way to a more complete and appropriate theory.

Traditional neoclassical economics posits that quantities of a factor of production are added until the value of the marginal product of the last quantity added is equal to the price paid to that factor of production. This implies that firm growth will occur as a reaction to changes in technology, the cost of production factors (land, labor, etc.), or the price of the product (output). As a result, if one is interested in if individual farms in the economies in transition will survive and grow, this simple theory suggests that one's attention must focus on the factors that have an impact on supply and demand for the product produced by the farm enterprises.

The "stochastic" models[1] extend this simple static framework by making it more dynamic: consideration is given to firms over time. These models also introduce firm-specific costs. In this framework, firms draw each year's growth rate from a distribution. "Lucky" firms repeatedly draw high rates and grow over time. These models are based on the Gibrat's law, the stylized fact that firm growth and firm size are independent. However, researchers began to find fault with the assumptions of the stochastic models, and empirical work demonstrated that Gibrat's law does not hold.

This stochastic model was superseded in the theoretical literature by Jovanovic's (1982) "learning model". In this framework, efficient firms (that is, firms with able managers) grow over time, expanding each period when their managers observe that their guesses about their managerial efficiency turn out to have understated their true efficiency.[2] Jovanovic's model, in its simplest form, predicts that the annual growth rate of a firm will be a function of the accuracy of the manager's predictions regarding their ability, as well as the price of the product. The learning model also has implications about the relationships between growth rates and firm size and age. As successful firm ages, its manager's estimate of their efficiency becomes increasingly accurate. This reduces the variance of the information-updating density, which in turn reduces the probability that next period's output will be widely different from this year's. Therefore, on average older firms grow more slowly than younger ones. With respect to firm size, larger firms grow more slowly controlling for firm age. Larger firms have small values of the cost parameter (that is, they are more efficient).

[1] See for example Simmon and Bonini (1958) and Ijiri and Simon (1964).

[2] Jovanovic assumes demand to be deterministic, and the only firm-specific cost is that associated with managerial inefficiency. There is no technological change in this model.

Such firms have less and less room for further increases, given that the information distribution has a lower bound.

The Jovanovic's model has been criticized for the immutability of the efficiency parameter. In that model, managers are born with an efficiency level, and while they learn what that level is over time, they cannot alter it. Pakes and Ericson (1987) extended the basic model to allow this parameter to be changed through human capital formation.[3] Those firms with managers possessing greater stocks of human capital should be more efficient, and therefore should survive and grow relatively faster.

Another strand of the literature involves economies of scope at the firm level. Teece (1980), building on the work of Penrose (1959) and Williamson (1975), theorizes that when the market for proprietary know-how does not function efficiently, or when an input is specialized and indivisible, a firm may find it more sensible to expand (diversify) than to sell the know-how or output to another firm producing a different product. This approach emphasizes the internal dynamics of the administrative structure of each firm. While this strand seems likely to offer some useful insights into the process of firm growth, such an analysis is beyond the scope of our research.

While these models have motivated a large number of empirical studies for manufacturing industries (examples are Evans, 1987; Variyan and Kraybill, 1994; Nafzinger and Terrell, 1996; Konings, 1997; Lundgvall and Battese, 2000; Goedhuys and Sleuwaegen, 2000), much less has been done for the case of agriculture. Hallam (1993) provides a survey of empirical

[3] One must bear in mind, however, that human capital formation is a lengthy process and in the specific conditions of the economies in transition, in a short to medium term, managerial ability of new individual farmers will be fairly constant.

tests of Gibrat's law for the US and Canadian farm sector. Empirical work for agricultural sector that goes beyond testing Gibrat's law by focusing on the farmer and his / her attributes as a key determinant of farm growth is rare. Sumner and Leiby (1987), Upton and Haworth (1987) and Weiss (1999) are the only studies investigating the relationship between human capital and farm growth in more detail. Even less attention has been devoted to the ability of farms to survive. Farm exits are a precondition for the farm sector to change its structure since land and labor are reallocated among remaining farmers or associations of farmers or converted into non-agricultural uses (Roe, 1995). In addition, the decline in the number of farms is closely related to the overall rural development and may have unfavorable external effects for the non-farm economy particularly in economies in transition.

This paper, besides contributing to the analysis of above-mentioned issues, presents a follow-up analysis of the research concerning start-up of individual farming developed in Rizov et al (2001). In section 2, we put forward a conceptual framework able to explain the survival and growth of individual farm enterprises. Our point of departure is the Jovanovic's (1982) learning model. Next in section 3, we specify the empirical model and discuss estimation issues and variables. In section 4, the hypotheses derived through the conceptual framework are empirically tested. We analyze in detail the survival and growth of individual farms by using micro survey data from Hungary. Section 5 presents discussion and conclusion of the paper.

2 CONCEPTUAL FRAMEWORK

Jovanovic's (1982) theory of firm selection is particularly appealing in view of the rather startling size of most new individual farms. For example, the mean size of the 1618 individual farms surveyed in Hungary in 1997, was 5 hectares, with a large proportion of farms, about 87% being smaller than 5 hectares and 63% smaller than 1 hectare. While the minimum efficient scale (MES)[4] of operation is around 2 hectares, in average and varies substantially across subsectors and even across various product classes, the observed size of most new individual farms is sufficiently small to ensure that the bulk of new farms will be operating at a suboptimal scale of production. Why would an entrepreneur start a new farm that would immediately be confronted by scale disadvantages? An implication of Jovanovic's (1982) theory is that individual farms may begin at a small even suboptimal scale of production and then, if merited by subsequent performance, expand. Those farms that are successful will survive and grow, whereas those that are not successful will remain small and may ultimately be forced to exit from the industry if they are operating at a suboptimal scale of production.

Subsequent to entering production, a farmer must decide whether to maintain the size of operation and respective output (Q_{it}), expand, contract, or exit. The probability of a farm remaining in business in period t, $p(Q_{it}>0)$, is essentially determined by the extend to which this farm is burdened with an inherent size disadvantage, and the probability of undertaking some growth-inducing activity g (e.g., investing, implementing an innovation, etc.). Thus $p(Q_{it}>0)=f(g_{it},c(Q_{it})-c(Q^*))$, where $c(Q_{it})$ is the average cost of producing at a scale of output

[4] In the literature MES of operation is often defined as the mean size of the largest firms in each industry accounting for one-half of the industry value-of-shipments (Commoner and Wilson, 1967). Another example is

Q_{it}, and $c(Q^*)$ is the average cost of producing at the MES level of output, or the minimum level of production required to attain this minimum average cost, Q^*. Thus, in deciding whether to remain in or exit out of the industry, a farm will weigh the extent to which it is confronted by scale disadvantage against the likelihood of growing.

One of the main points to be emphasized is that, as farm size grows relative to the MES level of operation, the more likely the farm is to remain in the industry. This suggests that either an increase in the startup size of the farm or decrease in the MES level of operation should increase the likelihood of survival. It also implies that, given a level of MES, the greater the size of the farm, the less it will need to grow in order to exhaust the potential scale economies.[5]

Next, the role of growth opportunities should also be emphasized. On the one hand, a greater perceived likelihood of growth opportunity (g) will lead the farm to remain in an industry, even if other factors such as the gap between the farm's size and the MES level of operation resulting in a cost differential of $c(Q_{it})$-$c(Q^*)$, would otherwise have led the farm to exit out of the industry. Seen from this perspective farms in environment with high level of growth opportunities (cheap or accessible inputs, positive market developments, etc.) will tend to have a lower propensity to exit, *ceteris paribus*, as long as the perceived likelihood of growth is relatively high. On the other hand, the likelihood that the farm will actually end up producing viable competitive product will clearly be lower in a more competitive environment offering more opportunities. A paradox could be that new farms may have a greater likelihood of growing in an environment characterized by what Scherer (1991) has

in Van de Gucht et al. (2000), where MES is proxied by the median employment for the industry at the three digit level of the NACE classification.

[5] There is an alternative hypothesis (Dunkelberg and Cooper, 1990) suggesting that larger new firms have more financial muscle and are presumed to grow faster.

termed as a "high technological opportunity class" than in an environment characterized by a low "technological opportunity class". Yet, the likelihood that a farm will emerge with a viable and marketable product is greater in the low technological opportunity class, where the product variety and quality required is low too.

That is, the actual expansion activity of the farm, G_{it}, and not the likelihood of that activity, g_{it}, will ultimately determine its size and shape its actual level of output in period t, Q_{it}, so that: $Q_{it}=Q_{it}°+Q(G_{it})$. $Q_{it}°$ is a factor of the farm's output in the previous period, $Q_{it}°=Q_{i0}+\chi Q_{it-1}$, where Q_{i0} is an autonomous level of output and χ is a factor representing the portion of the previous period's output that can be maintained in the market next period (this could be zero in some cases). Factors such as market growth presumably influence the value of χ. That is, if the market growth is sufficiently high, a farm may be able to grow enough so that $Q_{it}=Q^*$, even in the absence of growth inducing activity.

An important implication of the above process is that farms are more likely to be operating at a suboptimal scale if the underlying market and technological conditions are such that there is a greater chance of conducting growth-generating activity. If farms successfully learn and adapt, or are just plain lucky, they grow into viably sized enterprises. If not, they stagnate and may ultimately exit from the industry. This suggests that entry and the startup of new farms may not be greatly deterred in the presence of scale economies. As long as entrepreneurs perceive that there is some prospect for growth and ultimately survival, such entry will occur. Thus, in environments where the MES is high, it follows from the observed general small size of new-farm startups that the growth rate of the surviving farms would presumably be relatively high.

At the same time, farms not able to grow and attain the MES level of operation would presumably be forced to exit from the industry, resulting in a relatively low likelihood of survival. In environments characterized by a low MES, neither the need for growth, nor the consequences of its absence are as severe, so that relatively lower growth rates but higher survival rates would be expected. Similarly, in environments where the probability of growth generating activity is greater, more entrepreneurs may actually take a chance that they will succeed by growing into a viable sized enterprise. In such environments, one would expect that the growth of successful enterprises would be greater but that the likelihood of success (in terms of producing the right product the most efficiently), and therefore survival, would be correspondingly lower.

3 Empirical Implementation

Measuring survival and growth

The conceptual framework developed in section 2 assumes that uncertainty characterizes the managerial ability and thus the optimal size of operation at the point of small business startup. Also in line with the theory, those who enter self-employment gradually learn about their managerial abilities by engaging in the actual running of a business and observing how well they do (Jovanovic, 1982). As they learn more about their abilities through expanding, farm behavior changes throughout time: those who revise their ability estimates upward tend to grow while those embracing downward estimates tend to contract and finally dissolve their operation. Over time, survivors acquire through experience precise estimates of their abilities and optimal scale; the younger farms exhibit more variable behavior because they have less precise estimates of their true abilities.

Data describing selected trails of individual farms (table 1) are consistent with the theoretical framework in section 2 and Jovanovic's characterizations of entrepreneurship. A subsample[6] of 740 individual farms is split into groups of younger and older farms: the older farms, by definition are owned by households who entered individual farming before and during 1991; the younger farms involve entry over the 1992-1994 time period. Table 1 reports the percentage of the sample farms that had decreased their size under the level of 1 hectare by the end 1997 (discontinuance rate) and next, the mean values of 1994 farm size, and size variance.

Table 1 Individual farm groups: Households entering individual farming before and in 1991 vs. those entering in 1992 - 1994

	Pre 1991 & 1991 Entrants	1992-1994 Entrants
Discontinuance rate 1997	18.7%	29.4%
1994 farm size (mean)	10.52 ha	7.12 ha
1994 farm size (std.dev./mean)	4.06	6.46
N	489	251

Relative to the older farm group, the younger farms were (1) much more likely to discontinue operations by end 1997, (2) smaller regarding 1994 farmland size (10.52 ha versus 7.12 ha), (3) more dispersed around mean values. The younger farms clearly exhibit the less settled behavior that is consistent with the hypothesis that they are in the process of learning what their entrepreneurial abilities and thus optimal scale of operation are.

Besides this industry evolution pattern, the questions at individual farm level such as: "Who are the likely survivors of the sorting out process?" is to be answered next. The previous research points out to education (Douglas, 1976), age and experience (Evans and Leighton, 1989), general business acumen (Shapiro, 1975), access to capital (Evans and Jovanovic,

[6] This subsample is drawn out from the country representative sample of 1618 Hungarian farms surveyed in

1989), etc. as important determinants of the entrepreneur's success.

As a first step, we study empirically the question – who are the farmers that are likely to survive the sorting process that characterizes early years of individual farming? Those who remain individual farmers are expected, relative to discontinuances, to possess greater business acumen as well as labor skills and greater access to financial capital. Finally, the youngest farms are most likely to fail.

Next step is to answer the questions about the growth of surviving farm enterprises and how to measure it. Growth of a farm can be measured in several ways, including growth of sales, profits, number of workers, number of livestock, size of land operated. If measurement error and availability of data were not a problem, defining growth in terms of sales or profits might be preferable to a labor, livestock or land-based measure from an accuracy standpoint.[7] Also it must be noted that data sets used in this research rely on a retrospective technique. Since most individual farmers do not keep records, they are unable to report their sales (if any) or profits even at the present time. Moreover the only available relevant information that we have is about the land size of the farm. As a result the measurement of growth in this research is in terms of changes in the size of the land farmed individually.

Other studies have found that growth in sales and growth, for example, in the number of workers are highly correlated. Evans (1987) reports that estimates using employment figures are similar to those using sales. Presuming that growth measures are correlated and facing

1997 and consists of all farms operating in 1994 and equal or larger than 1 hectare.

[7] Growth in the number of livestock or size of landholding is much more "lumpy" than growth in, say sales. A farm might increase its sales a great deal before it adds to its inventory livestock or hectares of land. Same is true for adding additional workers as well.

the restrictions of the data available, using the somewhat less accurate land size measure of growth is not perceived as terribly costly.

Econometric Issues

Based on the theoretical findings discussed in the previous sections and following Nelson and Winter (1982) and Evans (1987) the farm growth relationship is specified as:

$$S_{t+1}=[G(T,S)]^{d}(S_t)e_t, \qquad (1)$$

where S is the size of the farm, T is the age of the farm, t denotes time, d is the time interval over which the growth is measured, and e is a lognormally distributed error term with possibly non-constant variance. Equation (1) suggests the following general growth function[8]:

$$\frac{\ln S_{t'} - \ln S_t}{d} = \ln G(T_{t'}, S_t) + u_t \qquad (2)$$

where $t'>t$, $d=t'-t$ and u_t is normally distributed with mean zero and possibly a non-constant variance and is independent of T and S.

The estimating equation consists of a second-order approximation of the general growth function[9] and as in Konings (1997) we add an extension by a linear combination of variables (X_i) to take into account the effects of market and industry specific conditions and human capital embodied in the entrepreneur-farmer:

[8] Alternative functional forms for the ln$G$ have been tested by regressing the dependent variable against Box-Cox transforms of the levels, squares, and cross products of age and size (Brock and Evans, 1986). In this cases, however, the likelihood function has failed to converge. A semilog specification (where the exogenous variables are measured in levels) has also been tested. The mean square error for the double-log specification has always been lower that that for the semilog specification. In any case, the results for the two last specifications have been similar.

[9] Previous studies have found or assumed an inverse linear relationship between firm growth and firm age (Evans, 1987; Jovanovic, 1982). In respect to the firm growth and firm size, some studies (Evans, 1987; Mansfield, 1962) conjecture inverse relationship, other (Nelson and Winter, 1982) predict an inverted U relationship while a third group of studies (Lucas, 1978; Simon and Bonini, 1958) assume or imply that firm growth is independent of firm size, that is, Gibrat's law holds.

$$\frac{\ln(S_{t'}) - \ln(S_t)}{d} = \alpha + \beta_1 \ln(S_t) + \beta_2 [\ln(S_t)]^2 + \beta_3 \ln(T_{t'}) + \beta_4 [\ln(T_{t'})]^2 + \\ + \beta_5 [\ln(S_t) \ln(T_{t'})] + \sum_{i=1}^{n} \gamma_i X_i + u_t \quad (3)$$

In dealing with econometric issues such as specification of the functional form of *G*, we have tested successive higher order logarithmic expansions until there was no evidence of further non-linearity. As most of the studies show second-order expansion was sufficient.

In principle, however, farms that survive the sort-out process may be systematically different in terms of unobservable characteristics from those that discontinue. Predictions of the farm growth based on estimates obtained only from a sample of farms that survive and grow may be bias due to sample attrition.

Given that ordinary least squares estimates of farm growth may be biased and inconsistent if not corrected for this selectivity bias, a two-step procedure is appropriate to be applied (Heckman, 1974, 1976, 1979). First, survival probabilities are estimated (probit equation) in order to obtain an inverse Mill's ratio. Second, the farm growth rates are estimated. The econometric procedures are as follows.[10]

Survival of farm enterprises can be modeled as:

$$z = \alpha x + \nu, \quad (4)$$

where z=1 if the farm survives until the end of the period, i.e. end 1997, z=0 otherwise. Each surviving farm enterprise has the growth equation:

$$y = \beta x + \xi, \quad (5)$$

where x is a vector of exogenous variables (including the age and size of the farm) as specified in equation (3) determining the farm growth. z=1 if farm growth is y>0, and z=0 if y=0. Given $v,\xi \sim n(0,\sigma_i)$ with correlation ρ, equation 5 can be estimated as:

$$E[y|z=1]=\beta x+\rho\sigma_\varepsilon\lambda_v+\omega, \qquad (6)$$

where $\lambda_v=\phi(\alpha x)/\Phi(\alpha x)$, and ϕ and Φ are the standard normal *pdf* and *CDF*, respectively, for individual farming labor participation.

Farm growth is then estimated including λ as an explanatory variable. If λ is significant, then the censored sample (i.e., only surviving farm operators) is biased and Heckman's procedure must be used with λ correcting for the bias. Otherwise, the OLS estimator is appropriate.

Data and Variables

The samples of individual farmers analyzed throughout this paper are drawn from the 1997 Farm Household Survey in Hungary.[11] The survey is conducted as a cross-section for 1997 but contains some retrospective questions on the size of the land farmed individually as well as on the individual farmer characteristics. The definition of an "individual farm" for the purposes of our analysis here is by no means clear-cut. On the basis of the information available we define an individual farm operation as an individual farm if its land size equals or exceeds 1 hectare.[12] Thus from the total sample of 1618 rural households, 740 (or 45.7%) satisfied the criteria above in 1994, which is the base year for our analysis. Data on several aspects of household's *human capital*, including variables measuring years of education, age,

[10] The specification of the equations in econometric procedures is similar to the specification of Weiss (1999). Considering the nature of the selection process, using the same set of variables x in both equations is justified (see Heckman, 1979).

[11] See Ferenczi (1999) for a detailed description of the Survey.

[12] This criterion is applied also to determine the discontinuance or exit of a farm. When the size of the farm decreases below 1 hectare in the end of the period year, 1997, the farm is considered as exited production. Thus we distinguish between agricultural household plots and individual farm operation. Besides these reasonable considerations, the scarcity of information available forces us to stick to these definitions.

social capital and experience of the household head, are available. In addition to farmer's human capital measures, variables characterizing the *history of farm enterprise* such as age and initial (start-up) size of the individual farm are introduced. Finally, characteristics of the *market and industry conditions* are included. These are MES by subsectors[13] of agricultural production, index measuring the physical access to markets, dummies indicating availability of land, credit, labor, and product markets as well as quality of contract enforcement. Regional fixed effects, are also included in the regression. All of the households analyzed have entered into individual farming before the end of 1994. The selection (survival) equation dependent variable equals one if the farm is still operating (with a minimum farmland size of 1 hectare) in end 1997; it equals zero otherwise. The dependent variable in the growth equation is the average annual growth rate of farm size measured by the land calculated over 3 year period from 1994 until 1997.

Following the estimating equation the set of explanatory variables includes farm size, FSIZE and farm age, FAGE. Farm size is measured at the beginning of the period under consideration, i.e. 1994. Farm age is measured in 1997. Both size and age are in logarithmic terms. The squared terms, FSIZE2 and FAGE2, and the interaction term necessary for the second-order expansion, FSIZE*FAGE are also included.

Human capital is measured by the extend to which the farmer has received formal education and his age as proxies for general skills and experience. The effect of education is analyzed by including a variable EDUHH representing the years of schooling of the household head

[13] The subsectors by production specialization are: 1) mixed crop farms, 2) grain farms, 3) mixed livestock farms, 4) beef farms, 5) chicken and pig farms, 6) mixed livestock and feed farms, 7) mixed livestock and crop farms, 8) other.

and its squared term, EDUHH2.[14] The age of the household head, AGEHH and its squared term, AGEHH2, respectively capture the effect of experience and motivation.[15] Further measures of ability to survive and expand the farm operation are the following dummies: AGREDU is equal to 1 if the farmer has a specialized agricultural education and 0 otherwise; SOCCAP equals 1 when farm household has lived all the time in the same settlement and 0 otherwise; RUREXP equals 1 if household head has always lived in a rural area and 0 otherwise.

The *market and industry related characteristics* include: MES, which is variable created by using the median farm size at 8 production specialization subsectors; the access to markets is taken into account through an index variable, ACCESS[16] which takes higher values when the access is good. The availability and functioning of factor markets is proxied by the dummy variables: LANDMKT, CREDMKT, LABOMKT, PRODMKT, and CONTRACT which take value of 1 if farmers report no or only little problems in functioning of these markets; otherwise the value of these dummies is 0. Region fixed effects are included to control for location specific changes in climatic and market environment.[17] Summary statistics for the variables described above are reported in table 2.

[14] Here it is assumed that the education level of the household head is the same as at the time of starting up the individual farming operation (3 to 6 years ago). This assumption is plausible having in mind the relatively higher age of farmers implying that they should have normally completed their formal education quite some years ago.

[15] The age of the household head is recalculated such that to equal the age at the time of individual farm startup.

[16] The index ACCESS is calculated in the following way: ACCESS=100/((DS+DC+DV+DD)/4), where DS is the distance to the nearest train station, DC is the distance to the county capital, DV is the distance to the village center, and DD is the distance to the nearest department store.

[17] Region 1 consists of the counties Budapest, Fejer, Heves, Nograd and Pest, located around the capital Budapest. Region 2 covers Western Hungary and includes the counties Gyor-Moson-Szolnik, Komarom-Esztergom, Somogy, Vas, Veszprem and Zala. The counties Baranya, Bacs-Kiskun and Tolna located in Southern Hungary are included in region 3. Eastern Hungary consists of the counties Bekes, Borsod-Abaúj-Zemplén, Csongrad, Hajdù-Bihar, Szabolcs-Szatmar-Bereg, and Jasz-Nagykun-Szolnik and is covered by region 4.

Table 2 Summary Statistics

Variable	Definition	Survivors	Discontinuances	Total sample
		Mean (Sd.)	Mean (Sd.)	Mean (Sd.)
GROWTH (dep. variable)	Measure of farm growth over a period of 3 years, calculated as in (2)	0.0536 (0.1776)	-0.0654 (0.2129)	0.0398 (0.1547)
FAGE	Logarithm of the farm age in 1997, the end of the period of analysis	1.8722 (0.1764)	1.8702 (0.2620)	1.8707 (0.2427)
FAGE2	Squared term of the logarithm of the farm age in 1997	3.5663 (0.9542)	3.5363 (0.6211)	3.5585 (0.8800)
FSIZE	Logarithm of the farmland size in 1994, the beginning of the period of analysis	1.1883 (1.1682)	0.1964 (0.6387)	0.9323 (1.1426)
FSIZE2	Squared term of the logarithm of the farmland size in 1994	2.7742 (4.9147)	0.4444 (1.8796)	2.1728 (4.4565)
FAGE*FSIZE	Cross product of FAGE and FSIZE	2.2241 (2.2572)	0.3374 (1.0975)	1.7372 (2.1841)
EDUHH	Years of education of household head	9.8206 (3.3414)	9.2652 (2.8918)	9.6780 (3.2390)
EDUHH2	Squared term of the years of education of household head x 10^{-1}	10.7588 (7.4290)	9.4160 (6.5563)	10.4140 (7.2343
AGEHH	Age of household head	53.4389 (12.2558)	57.7624 (12.2698)	54.5489 (12.3956)
AGEHH2	Squared term of the age of household head x 10^{-2}	30.0564 (13.2852)	34.8621 (14.0746)	31.2902 (13.6448)
AGREDU	Equals 1 if household head has obtained college level agricultural education and 0 otherwise	0.0765	0.0471	0.0689
SOCCAP	Equals 1 if household head has lived always in the same settlement and 0 otherwise	0.6430	0.5392	0.6162
RUREXP	Equals 1 if household head has lived always in rural area and 0 otherwise	0.8579	0.8324	0.8514
MES	MES (median of farmland size) by production specialization subsector	1.5726 (0.7489)	2.4674 (1.3964)	2.2320 (1.3186)
ACCESS	Index measuring the access (distance) to market outlets	9.2974 (13.9349)	8.8547 (10.2174)	8.9690 (11.2861)
LANDMKT	Equals 1 if land market is functioning well and 0 otherwise	0.5602	0.4918	0.5094
CREDMKT	Equals 1 if credit market is functioning well and 0 otherwise	0.4660	0.3534	0.3824
LABOMKT	Equals 1 if labor market is functioning well and 0 otherwise	0.5078	0.4444	0.4608
PRODMKT	Equals 1 if product market is functioning well and 0 otherwise	0.3351	0.2259	0.2540
CONTRAKT	Equals 1 if contract enforcement is functioning well and 0 otherwise	0.4136	0.3078	0.3351
Number of observations		549	191	740

4 ESTIMATION RESULTS

The results of the Heckman's two-stage consistent estimator are reported in table 3. The estimation model is statistically significant at 1% level as measured by the likelihood ratio test. Sigma stands for the estimated standard deviation of the residuals in the growth equation. Rho is the estimated correlation coefficient between the residuals in the survival and growth equations. And Lambda is the inverse Mill's ratio, i.e., the ratio of the standard normal *pdf* and *CDF* for surviving farms. The inverse Mill's ratio is positive and significant, indicating that farms that survive and operate individually have unmeasured characteristics leading to higher growth rates.

Due to data limitations, factors such as financial structure of farms (Shepard and Collins, 1982), farm income, profitability and productivity, the farmer's attitude toward risk (Stefanou, 1988) are not included in the regression. Since some of these unobserved variables will influence both farm survival and farm growth, one might expect the residuals of the two equations to be correlated. Not controlling for farm exits in a model of farm growth would then give biased estimation results. In the regression Rho is negative and significant, which implies that the issue of sample selectivity is important for analyzing survival and growth of farms.[18]

[18] A negative correlation between the disturbances in the growth and survival model has been reported both for business firms (Dunne and Hughes,) and farms (Weiss,).

Table 3 Survival and growth of individual farm analysis (Heckman two-step estimator)

Dependent variable: **GROWTH (Measure of farm growth over a period of 3 years, calculated as in (2))**				
Variables	***Survival***		***Growth***	
	Coef.	***Std.err.***	***Coef.***	***Std.err.***
Farm characteristics				
FAGE	2.5417	0.2170 ***	- 0.2664	0.1087 **
FAGE2	- 0.7123	0.6092	0.0480	0.0410
FSIZE	1.4284	0.3742 ***	- 0.1554	0.0172 ***
FSIZE2	- 0.4262	0.3082	0.0088	0.0017 ***
FAGE*FSIZE	0.3260	0.2062	0.0470	0.0486
Human capital				
EDUHH	0.1215	0.0500 ***	0.0055	0.0019 ***
EDUHH2	- 0.0655	0.0222 ***	- 0.0030	0.0023
AGEDHH	0.0541	0.1363	0.0211	0.0106 **
AGEHH	0.0485	0.0214 **	0.0142	0.0019 ***
AGEHH2	- 0.0658	0.0192 ***	- 0.0132	0.0018 ***
SOCCAP	0.1537	0.0718 **	0.0099	0.0069
RUREXP	0.0738	0.1167	0.0405	0.0108 ***
Market and industry characteristics				
MES	- 0.4642	0.0308 ***	0.0048	0.0019 ***
ACCESS	0.0025	0.0038	0.0010	0.0003 ***
LANDMKT	0.2289	0.0811 ***	0.0572	0.0065 ***
CREDMKT	0.3918	0.0883 ***	0.0446	0.0076 ***
LABOMKT	0.0597	0.0806	0.0022	0.0073
PRODMKT	0.0255	0.0791	0.0139	0.0073 *
CONTRACT	0.0240	0.0771	0.0277	0.0071 ***
Shifters				
REG 2	0.3534	0.0899 ***	0.0510	0.0097 ***
REG 3	0.9268	0.1114 ***	0.0179	0.0095 *
REG 4	0.6470	0.0818 ***	- 0.0134	0.0085
Intercept	2.1022	0.1971 ***	0.0432	0.0148 **
Selection terms				
Rho		- 0.1346	0.0445 ***	
Sigma		0.1542	0.0172 ***	
Lambda		0.0208	0.0069 ***	
Number of observations		740		
Log-likelihood		-665.3972		

***, **, * indicate that the effect of a variable is significant at the 1, 5, or 10 percent level, respectively.

This implies that farms that are growing faster than predicted (a positive error in the growth equation) are more likely to exit from the sample when holding size in 1994 constant (a negative error in the survival equation). One may hypothesis that human capital, for example, would contribute positively to farm growth thereby reducing the likelihood of farm exit. However, human capital may also increase the earnings capacity of a farm operator in the non-farm economy, which has the opposite effect by reducing the probability of farm survival (Goddard et al., 1993). If the second effect is stronger than the first one, a positive impact of human capital on farm growth, for example, can coincide with a negative impact of this variable on farm survival. Since human capital is not completely observable, one can find a negative correlation of the disturbances from the survival and growth equations.

According to our theory, new individual farmers know least about their entrepreneurial abilities at the point when they first enter individual operation. The relationships between farm age and size and its survival are positive, i.e., the newest individual farms are most likely to fail other factors constant. The FAGE and FSIZE variable coefficients indicate that these factors are the strongest determinants of individual farm survival identified in table 3. The longer the period since the farmer entered into individual farming, and the larger the initial farm size, the more likely it is that the farm will remain in operation in 1997.

Farm growth is less than proportionate to farm size and farm age, which implies rejection of Gibrat's law and suggests that smaller and newer farms do grow faster than larger and older ones. The size-growth relationship, however, is also non-linear over the whole range of farm sizes. This fact can be explain by considering a L-shaped long-run average cost curve, as suggested in a number of empirical studies for the farm sector (Kumbhakar, 1993).

Increasing returns to scale up to some threshold level at or above which the returns to scale are constant would suggest that smaller farms either exit or adjust upwards rather quickly towards some minimum efficient scale of production while farms at or above the threshold scale have essentially stochastic growth characteristics. The impact of initial farm size is negative for farms smaller than a certain threshold (about 157 hectares), indicating that within this group, smaller farms grow faster than larger farms. For the farms above the threshold, the impact of initial farm size on farm growth is positive. These significant non-linearities in the growth paths of farms observed here cast doubt upon empirical studies assuming an identical size-growth relationship over the entire spectrum of farm sizes, thus implying a "regression towards mean" for farm sizes. In contrast, our study suggests a polarization of growth rates and provides support to the notion of a "disappearing middle" or "bimodal distribution" in the farm sector in Hungary.[19]

Other important variables for defining survival and growth of farms are human capital characteristics. Education has a positive but non-linear effect on the survival probability. The threshold is at about 9 years of schooling after which the effect turns to be negative. For the growth of the farm, however, the effect of education is linear and positive. Agriculture-specific schooling (AGEDHH) has a significant positive effect on farm growth as well.

Age affects both the survival and growth of farms in non-linear manner as well. The effect of age on the probability of survival is positive for young farmers and becomes negative when age exceeds 37 years. For farm growth, the peak of the quadratic term is at a substantially higher age of 54, which is about the average age of farmers. Generally, these results are

[19] Similar results have been reported by Edwards, Smith and Peterson (1985) and Garcia, Offutt and Sonka (1987) for the U.S. agricultural sector and by Weiss (1999) for the Austrian farm sector.

consistent with the life cycle theory of enterprise development.[20] The positive impact of age on survival and growth at younger age of farm operators is in line with Jovanovic's evolutionary model focusing on the effect of learning and the acquisition of experience. On the other hand, aging implies an approach to the end of life cycle that, by shortening the time horizon within which the gains from growth can be realized, may explain the negative effect of age on growth and survival for older farm operators. The lower turning point for age in the survival equation suggests that for younger individuals there might be better earning opportunities off-farm.

Other human capital characteristics, SOCCAP and RUREXP have positive impact on farming. Social capital is important for the survival of farm enterprises, while rural experience contributes to the farming skills of farm operators and in this way plays significant role in the growth of farms.

The third group of variables, market and industry characteristics, has also significant positive impact both on the survival and growth of farms, in general. Exception is MES, which influences negatively the probability of survival. In a production specialization subsectors with a smaller MES, it is more likely that farm enterprises survive, as measured by the farmland size. Other important determinants of farm survival are the availability and functioning of land and credit markets. For the growth of farm enterprises besides these two market characteristics, important positive role plays also the physical access to markets and the good enforceability of contract. The functioning of product market is relatively important too thus lending support to the hypothesis that in a growing market enterprises are more likely to grow too, conditional on their survival. Finally, farms operating in subsectors

[20] Similar patterns are observed by Gale (1994) in the U.S. farm sector and by Weiss (1999) in the Austrian farm sector.

characterized by a larger MES are much more likely to increase their farmland size, conditional on their survival.

Regions of Hungary have also significant effect on survival probability. The coefficients of regions 2, 3, and 4 are significant and positive relative to the region around the capital, Budapest. This implies that in the close proximity of the capital it is less likely for farms to survive, which besides all might be due to the better non-farm employment opportunities there. This is also in line with our conclusion concerning the differences between turning points for age variable. Conditional on survival, farms in Western and Southern Hungary are likely to grow more than farms in Eastern Hungary and around the capital, Budapest. The explanation for this result, concerning Eastern Hungary, is that in this region market conditions are generally worst in the country.

5 DISCUSSION AND CONCLUSION

On the basis of our estimation results, three key empirical findings emerge. First, older and larger farms are more likely to survive. Second, farm growth decreases with farm age when farm size is held constant, which suggests that the learning considerations captured by Jovanovic's model are important. Third, the inverse growth-size relationship indicates some caution in appealing to Gibrat's law for theories that are meant to apply to the complete size distribution of farms rather than to the specific part of the size distribution (usually largest farms) in the farm sector. The above empirical results are consistent with the theoretical framework developed in section 2.

With respect to the impact of human capital on farm growth and survival, two counteractive effects may be operative (Goddard et al., 1993). On the one hand, an increase of human capital can be expected to improve the effectiveness of a farm operator in allocating the farm's resources and adopting new technologies (Zepeda, 1990), which should translate into higher growth and survival rates. On the other hand, a farmer's opportunity for employment outside the sector also increases with his human capital (Rizov, Mathijs and Swinnen, 2000), which raises the probability of switching to part-time farming or exiting the farm sector altogether. Our results indicate that certain human capital and demographic traits are capable of delineating individual farm survivors from discontinuances. Alternative explanations, however, are also consistent with these findings: human capital inputs partially cause financial capital inputs, and the latter variables may be the true predictors of farm surviving and growth.

The modern theory of finance is built upon perfect market assumptions. Often, however, in

the conditions of the economies in transition, life is not this simple. The value of the small individual business such an individual farm, hinges upon something that cannot readily be sold and bought: the effort of a single owner-manager. The individual farmers often find it "impossible" to persuade potential supplier of capital to share their subjective beliefs, regarding future returns from investment in the farm. Moreover, individual farmers are unsure of their managerial abilities at the point of startup. When uncertainty typifies entrepreneurial talents, as well as the return that can be expected from investing financial capital in the enterprise, it is not surprising that capital market access is limited.

Casual interrelationships between human and financial capital inputs in fact typify only the bank borrower subset of the individual farm startup sample. For startups not receiving bank loans, inputs of human and financial capital are not systematically related; factor input interrelationships, therefore, are unlikely to skew the estimation results. Due to the lack, however, of appropriate data concerning financial capital inputs at the point of startup, it is not possible here to pursue further this avenue of analysis.[21]

[21] Additionally, it is a widely observed fact in the economies in transition that only a very few farmers receive loans from formal sources such as banks (Swinnen and Gow, 1999). Therefore, one can assume that the sample is dominated by farmers who have taken no bank loan.

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