THE ALLOCATIVE EFFICIENCY OF LAND RENTAL MARKETS IN TRANSITION AGRICULTURE

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Introduction

Policy recommendations concerning land issues are widely discussed and have known important evolutions. In 1975, the World Bank formulated its "land reform policy paper" in which they set out four guiding principles: (1) the desirability for owner-operated family farms on both efficiency and equity grounds; (2) the importance of secure property rights to land in eliciting effort and investment and in providing the basis for land transactions; (3) the need for a policy and regulatory environment that promotes transfers to more efficient land uses; and (4) the positive impact of an egalitarian asset distribution and the scope for redistributive land reform where non-market forces have led to a highly dualistic ownership and operational distribution of land, that is, a distribution characterized by very large and very small holdings. Although these principles remain valid, the earlier skeptical view of land rental markets has given away to recognition of their critical role as a means for providing the poor with access to land. The removal of remaining restrictions on land rental markets is therefore a top policy priority (Deininger and Biswanger).

According to Sadoulet et al., it is important to know how land rental markets function for both efficiency and welfare reasons. They assign an efficiency-enhancing effect to land rental markets since the rental market is more likely to allow land transfers from less to more productive users than the sales market. Land transfers are important if there are economies of scale in production or imperfect markets for the determinants of production since, in such circumstances, there exists an optimal operational farm size, which may not correspond to

current household land endowments. Furthermore, rental contracts can directly improve efficiency by compensating for market failures to which tenants are subjected. In the short-run, land rental markets have welfare effects because access to land enables better use of indivisible assets, allows households to use idle assets that can only be valorized through access to land (such as captive family labor and unused managerial and supervisory skills), and helps households access resources for which the market is either imperfect or missing (Sadoulet et al.).

In most Central and East European countries (CEECs), the practice of buying and selling land has not yet developed as a result of both economic and legislative reasons. This has resulted in a very unequal distribution of farm sizes, following the initial land reform processes that started in 1991-1992 (Sarris et al.). Authorities only slowly implement policies to facilitate further movement of land plots between individuals, with the objective of creating farm sizes that are appropriate for efficient farming. Without a functioning land market, land owners who are the least risk-averse and the most motivated to farm individually will not be able to increase their initial holding and thus land will remain locked into an inherently inefficient distribution pattern. In order to avoid under-utilization of valuable land resources a clear legal process must be defined for inactive landowners to rent or sell land to those who want to farm. Since land sales are still restricted throughout CEECs, private farmers can take advantage of leasing opportunities in order to adjust their holdings.

In this paper we will take a closer look at the functioning of the Hungarian land rental market following Barrett et al.'s approach to the labor market. However, rather than developing a formal (household) model, we try to develop a simple framework to assess the functioning of land (rental) markets that is easy to disseminate. The methodology we used for this objective is described in the second section of the paper. The third section tries to characterize the Hungarian land rental market: on the one hand a general overview of land

use and ownership in Hungary is given, on the other hand we discuss the data used in our analysis as well as the incidence of leases. In the fourth section we show how the effectiveness of the land rental market varies among households and regions and we try to explain these differences using regression analyses. Finally, we formulate the conclusions of our analysis.

Methodology

The aim of this paper is to assess and explain the functioning of land rental markets. For this, we use a simplified version of the four-step methodology proposed by Barrett et al.'s to estimate labor supply in Côte d'Ivoire agriculture. The procedure is as follows:

1. For each farm in the sample the Marginal Value Product of Land (MVPL) is estimated using a Cobb-Douglas production function. Farm-specific MVPL are then calculated by taking the derivative of the estimated function with respect to land. [1]
2. Using a sub-sample of farmers who are active in the land rental market (i.e. those leasing in and/or out agricultural land), the computed MVPL figures are compared to the land rental prices paid or received by these farmers. We calculate the "allocative inefficiency" (AI) of a household as the deviation of the text book equilibrium MVPL = w_{rental}, being AI = $\ln(MVPL/w_{rental})$. Consequently, we can estimate the AI as a function of household characteristics that are either immutable or predetermined choices, and measures of factor constraints.[2]

[1] Barrett et al. use a generalized Leontief production frontier for their estimations because of the many zero-valued observations in their sample. With the Cobb-Douglas specification, we have chosen a more simple approach, as it is much easier to adopt.

[2] Such allocative inefficiency – relative to the textbook welfare-maximizing equilibrium condition – appears commonplace in low-income agriculture (Ali and Byerlee, 1991). Also Feder (1985) argues that, in the presence of multiple market failures (e.g. land, labor, credit and insurance markets), the households' marginal valuation of factors of production routinely deviates from prevailing market prices, and this in a structural manner.

3. These estimated parameters are then used to derive the AI of those households who are nor leasing in nor renting out agricultural land.
4. Finally, these AI-scores are aggregated to a level that corresponds to the notion of a land market. For Hungary, we take the county level. This county-specific indicator then allows us to determine the factors that cause regional differences in the functioning of the land rental market.

The Hungarian Land Rental Market

In this section we will describe the features of the Hungarian land rental market. Hence, we first discuss land ownership and land use in Hungary in order to get a general overview of the country-specific situation. Second, we depict the data used for determining and clarifying the regional differences concerning the effectiveness of the Hungarian land rental market.

Land ownership and land use

Under the communist regime, three types of organizations dominated Hungarian agriculture: collective farms, state farms and household plots. Their share in land use was estimated at 80%, 14% and 6% respectively. Nevertheless, these figures differ considerably from the ownership distribution of productive land: the collective farms owned 42%, the members of the collectives 24%, the state owned 27% and other private owners hold 7% of productive land. In 1989, the central planning apparatus was dismantled and profound reforms accompanied the transition to a market economy. Within the agricultural sector, four concepts were at the center of attention: restitution, compensation, transformation and privatization (Mathijs and Mészáros).

Restitution is the first key issue that characterizes the agricultural reforms. This term refers to the fact that members of collective farms who had always retained title to part of the

land were permitted to withdraw land freely from the collective farm. This land was owned by individuals but cultivated by the collective farms during the communist period. Hence, it was subject to land consolidation and improvement investments by the collective. As a result the members could withdraw a share of this land proportional to the land they brought in.

Former landowners who had lost their land were compensated for their losses. People eligible for compensation were farmers whose land was seized just after the Second World War and farmers who were forced to sell their land to the collective farm for a low price in the 1970s and 1980s. Former owners (or their descendants) who claimed compensation received vouchers based on the estimated value of their lost property. These vouchers could be used (1) to buy physical assets and shares in newly privatized companies; (2) to buy, at auctions, land designated for compensation; (3) to buy apartments owned by the state or local authorities; (4) to claim a life-annuity from the state (for elderly people); or (5) to sell directly or through the stock exchange.

Transformation of collective farms embraces the third aspect of the agricultural reforms. Collective farms could choose between three alternative directions of transformations: (1) to transform the collective into a free co-operative, (2) to divide the property of the collective among its members, or (3) to transforms the collective farm into a free co-operative. All the collectively owned non-land assets were divided as business shares among members and employees of the collective farms. The land that the collective farms used was divided into three land funds: (1) approximately one-third of the land was still privately owned; (2) one-third was collectively owned land set aside for members and employees; (3) the residual one-third of collectively owned land was set aside for compensation.

Finally, the state farms were broken up into more variable farm units and then privatized. People who can buy shares of state farms include existing workers and tenants,

on-farm and outside owners of compensation vouchers, creditors and domestic and foreign investors. Land was excluded from this privatization procedure. Land remains in public ownership and the companies are now renting their land.

Farm restructuring and land reforms generated important changes in land use as well as land ownership, that are illustrated in tables 2 and 3. Despite these changes in land ownership, Hungary's land sales market is still embryonic which is caused by two factors. First, there is the problem of the delay in land entitlement, in particular for co-operative shares. Second, existing legislation constraints land ownership and thus land transactions by setting an upper limit of 300 ha for individual ownership, by prohibiting legal persons and non-resident foreign citizens to own agricultural land and by forbidding the sale of land received through compensation or as a share from collective farms for three years after receipt. These constraints clarify the importance of the land rental market in transferring land from less to more productive users.

As opposed to the sales market, we observe a very active rental market with many different participants. In this study we want to investigate how the functioning of the land rental market enables farmers to adjust the operational size of their production units. As a consequence, we focus on the impact of the functioning of the rental market on individual farmers, and thus not on the constraints and possibilities experienced by other individuals or legal persons. An overview of the use of land by individual farmers in 1994 is given in table 3.

Data

The data used in this paper originate from two sources. On the one hand, we use county-level information from the statistical yearbook of Hungary (Hungarian Central Statistical Office). On the other hand, we use data derived from a representative survey of Hungarian family

farms carried out in 1998 collecting data for 1997.[3] The data sets contain detailed information on production structure, labor, land and other input use, capital, non-agricultural activities, investments, credits and external conditions of 1,618 family farms. A review of the data revealed some errors and farms for which errors could not be resolved were dropped. Further, farms for which information about physical production was missing were eliminated. We assumed further that two inputs are essential in agricultural production: labor and land. If information about these inputs was absent, the farm was also removed, such that we ended up with a sample of 1,158 family farms.

The data used for the estimation of the Cobb-Douglas production function include gross output and data on land, labor, capital and other inputs. Concerning land use, figures were available for the total cultivated area in 1997. The input capital consists of four components, i.e., the estimated value of buildings, machinery, livestock and plantations. The available labor figures were converted into annual working units (AWU). One AWU corresponds to 2,150 hours worked, i.e., the number of hours that a full-time worker can perform in one year. The surveys include also figures on other inputs, such as purchases of seeds, feed grains, roughage, concentrated feed, fertilizers, electric energy, gas, fuels and services. Output is physical production valued at fixed prices and corrected for own produced feed used for the breeding of animals. Using fixed national prices was necessary to avoid that output would be effected by price differences. The prices used in the output calculations were based on price information available in the surveys. Further, we also incorporate a measure for land quality in the specification of the production function since this will affect the magnitude of output change when increasing the cultivated land area with one unit. Finally, we enclose regional dummies since geographical conditions are likely to be

[3] These data were collected in the framework of EU Phare ACE project P96-6090-R coordinated by Jo Swinnen and Erik Mathijs. The Hungarian survey was coordinated by Tibor Ferenczi, Budapest University of Economic Sciences.

important when looking at the derivative of output with respect to the amount of cultivated land.

Summary statistics for the variables used in the Cobb-Douglas specification can be found in table 4. By way of illustration, we also report the descriptive statistics of explanatory variables of the production function for two sub-samples: the group of farmers active in the land rental market (22%) on the one hand, and a group of farmers neither leasing in nor renting out agricultural land (78%) on the other hand. It becomes clear that there are important differences between the two sub-samples: those active in the land rental market are on average larger than those neither leasing in nor renting out. Testing for equal means between both categories reveals that, at a 0.1 level of significance, the means of the variables *output*, *cultivated land*, *land quality*, *machinery*, *seeds*, *roughage*, *fertilizer*, *electric energy*, *fuels* and *services* are significantly larger for the sub-sample of farmers active in the land rental market. These results suggest that farmers who adjust their land size through the land rental market will reach a larger economic size. Since there exists a positive relation between economic size (measured by total output) and the efficiency of Hungarian family farms (Mathijs and Vranken), these results suggest that farmers who adjust their farm size through land leasing may be more efficient.

Table 5 reports descriptive statistics of the variables, which will be used in step 2 and 3 of our analysis, respectively estimating the AI as a function of household characteristics and measures of factor constraints, and deriving the AI of those households who are neither leasing in, nor renting out agricultural land. Again we see important differences between the means of some variables. Based on t tests for equality of means, we can conclude that the average *share of non-farm income* as well as the average *expenditures per household member* are significantly larger for farmers not active in the land rental market. Conversely, means of the *age* of the household head, the *labor endowment* of the household, the *distance* to the

railway station, the *number of plots* cultivated and the *number of crops* grown are all significantly larger for the sub-sample of family farms involved in the land rental market. Further, the share of households from which someone is *member of a cooperative* or *partner in a company*, as well as the share of family farms who *received land in compensation* is also significantly larger for those active in leasing in and/or out land.

Characterization of the Hungarian land rental markets

In this paragraph we try to shape regional differences in the incidence of leases, in the constraints concerning renting in land experienced by rural households and in reasons why households rent out (part of) their agricultural land (table 6). First, it becomes clear that there is a huge variation in the share of households active in the rental market (from 1% to 38%). This variation is mainly caused by enormous differences in the percentage of households leasing out their agricultural land. Further, renting out seems to occur much more frequently than renting in land. Most reasons for renting out land are linked with the lack of labor and machinery. Nevertheless, the percentage of households who experience that labor and/or machinery shortages drive them to rent out land differs greatly among counties. Finally, also deficiency in labor impedes households to rent in (more) agricultural land. These figures indicate that there are strong links between the functioning of the land rental market and the labor market, which we will investigate in the next section.

Estimation Results

Calculation and assessment of allocative inefficiency at household level

In the first step of our analysis we estimate a Cobb-Douglas production function in order to derive the marginal value product of land. Since some inputs may have zero values, we include a dummy variable for each input, which equals one if the farmer does not have/use

the particular input and 0 otherwise. At the same time the original input variables are replaced by a new variable, which equals the original value if the original variable has a positive value, and which equals 1 when the original variable is zero. We use this procedure only for *buildings, machinery, livestock, permanent crops, seeds, feed grain, roughage, concentrated feed, fertilizer, electric energy, gas, fuel* and *services.* According to Battese, this technique yields efficient estimators using the full data set without introducing bias. Furthermore we also include county-dummies in order to capture regional differences that may affect the production function. Results of the production function estimates are given in table 7.

The production function estimates allow us to calculate the AI of farmers who do adjust their land size by renting practices since we know the land rental price they received or paid. If the AI has value zero, then the farmer equalized his marginal value product of land to the land rental price so the textbook equilibrium has been reached. Conversely, deviation of the AI-scores from zero means that land is under- or oversupplied. In order to capture these deviations we take the absolute value of the AI from which we give the distribution in figure 1. In principle, this distribution is censored at 0 and has a relatively large but thin positive tail (kurtosis 2.9, skewness 0.5). Therefore to estimate the AI as a function of household characteristics and factor constraints a left-censored tobit regression has to be used. But since none of the variables were censored at zero in the tobit-model, the regression reduced to the classical ordinary least squares with the following results (table 8):[4]

1. Personal characteristics of the household head do not influence the AI significantly. The same holds for income characteristics and the asset index of the household. These results suggest that there are no differences in access to the land rental market

[4] The lower the AI score, the better the land rental market works. Thus, when a variable has a positive impact in the regression, it means that it increases the AI score and it is worsens the functioning of the land rental market and vice-versa.

between poor and wealthy farmers, well-educated and poorly educated farmers, etc., *ceteris paribus*.

2. Land endowment has a negative impact on AI. Hence, households with more land are more capable to adjust their land size to the prevailing market prices. According to Skoufias, households who own more land are more likely to rent out land. In this way they can adjust their landholdings to an optimal operational size by renting out, while they still cultivate enough land themselves to make a living.
3. A larger herd (i.e. equivalent numbers of livestock heads) leads to a higher AI. In other words, livestock farmers have more difficulty to adjust their farm's land endowment than crop farmers.
4. More remote household farms are less efficient in adjusting their land size to the prevailing market prices. One possible explanation for this can be that farmers in remote areas have less labor opportunities so that they stick to farming, even if they can not reach on optimal size, since that is their main (or only) way of making a living.
5. The more plots, the better a farmer succeeds in equalizing his MVPL to the market price. This suggests that some degree of land fragmentation is necessary for the land rental market to work.
6. The impact of the number of cultivated crops on AI is non-linear: negative up to 4 different crops and positive thereafter. This result suggests that when a farmer is too diversified he will run into problems getting enough land for each crop, i.e., that he is loosing scale economies.
7. Being partner in a farming company lowers the allocative inefficiency, while being member of a cooperative has no significant effect on AI. This is an indication that the vicinity of a cooperative suppresses the functioning of the land rental market which

can be caused for example by forcing members to rent out their land to the cooperative for a very low price. Conversely, the proximity of a company is beneficiary for the effectiveness of the land rental market. Probably, this has to do with the fact that companies are mostly smaller than cooperatives so the former will be less capable to dominate and distort the market.

Table 8 reveals that there is a nontrivial systematic variation in the AI scores, with the R^2 of 0.38 suggesting some reasonable possibility for imputing AI values of households not participating in the land rental market. The distribution of the fitted AI scores (i.e. AI scores for households not active in the rental market) plus the actual AI scores (i.e. scores of households leasing in/out land) is shown in figure 2.

Calculation and assessment of allocative inefficiency at county level

In the last step of our analysis we aggregate the actual and fitted AI scores to county level so that we reach an indicator for each county. In figure 3, a map of Hungary illustrates the regional differences in AI: the lower the AI score, the better the land rental market functions in that county. The map reveals that southeastern counties, the fertile plains of the Puszta, have a land market which functions much better than in the counties in the northwest, close to the Austrian border. The latter is somewhat surprising as anecdotal evidence is often provided about Austrian farmers being very active in the land rental market close to the border. However, this phenomenon is probably confined to some municipalities close to the border and does not seem to have a substantial impact on the land market at the county level.

There is reasonable belief that constraints in rural labor markets have spillover effects on land market participation decisions (Pereira and Summer). More specifically, we consider the relationship between the county-level AI and the following variables which were readily available from the Hungarian statistics: the number of industrial employees per 1000

inhabitants, the unemployment rate, the change in unemployment between 1992 and 1996, and the agricultural wage. Table 9 reveals the following regression results (all results are significantly significant at 5% level):

1. The number of industrial employees per 1000 inhabitants is positively related to AI: the more industrialized a county, the less efficient its land market. In such counties agriculture is not an important economic activity and is even performed for subsistence reasons. Farmers adjust their labor endowment rather than their land endowment as sufficient off-farm opportunities are available. As a result, the land market is rather thin in industrialized counties.
2. The unemployment rate is negatively related to AI: counties with a higher unemployment rate have more efficient land rental markets. Unemployed individuals are forced into self-employment activities in the absence of viable alternatives. These activities constitute primarily agricultural production. More actors imply better functioning land rental markets.
3. However, the change in unemployment is positively related to AI, which suggests that the impact of unemployment on the AI is conditional on the initial level of unemployment in 1992.
4. The agricultural wage is negatively related to AI: a high agricultural wage reflects good agricultural conditions and thus a more active land market.

In summary, there is a negative spillover effect from the labor market into the land market, when the initial unemployment level is low. In such counties, individuals working off-farm still keep their land, thus hampering the emergence of an active land market. This is surprising as the existence of economies of scale would suggest transactions to take place to enlarge the holdings of those who stay. Several reasons can be suggested for this phenomenon. First, individuals who engage into off-farm work may still have an incentive to

cultivate their land extensively. Speculation that land prices will increase upon EU accession is one such incentive. Second, it may be difficult to find somebody to rent the land, as everybody moves to the labor market, resulting in a matching problem. Third, there may be other factors explaining why farmers do not increase their holdings despite the existence of scale economies. For example, Gow and Swinnen indicate the existence of delayed payments for delivered product as an important problem in CEEC agriculture explaining why farmers do not invest. In a more dynamic environment characterized by decreasing unemployment, these incentives seem to play a lesser role.

Conclusions

In this paper, we adopted a four-step methodology to assess the functioning of the land rental market in Hungarian agriculture, both at the level of the household and of the "market" represented by the county. We computed an index of allocative inefficiency as the wedge between opportunity cost of land and land rental price paid. At the household level, no systematic differences in human capital and wealth was observed between farmers with high and low allocative inefficiency. We did find that larger farms (in terms of land) display higher levels of allocative efficiency. At the county level, we have found significant correlations with labor market characteristics, suggesting that a well functioning labor market involves a thin land market and vice-versa. The implication of this is that in Hungary, while improving the livelihoods of households, improving off-farm opportunities does not automatically lead to a better functioning land rental market. Hence, specific measures to overcome matching problems, such as better land information systems, may be necessary. Further research must explore whether additional problems, such as uncertain business environment, cause land markets to be imperfect.

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Table 1: Ownership of productive land (%), 1990-1995

Year	State	Collective farms/ co-operatives	Co-operative members	Other private owners
1990	27	42	24	7
1991	27	39	23	11
1992	24	31	26	19
1993	23	19	23	35
1994	21	-	40	41
1995	20	-	33	48

Source: European Commission

Table 2: Use of productive land in 1996

	Companies	Co-operatives	Private (individual) farms
Number	4300	2100	1200000
% of agricultural area	18	28	54
% of total productive land	28	24	48

Source: European Commission

Table 3: Use of land by individual farmers in 1994

	1000 ha	Percent
Leased	883	41
Used for own production	1286	59
Total land owned	2169	100
Owned and used for own production	1286	86
Rented	178	12
In household ownership	35	2
Total land used	1499	100

Source: European Commission

Table 4: Summary statistics, variables used in Cobb-Douglas specification

	Total sample		Sample of farmers active in the land rental market		Sample of farmers NOT active in the rental market	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Output (10^3 HUF)	918.8	4464.6	1704.8	7097.5	699.1	3353.8
Cultivated Land (ha)	7.3	44.6	15.1	67.6	5.2	35.3
Land Quality (Gold Crown)	19.9	9.1	21.2	8.6	19.5	9.3
Labor (AWU)	1.1	1.0	1.1	0.9	1.1	1.0
Buildings (10^3 HUF)	452.9	3176.3	606.6	1782.8	409.9	3466.7
Machinery (10^3 HUF)	471.0	3931.3	814.1	4263.0	375.1	3830.5
Livestock (10^3 HUF)	259.3	2445.2	273.4	690.0	255.4	2742.2
Permanent crops (10^3 HUF)	259.2	2877.3	302.3	1977.0	247.1	3083.2
Seeds (10^3 HUF)	49.5	359.4	139.4	741.0	24.4	96.5
Feed grain (10^3 HUF)	26.7	141.4	39.1	211.4	23.3	114.3
Roughages (10^3 HUF)	5.7	37.6	9.1	36.5	4.8	37.9
Concentrated feed (10^3 HUF)	48.5	493.0	97.6	781.7	34.7	373.9
Fertilizer (10^3 HUF)	52.1	390.8	136.6	748.9	28.5	191.2
Electric energy (10^3 HUF)	22.2	97.9	33.6	144.5	19.0	80.0
Gas (10^3 HUF)	12.9	95.4	11.4	66.0	13.3	102.1
Fuels (10^3 HUF)	68.7	460.0	152.3	713.2	45.3	355.7
Services (10^3 HUF)	60.1	237.6	127.7	419.8	41.2	146.7
Central Hungary						
Budapest and Pest[a] (%)	11.0		13.8		10.2	
Fejér[a] (%)	3.8		0.4		4.8	
Heves[a] (%)	4.1		2.8		4.4	
Nógrád[a] (%)	3.2		3.6		3.1	
Southern Hungary						
Baranya[a] (%)	1.7		2.4		1.5	
Bacs-Kiskun[a] (%)	11.1		11.1		11.0	
Tolna[a] (%)	3.9		7.1		3.0	
Eastern Hungary						
Békés[a] (%)	5.0		4.7		5.1	
Borsad-Abaúj-Zemplén[a] (%)	7.8		9.5		7.3	
Csongrád[a] (%)	6.5		5.9		6.6	
Hajdú-Bihar[a] (%)	6.2		4.0		6.9	
Szabolcs-Szatmar-Bereg[a] (%)	11.0		3.2		13.1	
Jasz-Nagykun-Szolnok[a] (%)	4.4		4.7		4.3	
Western Hungary						
Györ- Moson-Sopron[a] (%)	5.3		7.9		4.5	
Komáron-Esztergom[a] (%)	1.6		2.8		1.3	
Somogy[a] (%)	4.2		5.5		3.9	
Vas[a] (%)	3.6		6.3		2.9	
Veszprém[a] (%)	2.8		1.6		3.2	
Zala[a] (%)	2.8		2.8		2.9	
Number of observations	1158		253		905	

[a] Share of family farms located within the county

Source: Own calculations

Table 5: Descriptive statistics, variables used for estimating allocative inefficiency

	Total sample		Sample of farmers active in the land rental market		Sample of farmers NOT active in the land rental market	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Share of non-farm income (%)	79.8	24.7	74.8	27.3	81.2	23.7
Expenditures per household member (10^3 HUF)	20.1	12.6	18.6	11.5	20.6	12.8
Age of household head (year)	52.1	12.9	53.3	12.3	51.8	13.1
Education of household head (year)	9.3	2.7	9.4	3.1	9.2	2.6
Land endowment (ha)	5.5	33.0	7.1	22.9	5.1	35.3
Livestock (index)	10.3	98.5	12.3	77.4	9.7	103.6
Labor endowment (persons)	3.1	1.4	3.4	1.6	3.1	1.4
Distance to train station (km)	6.4	7.8	7.3	8.7	6.1	7.4
Number of plots	2.3	2.4	3.1	3.7	2.1	1.9
Number of crops	1.5	1.4	1.7	1.7	1.4	1.3
Asset index	571.2	91.9	567.6	104.0	572.1	88.2
Member in cooperative[a] (%)	17.9		36.0		12.8	
Partner in company[a] (%)	3.3		5.9		2.5	
Land received in compensation[a] (%)	21.9		26.1		20.8	
Land owned before 1990[a] (%)	64.9		64.8		65.0	
Central Hungary[a] (%)	22.0		20.6		22.4	
Southern Hungary[a] (%)	16.7		20.6		15.6	
Eastern Hungary[a] (%)	40.8		32.0		43.3	
Western Hungary[a] (%)	20.5		26.9		18.7	
Number of observations	1158		253		905	

[a] Share of households for which the dummy equals one

Source: Own calculations

Table 6: Incidence of leases and constraints experienced by rural households

	Share of households active in rental market	Share of households renting in	Share of households renting out	Reasons for renting out			Constraints to rent in land			
				Not enough labor	Not enough machinery	More profitable to rent out	Not enough labor	No legal security	Rent too high	No tradition of renting
Central Hungary										
Budapest and Pest	34	12	22	69	72	20	80	6	21	7
Fejér	1	1	0	0	0	0	77	1	4	0
Heves	22	9	13	49	47	13	66	12	26	9
Nógrád	24	6	18	100	50	50	78	14	14	10
Southern Hungary										
Baranya	10	2	10	86	86	0	71	22	48	7
Bacs-Kiskun	22	12	10	63	81	44	85	16	36	23
Tolna	34	9	27	80	92	9	82	17	62	30
Eastern Hungary										
Békés	30	7	25	75	63	43	75	32	53	12
Borsad-Abaúj-Zemplén	30	9	21	55	60	38	54	8	33	21
Csongrád	20	13	9	55	64	36	75	5	16	3
Hajdú-Bihar	25	5	20	74	77	31	71	33	40	15
Szabolcs-Szatmar-Bereg	7	3	5	44	44	50	68	12	46	8
Jasz-Nagykun-Szolnok	23	5	18	93	100	54	83	9	27	10
Western Hungary										
Györ- Moson-Sopron	38	9	28	67	94	61	85	41	67	48
Komáron-Esztergom	35	16	19	75	100	0	61	0	16	0
Somogy	20	8	15	98	70	56	78	12	23	1
Vas	37	7	32	100	94	53	88	20	15	23
Veszprém	22	3	21	100	86	60	95	82	91	67
Zala	13	2	11	57	100	33	97	22	23	22
Total sample	23	7	16	70	72	34	76	15	32	13

Source: Own calculations

Table 7: Cobb-Douglas production function

Independent variable	Coefficient	P-value
Ln (land*100)	0.3268	0.0000
Ln (land quality)	0.4005	0.0000
Ln (labor*100)	0.0927	0.0460
Ln (buildings)	0.0733	0.0200
Ln (machinery)	-0.0428	0.2050
Ln (livestock)	0.1667	0.0000
Ln (permanent crops)	0.0934	0.0400
Ln (seeds)	0.0455	0.2440
Ln (feed grain)	0.2245	0.0000
Ln (roughage)	-0.0200	0.8520
Ln (concentrated feed)	0.1470	0.0020
Ln (fertilizer)	0.1672	0.0000
Ln (electric energy)	0.0548	0.2600
Ln (gas)	0.0442	0.5350
Ln (fuels)	0.0467	0.3640
Ln (services)	0.0474	0.1750
Buildings dummy	0.2434	0.2590
Machinery dummy	-0.1638	0.3040
Livestock dummy	0.6590	0.0000
Permanent crops dummy	0.2811	0.2320
Seeds dummy	0.1896	0.1080
Feed grain dummy	0.5507	0.0050
Roughage dummy	-0.1454	0.7090
Concentrated feed dummy	0.2383	0.1540
Fertilizer dummy	0.3409	0.0080
Electric energy dummy	-0.0002	0.9990
Gas dummy	0.1660	0.5220
Fuel dummy	0.1949	0.3100
Services dummy	-0.1303	0.3010
Central Hungary		
Fejér	-0.2860	0.1960
Heves	0.0391	0.8520
Nógrád	-0.3754	0.1000
Southern Hungary		
Baranya	-0.2991	0.2990
Bacs-Kiskun	0.2137	0.1580
Tolna	-0.2980	0.1560
Eastern Hungary		
Békés	0.3538	0.0660
Borsad-Abaúj-Zemplén	-0.0050	0.9750
Csongrád	-0.1558	0.3820
Hajdú-Bihar	0.0605	0.7380
Szabolcs-Szatmar-Bereg	-0.0727	0.6570
Jasz-Nagykun-Szolnok	-0.0725	0.7130
Western Hungary		
Györ- Moson-Sopron	0.1765	0.3530
Komáron-Esztergom	0.1909	0.5010
Somogy	0.2613	0.2030
Vas	0.5074	0.0160
Veszprém	0.2937	0.2120
Zala	0.5257	0.0270
Intercept	5.7231	0.0000
R^2	0.56	
Adjusted R^2	0.55	
Number of observations	1158	

Source: Own calculation

Table 8: Allocative inefficiency scores regressed upon household characteristics

Independent variable	Coefficient	P-value
Share of income not coming from own farm	-0.0051	0.1190
Expenditures per household member	-0.0041	0.6340
Age of household head	-0.0564	0.2100
(Age of household head)2	0.0006	0.1630
Education of household head	0.0546	0.6500
(Education of household head)2	-0.0029	0.5940
Land endowment	-0.0210	0.0710
Land endowment2	0.0001	0.2160
Livestock unit	0.0116	0.0100
Livestock unit2	0.0000	0.0160
Labor endowment	0.0829	0.6250
Labor endowment2	-0.0106	0.4910
Distance	0.0423	0.0210
Distance2	-0.0006	0.2170
Number of plots	-0.0844	0.0780
Number of plots2	0.0018	0.1690
Number of crops	-0.4893	0.0000
Number of crops2	0.0567	0.0000
Central region	-0.6961	0.0010
East region	-1.1529	0.0000
South region	-0.9482	0.0000
Member in cooperative	0.1148	0.4240
Partner in company	-0.6285	0.0430
Asset index	-0.0017	0.9820
Land received in compensation	-0.0584	0.7070
Land owned before 1990	0.0522	0.7420
Intercept	4.4178	0.0040
R^2	0.39	
Adjusted R^2	0.32	
Number of observations	239	

Source: Own calculations

Table 9: Allocative inefficiency scores at county level

Independent variable	Coefficient	P-value
Industrial employees per 1000 inhabitants	0.0085	0.0220
Unemployment rate	-0.1562	0.0000
Change in unemployment (1996-1992)	0.0234	0.0030
Agricultural wage	-0.0048	0.0120
Intercept	5.3785	0.0000
R^2	0.80	
Adjusted R^2	0.74	
Number of observations	19	

Source: Own calculations

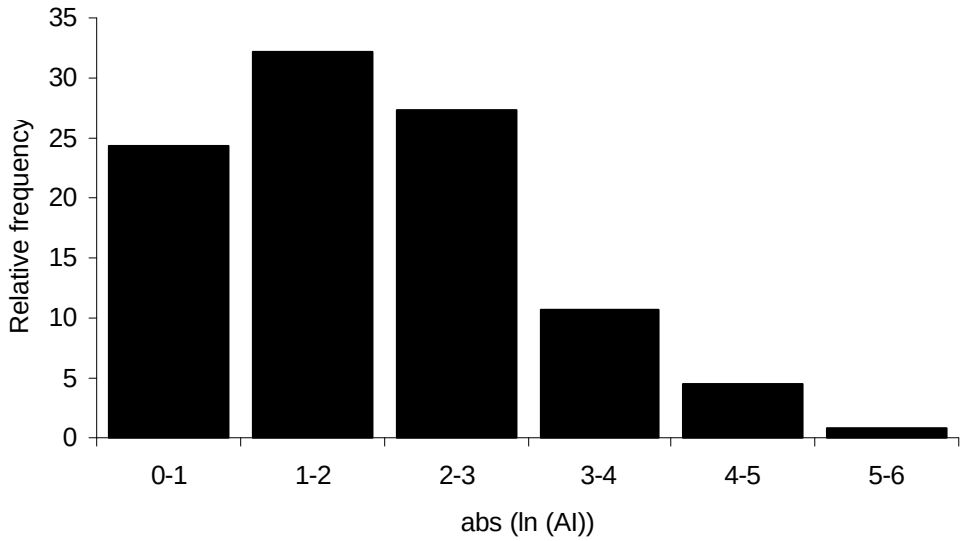

Figure 1: Distribution of the allocative inefficiency of farmers participating in the land rental market

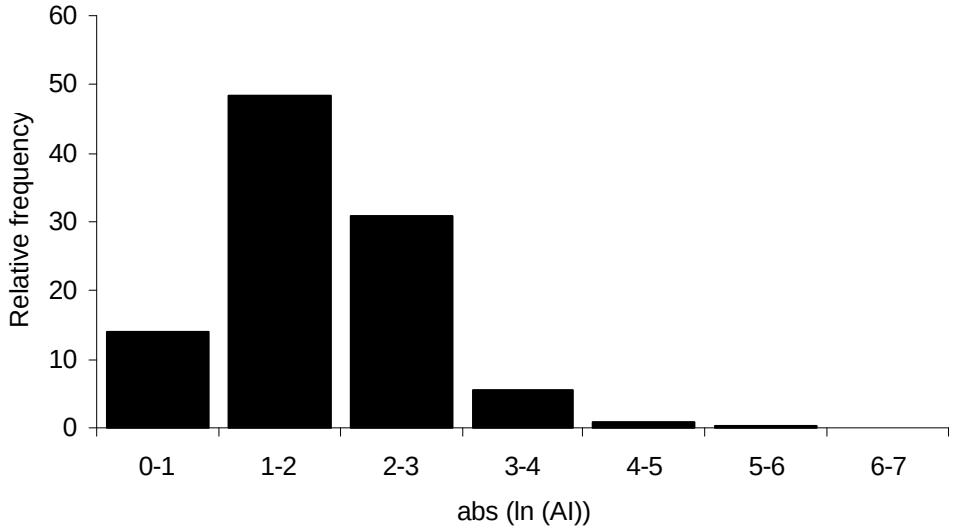

Figure 2: Distribution of the allocative inefficieny of farmers participating and not participating in the land rental market

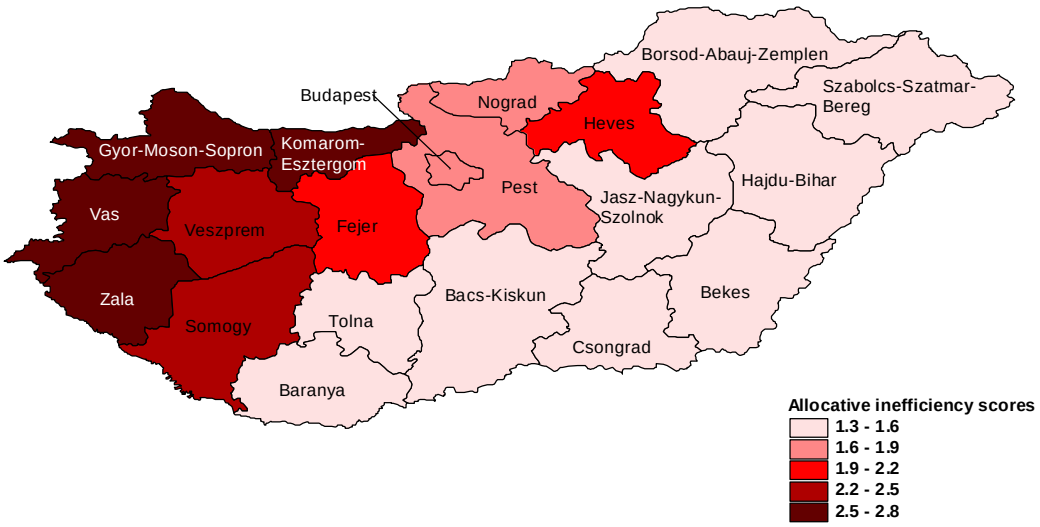

Figure 3: Allocative Inefficiency Scores at County Level