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Determinants of commercial orientation of the individual farms in Romania[1]

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Abstract
In Romania during the transition period towards the market economy the performance of the agricultural sector has decreased while poverty has increased. These negative aspects have been related to the reforms in the agricultural sector, including the privatization of land and the emergence of individual farms. Individual farms now possess the largest part of agricultural land as compared to other production entities, however they are constrained in their development by the lack of necessary assets and undeveloped output and factor markets. As a result of the constraints, individual farmers have increased self-consumption at the cost of marketed output sometimes to the extent that they do not sell output at all. The predominance of asset poor and market constrained individual farmers in Romania has contributed to the deterioration of the overall performance of the agricultural sector. Still it is little known what factors determine the commercial orientation of the individual farms in Romania, essential for increasing the performance of the agricultural sector in general and the living standards of the poor households in particular. The paper seeks to answer this question, specifically how the endowment of the households with factors of production, transaction and transportation costs influence commercial orientation. The methodology employed in the study consists of econometric analysis. A selection model and a tobit model is used to find out the determinants of sales and the determinants of the share of sales in total production. The analysis is based on an agricultural household survey from 2003 collected as part of a Phd research. The study finds that low transaction and transportation costs are important determinants of commercial orientation. Moreover, a minimum production level as well as basic endowment with factors of production is necessary for a household to decide to sell.

Keywords: transaction costs, transportation costs, agriculture, commercial, individual farming, Romania, transition countries.

1. Introduction
In Romania during the transition period towards the market economy the performance of the agricultural sector has decreased while poverty has increased. These negative aspects have been related to the reforms in the agricultural sector, including the privatization of land and the emergence of individual farms. Individual farms now possess the largest part of agricultural land as compared to other production entities, however they are constrained in their development by the lack of necessary assets and undeveloped output and factor markets. As a result of the constraints, individual farmers have increased self-consumption at the cost of marketed output sometimes to the extent that they do not sell output at all. The predominance of asset poor and

market constrained individual farmers in Romania has contributed to the deterioration of the overall performance of the agricultural sector. Still it is little known what factors determine the commercial orientation of the individual farms in Romania, essential for increasing the performance of the agricultural sector in general and the living standards of the poor households in particular. The paper seeks to answer this question, specifically how the endowment of the households with factors of production, transaction and transportation costs influence commercial orientation.

The methodology employed in the study consists of an econometric analysis. The econometric analysis relies on a selection model, in a first stage the decision of sales and in the second stage total sales as well as the share of sales from total agricultural production are regressed on the factors determining commercial orientation. Since the use of the selection model is not justified for the regression of the share of sales from total production, a tobit regression is employed as well. The analysis is based on an agricultural household survey from 2003 (AHS 2003) [1] collected as part of a Phd research.

The research first defines the concept of commercial orientation and its ways of measurement. The subsistence characteristics of the Romanian households and the different commercial nature of their products are presented; moreover a commercial orientation index is calculated. Next, the factors determining commercial orientation are analyzed with econometric methods. The study concludes what factors are important for moving the individual farmers out of the subsistence trap and increase commercial orientation, beneficial for the agricultural sector and for the poor.

2. The concept and measurement of commercial orientation

Subsistence farming and commercial orientation are two complementary concepts. Subsistence farming is frequently defined as the share of production used in the own consumption of the household. The percentage of the production that can be considered as sign of subsistence when used for self-consumption is arbitrary - in many cases the 50% benchmark is used (Bruentrup and Heidhues 2002, Wharton 1969). In line with this argument commercial orientation would define the case when less than 50% of the production is used in the own household for consumption, or when more than 50% of the output is marketed.

The commercialization of agriculture means not just the marketing of agricultural output, but also the fact that the purchase of inputs and product choice is done based on the principles of profit maximization. Moreover the substitution of non-traded inputs in favour of purchased inputs, the specialization of farms and the declining proportion of farm income in total household income as labour is allocated somewhere else are all signs of transformation of subsistence agriculture (Pingali 1997).

In parallel with the above description, commercialization is considered to occur on the output as well as the input side, with increased marketed surplus and increased use of purchased inputs. It does not refer only to the so-called cash crops, food crops are also marketed to a large extent (von Braun et al 1994).

According to the previous distinction commercialization of agriculture is approximated in the following ways (von Braun et al 1994).

[1] The AHS 2003 was conducted in 304 households in 15 villages all over Romania. The sites were chosen with the help of multistage stratified representative random sampling. The questions have referred to year 2002 and concerned among others variable and fixed transaction costs and transportation costs related to the purchase/sale of inputs/outputs.

$$\text{Commercialization of agriculture (output side)} = \frac{\text{Value of agricultural sales in markets}}{\text{Agricultural production value}}$$

$$\text{Commercialization of agriculture (input side)} = \frac{\text{Value of inputs acquired from the market}}{\text{Agricultural production value}}$$

$$\text{Commercialization of rural economy} = \frac{\text{Value of goods and services acquired through market transactions}}{\text{Total income}}$$

$$\text{Degree of integration into the cash economy} = \frac{\text{Value of goods and services acquired through cash transactions}}{\text{Total income}}$$

The empirical studies have measured subsistence versus commercial production in a diversity of ways: the work time of the household for household agriculture in hours in a year (ThoSeeth et al 1998), the allocation of the labor of peasant households to non-farm work (Keister and Nee 2001), total sales and total sales per hectare (Matthias and Noev 2002) or the ratio of land dedicated to individual farming (Rizov et al 2001).

Based on the above studies the research uses two measures of commercial orientation: share of sales value from production value — in what follows referred to as the commercial orientation index— and total agricultural sales.

In the case of the total amount of agricultural sales the value of sold output can be calculated by summing the sales value of all the agricultural products:

$$\text{Sold output} = \sum_{i=1}^{n} \text{price}_i * \text{quantity}_i$$

More delicate is the case of calculation of the commercial orientation index. Since there is no way of summing different crops or animal products, the value of total sales over the value of total production needs to be calculated. The output is composed of 17 crops and 17 animal products with prices observed only in the case sales have occurred. Prices vary in different regions, some crops/animals/animal products are not sold at all in some regions and therefore there is no price reference for them. Prices vary also in one region depending on what buyer the farmer has found, what quality his product had or if he needed to transport the product to the buyer for example. In order to calculate the index of commercial orientation, the subsistence characteristic of the producers and the nature of their products are examined in detail.

3. Subsistence production of the Romanian households

3.1. Subsistence production and the nature of the products

At the beginning of privatization, the new landowners had the choice to join newly established formal or informal associations or work the land on their own. Most of the farmers have decided to work the land themselves as individual farms. Due to their very small size individual farms played mainly a social role, providing basic subsistence to rural and in part to the urban population.

The subsistence characteristic of the new producers was related to the difficulties they faced with respect to production as well as sales. Prior to economic transition, collective and state farms occupied 90% of the agricultural territory with the input and output side of production organized by state companies (Kenneth 2003, OECD 2000). The reforms did not target the restructuring of down and upstream sectors in line with the needs of the individual farmers, therefore the input and output markets were not suitable for them (Tesliuc 2000).

In addition the characteristics of the individual farmers have also influenced the poor development of the farm input and output marketing system. The farmers lacked agronomical knowledge, capital and machinery and thus, they have returned to traditional crops requiring low quantity of inputs. Due to the specificity of land restitution the land in the ownership of the peasants was small and fragmented, contributing to the increase in transaction costs of production and sales, for example transportation and quality control. The transaction costs together with the risk-averse attitude of the farmers determined the diversification of agricultural production, increased self-consumption and decreased their reliance on the markets. The decrease in the use of the markets, through low level of supply of agricultural products as well as input demand has furthered the low development of commodity markets and input provision (Tesliuc 2000).

Table 1. Crop production and sales

Crop	Production cases(no)	Producers from all households	Sales cases (no)	Sellers from producers	Sales from production quantity
Wheat	133	43%	18	14%	56%
Corn	280	92%	21	8%	50%
Potato	88	28%	10	11%	40%
Oat	46	15%	1	2%	100%
Barley	69	22%	3	4%	55%
Rye	3	1%	0	0%	-
Grains and potato	**290**	**95%**	**38**	**13%**	
Sunflower	59	19%	27	46%	91%
Soia	1	0%	1	100%	100%
Textile plants	0	0%	0	0%	-
Sugarbeet	15	5%	7	47%	98%
Technical crops	**69**	**23%**	**33**	**48%**	
Grapes	88	29%	18	20%	80%
Grapes in wine region (20 households)	**18**	**90%**	**14**	**78%**	**78%**
Vegetables	27	9%	4	15%	70%
Fruits	24	8%	7	29%	63%
Other	11	4%	5	45%	100%
Fruits and vegetables	**51**	**17%**	**15**	**29%**	
Fodder	4	1%	0	0%	0%
Hay	103	34%	6	6%	73%
Lucerne	46	15%	1	2%	2%
Animal feed	**128**	**42%**	**6**	**5%**	

Source: Author's calculations from AHS 2003

Indeed, it is estimated that individual farms contributed 85% to total agricultural production while only 20% of the families sold some of their output. According to estimates around half of the total production of the individual farms has been marketed (OECD 2000). The percentage of sellers as reported in the literature varies depending on the survey used. For example in a survey conducted in 1999, the share of agricultural households that have sold at least some of their products on the market was 36% for Romania (Mathijs and Noev 2002). The AHS 2003 reflects that the percentage of sellers from the surveyed farmers was on average 57%, higher than the 20% respectively 36% reported above[2].

[2] The difference in the percentage of sellers may be due to the different years the data originate from, as well the different measurement of sales. For example in the AHS 2003 barter was included in the category of sales, and 17 crops as well as 17 animals and animal product types were considered, while there is no information on the benchmark used for defining a farmer as a seller in the other surveys.

The AHS 2003 illustrates the diversification of both crop and animal production, and the main crops and animal products produced by the households. Table 1 presents the crops produced by the households, the number of sales cases of each product and the share of sales quantity from production quantity for those farmers who have sold.

According to the information presented in Table 1 different crop groups can be distinguished depending on lower or higher subsistence orientation. Wheat, corn, potato, oat, barley and rye are produced in most of the households, while only in 13% of the cases sold. These crops have the role of providing the households and the livestock of the household with food. Sunflower, soia, sugarbeet and textile plants are cash crops, produced only in one quarter of the households, but when produced, mostly sold. The role of grapes as cash crops depend on the region, in regions specialized in wine production they are cash crops, in rest they have the role of supplementing the diet of the household. Fruits and vegetables are occasionally produced and sold, they could be considered as cash crops in part, complementing the income of the household. Hay, lucerne and fodder are subsistence crops used for feeding the animals, often produced but almost never sold.

Table 2. Animal production and sales

Animals/animal products	Production cases (no)	Producers from all households	Sales cases (no)	Sellers from producers	Sales from production quantity
Cow	180	59%	52	29%	58%
Oxen	8	3%	4	50%	84%
Bulls	23	8%	16	70%	97%
Cattle	**183**	**60%**	**67**	**37%**	
Horses	105	35%	14	13%	89%
Donkeys	7	2%	0	0%	-
Pig	**269**	**88%**	**71**	**26%**	**56%**
Sheep	**92**	**30%**	**17**	**18%**	**64%**
Rabbits	21	7%	0	0%	-
Poultry	299	98%	5	2%	22%
Bees	5	2%	0	0%	-
Pork meet	257	85%	2	1%	67%
Chicken meet	170	58%	1	1%	100%
Beef meat	9	3%	2	22%	100%
Meat products	19	6%	2	11%	55%
Subsistence food products	**302**	**99%**	**9**	**3%**	
Milk	169	56%	58	34%	58%
Cheese	92	30%	27	29%	59%
Eggs	283	93%	18	6%	27%
Semi-subsistence food products	**298**	**98%**	**77**	**26%**	

Source: Author's calculations from AHS 2003

Table 2 presents the production and sales statistics of animals and animal products. For livestock the share of sales quantity from production quantity is calculated by dividing the number of animals sold in 2002 with those owned in 2002. This share does not always correspond to the actual share of sales from production, since households could own livestock from years before 2002 and sell it in 2002. However, for example in the case of cattle often the calves are sold, which have a "production" of a year. Pigs and sheep are also usually bred in a year. Therefore the share of number of animals sold from those owned in 2002 is in most cases an acceptable approximation for the share of sales from production value.

In the case of animals and animal products several groups can be distinguished according to the commercial character of the product and its role in consumption. Therefore livestock like cattle, pig and sheep are frequently in the ownership of the household, and in a third of the cases sold. They could be classified as semi-subsistence products. Other animals and animal products, like rabbit, poultry, pork meet, chicken meat, beef meat and other meat products are produced in all the households and almost never sold. Indeed the livestock owned by the household is the source of the meat products, which are prepared for consumption. Milk, cheese and eggs form an animal product group which is always produced and in one third of the cases marketed.

3.2. Calculation of prices and of the commercial orientation index

Given the distinction of the crop and animal product groups depending on their commercial nature, the farm gate prices were calculated for some of the groups. At crops the prices were approximated for the groups of technical plants and grains and potato, with the exception of rye, where there was no price information at all. The prices from the main markets of the counties[3] (NCS 2003, MAPDR 2004), where the villages were located, were used for the purpose of approximation. The county prices were an average of the prices registered in the main markets of the counties in the first two months after harvesting a given crop in 2002. The county prices were compared to the actual village farm-gate prices –the sales prices decreased with the value of transportation costs and transaction costs[4]. The percentage difference between the farm-gate prices and county prices were calculated for each locality. These differences were used to calculate the village level farm-gate prices from the county prices for those crops where there was no price information.

At livestock and animal products the prices were approximated for cattle, pig, sheep and semi-subsistence animal products like milk, cheese and egg. The prices of animals and animal products were again approximated from the prices in the main markets of the counties reported in the national statistics (NCS 2003, MAPDR 2004). In the case of livestock, in order to calculate farm gate prices the percentage difference between livestock prices reported by the farmers with and without transportation costs was used. The county level livestock prices were decreased by this percentage resulting in farm gate prices.

The difference in the calculation of crops and livestock is due to the fact that the main sales points of livestock are not in the main market of the county headquarter but at certain animal trade fairs and processing points. Farmers can get the same price as the one in the main market, if they transport their animals to the closest sales point. Moreover, since livestock is valued according to the live weight, the prices reported by the farmers largely vary, depending on the weight of the animal. Calculating the percentage difference between farm-gate prices and county prices and using this in the calculation of livestock prices for the localities where there is no price information, just like in the case of the crops, would produce biased results. The difference between the county price and the village price for livestock is due mainly to the difference between the average weight of the livestock for which the county main market price is reported and the actual weight of livestock sold by the household. Using this difference in the calculation of farm gate prices would yield incorrect results.

[3] Counties are administrative territorial units in Romania with a main city as headquarter.

[4] The transaction costs were taken into account in the farm gate price, by using the price applied by the lowest transaction cost buyer —the trader, processor or wholesaler— depending on the crop.

At semi-subsistence products like milk, cheese and eggs, the same method was used as in the case of crops. Market prices were compared to farm-gate prices, and the percentage difference was used to calculate village level farm gate prices in each locality.

Prices were not calculated for vegetables and fruits, animal feed and for the subsistence animal products. The few sales cases in the villages for these products did not offer enough price information to be able to use the methods of price calculations mentioned above. Table 3 summarizes the major crop and animal product groups, and for the groups where there was farm gate price calculated the commercial orientation index –the share of sales value from production value—is also reported.

Table 3. Main crop and animal groups

Product	Production cases(no)	Producers from all households	Sales cases (no)	Sellers from producers	Sales from production value
Technical crops	69	23%	33	48%	91%
Grapes in wine region (20 households)	18	90%	14	78%	76%
Fruits and vegetables	51	17%	15	29%	-
Grains and potato	290	95%	38	13%	39%
Subsistence crops	128	42%	6	5%	-
Cattle	183	60%	67	37%	57%
Pig	269	88%	71	26%	56%
Sheep	92	30%	17	18%	64%
Subsistence food products	302	99%	9	3%	-
Semi-subsistence animal products	298	98%	77	26%	53%

Source: Author's calculations from AHS 2003

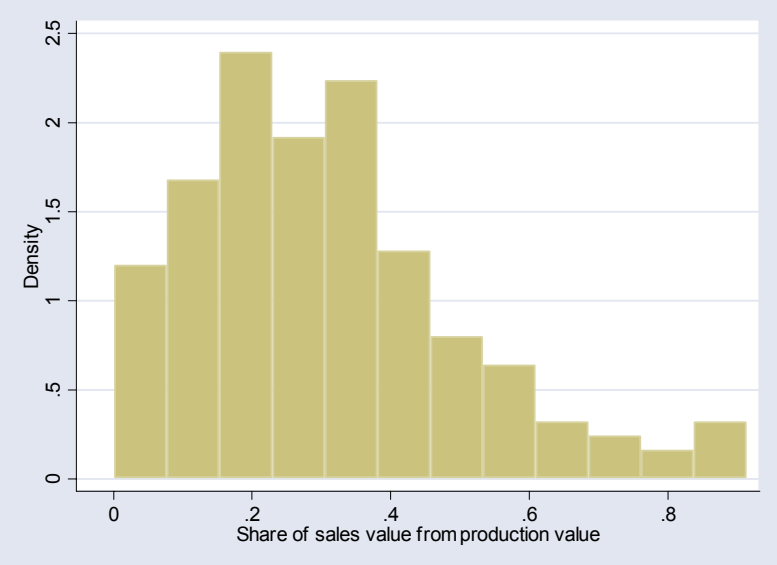
For the products where the farm gate price is available the commercial orientation index is calculated, with the formula of value sold over value produced. Table 4 presents the summary of these index and other indices related to commercial orientation. As one can see the average commercial orientation index is only 0.3, that is on average the seller households sell 30% of their products. The difference between the number of observations for commercial orientation index and other agricultural sales measures is due to the fact, that the commercial orientation index could be calculated only for the products where price information existed. As mentioned above, prices were not calculated for vegetables and fruits, for animal feed and subsistence animal products. Sellers of only these products are an additional number of 7 households, accounting for the difference in the number of observations for total sales and for the commercial orientation index.

Table 4. Summary statistics of the commercial orientation indicators

Variable	Obs.	Mean	Std. Dev.	Min	Max
Value of agricultural sales (Euro)	172	1482.3	5409.7	6.4	67899.5
Value of agricultural sales per hectare (Euro)	172	353.5	512.1	4.3	4351.3
Share sold from total production (Euro)	165	0.3	0.2	0.0	0.9
Number of products in the household	304	3.3	1.8	0.0	9.0

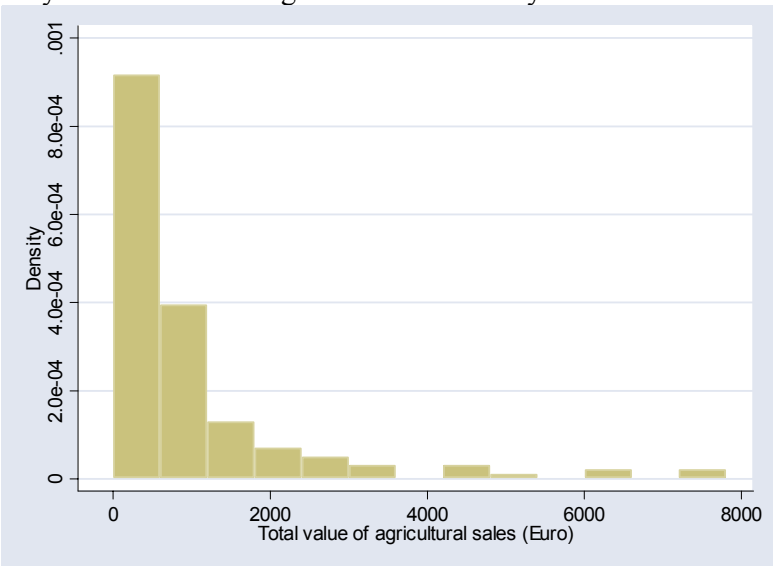
Source: Author's calculations from AHS 2003
Legend: Obs.=number of observations, Std. Dev.=standard deviation, Min.=minimum, Max.=maximum

Graph 1 presents the histogram of the commercial orientation index calculated for the groups of crops mentioned before. As one can see most of the households are having a commercial orientation index lower than 0.5, and only a few households are "really commercial".



Graph 1. Histogram of commercial orientation index

Graph 2 presents the histogram of the value of agricultural sales. There were only three households who had more than 10000 Euro sales in a year, and they were left out of the histogram because otherwise the 0-2000 Euro sales interval could not be observed in detail. The three households with more than 10000 Euro sales are left out from further analysis as well, since the extreme value of sales could distort the econometric estimation. One more household is left out of the further econometric analysis, a household with more than 200 hectares cultivated territory, a value very far from the average cultivated territory of 5 hectares.



Graph 2. Histogram of agricultural sales

4. Econometric estimation

4.1. Heckman regression of total sales and of share of sales from total production

The problem of commercial orientation can be conceptually defined with the help of an agricultural household model incorporating transaction costs (Key et al 2000, Omamo 1998). In the econometric model derived from the agricultural household model two explanatory variables

are used as estimation of commercial orientation: the total value of sales and the commercial orientation index. The econometric model is chosen by taking into consideration that the decision of sales is jointly made with the decision how much to sell. Therefore the econometric estimation of this system has to account for the selection bias (Sadoulet and de Janvry 1995: 162-163). For this purpose a selection model is the most adequate (Goetz 1992, Key et al 2000, Mathijs and Noev 2002). Therefore Heckman's two-step estimation is used, first the decision of sales is regressed on different factors and in the second stage an ordinary least square (OLS) regression is used to determine the influencing factors of total sales respectively of the share sold from total production (Green 2003). Given that the commercial orientation index is a bounded variable between 0 and 1, in order to include it in the OLS regression it needs to be transformed to a positive unbounded variable. One transformation is to calculate the variable L:

$$L = \text{commercial orientation index} / (A - \text{commercial orientation index})$$

In the formula A is given a value slightly higher than the maximum commercial orientation index (Roller and Waverman 2001). Since the highest value of the commercial orientation index is 0.9, A takes the value of 1. The problem with this transformation is related to the fact that the commercial orientation index is not normally distributed, since most of the population is concentrated in the area between 0 and 0.5. The formula transforms larger values of the commercial orientation index into very high positive values, while the values between 0 and 0.5 are only transformed in the interval (0, 1). As a result, the values of the commercial orientation index above 0.5 are transformed into "outliers". In order to smooth this problem, the logarithm of L instead of L is used. The final formula is presented below:

$$\ln L = \ln(\text{commercial orientation index} / (1 - \text{commercial orientation index}))$$

The explanatory variables consist of the household characteristics, production variables, production factors, transaction costs and transportation costs. As household characteristics the age of the head, gender and education are analyzed. Production variables are total production, production per hectare, production dummy for the case when the production has reached a certain minimum level and the number of agricultural products produced by the household. Production factors are cultivated land size, family and hired labor, machinery, ownership of a car, livestock and amount of yearly non-agricultural per capita income. Other explanatory variables are approximating transaction costs —share of agricultural products from total sales sold to a low transaction cost alternative— and transportation costs —road quality leading to the village, distance to the sales point.

The approximation of most of the variables is self-explanatory and their measurement unit is reported together with the regression results. Some of the variables which are not clarified in the regression results are explained in what follows.

Education is an ordered variable with values from 1 to 5, corresponding to less than 4 years of education, primary school, 8 classes, 12 classes and university or college. Machinery is calculated adding 1 for the ownership of a truck, 1 for the ownership of a tractor, 0.2 for the ownership of a plough for the tractor, 2 for the possession of a combine, 0.5 for the ownership of a carriage and 1 for the ownership of a harvesting machine. Therefore machinery takes minimum value of 0 and maximum value of 5.7. Livestock is calculated adding the number of cattle, the number of pigs multiplied by 0.5 and the number of sheep multiplied by 0.3. The calculations for the livestock and machinery are based on the methodology of another study on Romania (Rizov et al 2001).

In the model non-agricultural income instead of total income is used, in order to avoid the two way causality between agricultural sales and total income. Indeed, higher total income can determine agricultural sales, but agricultural sales are also important in determining the revenue generated from sales, therefore total income. The indicator road leading to the village takes the value of 1 for European, 2 for national, 3 for county and 4 for communal road.

Since some of the variables are influential on the decision of sales, but not on the amount sold or on the commercial orientation index, and vice-versa, there are some differences between the variables included in the selection equation and in the OLS regression. From the household characteristics education is not included into the selection equation, because it is not likely that education would constitute an important factor determining the decision to sell. Surplus production or age of the head of the household is for example more decisive for taking the decision to sell than education. Education is on the other hand included as explanatory variable in the OLS regression of total sales and share of sales in total production. Indeed education of the household head is likely to influence the amount sold and degree of commercial orientation since an educated head of the household would gather information on better sales opportunities, look for a certain consumer group etc.

From the production variables a dummy approximating a threshold production value of 900 euro per person is included in the selection equation. Indeed, production needs to reach a minimum value so that there would be a surplus left after consumption and therefore sales. The value of production is an explanatory variable in the OLS regression of the total sales and commercial orientation, since the more is produced it is likely that the more will be sold and the larger will be the share of sales in production. Moreover in the regression of share of sales from total production the production per hectare is also included as an explanatory variable.

Machinery is included in the OLS regression but not in the selection equation, because the quantity of machinery is not likely to influence the decision of sales. Indeed households can use agricultural services even if they do not have machinery for production. Machinery is included in the OLS regression because agricultural services are costly, therefore higher value of sales will occur only in the case of those households who own some equipment. The ownership of a car is included in the selection equation but not in the OLS regression, because car could play a role in the decision to sell through establishing an access to the markets.

The variable approximating transaction costs, the share of sales to a low transaction cost alternative from total sales is included in both the selection equation and the OLS regression. However, while in the selection equation the average share of sales to a low transaction cost alternative of the villagers is used, in the OLS regression the individual share of sales to a low transaction cost alternative is included. Similar is the case for the distance to the sales point, where the explanatory variable in the selection equation is the distance of transportation to the sales point specific for the village, calculated from averaging the distances across all the villagers[5]. In the OLS regression the individual distance of transportation is used.

Table 5 presents the results of the heckman regression. The explanatory variables are grouped into household characteristics, production variables, inputs of production, transaction costs and transportation costs. The use of the heckman regression is indicated for the regression of total

[5] For the calculation of distances only the distances lower than 60 km are taken into account. Usually for all the products there is demand within 60 kms and if some villagers were transporting their products to larger distance than 60 km, they may have done so because of very specific reasons. Taking into account these "outliers" would have distorted the actual distance of transportation specific for the village.

value of sales but not for the regression of the commercial orientation index. In the regression of the share of sales in total production the selection equation is independent from the ordinary least square equation.

The results for the selection equation of the total value of sales and the share of sales from total production are very similar. The household characteristics, age and gender, do not influence the decision of sales. The production dummy has a significant and positive impact on sales. This result verifies the assumption that the household needs to have a certain level of production so that after satisfying consumption there would be an amount left for sales.

Table 5. Heckman regression results for total sales and share of sales in prod. value

Independent variable	Total sales		Commercial orientation index	
Age head (years)	-124.82		-0.01	
Gender (1-male, 0-female)	-186.90		-0.07	
Education (1-lowest, 5-highest)	2599.76		0.03	
Total production (thou Rol)	0.42	***	0.00	
Total production per hectare (thou Rol)			0.00	*
Number of agricultural products produced by the household	-1548.77	***	-0.04	***
Cultivated land size (ha)	1249.68		0.02	
Family labor (mandays/month)	-194.07	***	-0.01	***
Hired labor (mandays/month)	206.75	***	0.00	*
Machinery	-3753.21		-0.07	
Livestock	-1462.94	***	-0.01	
Per capita non agricultural income (thou Rol)	0.12		0.00	
Share of products sold to a low transaction cost alternative from total sales of the household (processor, wholesaler)	3395.96		0.26	***
Distance of transportation of agricultural products of the household (km)	252.19		0.00	
Best road leading to the village (1-european, 4-village road)	1570.53		0.00	
Constant	26572.68	*	1.43	***
Selection equation				
Age head (years)	-0.01		0.00	
Gender (1-male, 0-female)	0.23		0.24	
Production dummy (1 if the production has reached a threshold level of 900 euro per person, else 0)	0.51	***	0.56	***
Cultivated land size (ha)	0.06		0.15	***
Family labor (mandays/month)	0.01	***	0.00	*
Hired labor (mandays/month)	0.07	***	0.04	***
Livestock	0.19	***	0.22	***
Ownership of car (1-yes, 0-no)	-0.10		-0.12	
Per capita non agricultural income (Thou Rol)	0.00	*	0.00	***
Average village share of products sold to a low transaction cost alternative from total sales of the villagers (processor, wholesaler)	1.49	***	1.37	***
Average village distance of transportation of agricultural products	-0.07	***	-0.07	***
Best road leading to the village (1-european, 4-village road)	-0.14	**	-0.13	*
Constant	-0.81	*	-1.23	**
Wald test of independence of equations, Prob>chi 2	0.00		0.58	

Notes: *** significance level 1%, ** signfiicance level 5%, * significance level 10%

The endowment with factors of production has a significant positive impact on the decision of sales. The cultivated land size positively influences the decision of sales in the commercial orientation regression and it has a positive sign however insignificant in the sales regression. The amount of family labor as well as hired labor positively influences the decision of sales.

The per capita non-agricultural income as well as the number of livestock has a positive impact on the decision of sales. Livestock is a measure of storage of wealth and at the same time is a source of provision of animal products for sales. Since animal products are usually more perishable than crop products, when they are produced in an amount above household consumption needs they need to be sold, otherwise they are wasted. Therefore it is plausible to say that livestock production is an important factor in the decision of sales. Surprisingly the ownership of car does not impact the decision of sales.

The village specific distance to the sales point, the share of sales to a low transaction cost alternative and the road quality have the expected signs. The higher the distance and the worse the road quality—the higher the transportation costs— the lower will be the likelihood of sales. The higher the demand from a low transaction cost alternative, the more likely that the households will decide to sell.

The results for the OLS regressions are similar. The household characteristics, age, gender and education do not influence the amount sold and the degree of commercial orientation. Total production positively influences total sales, while production per hectare, although with a very low value, positively influences the commercial orientation index. The number of agricultural products in the household negatively and significantly influences both sales and commercial orientation. This result is expected: the more specialized a household in only a few products the higher the degree of commercial orientation as well as the value of sales.

Cultivated land size is not important in both regressions. Contrary to the selection equation family labor has a significant and negative impact on total sales and on the commercial orientation index. Hired labor has a positive significant impact on sales and commercial orientation just like in the selection equation. The explanation could be that although the available labor in the household positively influences the decision of sales, commercial farmers rely on hired labor and not on family resources. This result is reasonable, since in the case of large scale production the family cannot provide the necessary workforce. Moreover, usually self-employment in the household is sign of subsistence farming, therefore it is likely that high share of employment in the household of the household members negatively influences commercial orientation and sales.

The coefficient of machinery is not significant and livestock has a significant negative impact only on sales. This result is contrary to the impact of livestock on the decision of sales and suggests that livestock, however plays an important role in the decision of sales due to the perishable nature of the animal products, it is not a means for commercial production. Crops are more appropriate for this purpose, due to the simplicity of their storage. Per capita non agricultural income is not significant. The share of sales to a low transaction cost buyer is significant and positive while the variables approximating transportation costs are not significant.

4.2. Tobit regression of share of sales from total production

Since the heckman equation was not significant for the share of sales from production, as an alternative the tobit regression is used. The results are reported in Table 6. There are two regressions, one corrected for heteroskedasticity and one not. The correction of heteroskedasticity is done because of the transformation of the commercial orientation index into a positive

unbounded variable. The results are very similar, which suggests that the transformation did not bring about severe heteroscedasticity. The difference is that while in the equation not corrected for heteroskedasticity the age of the household head has a significant negative impact on sales, the impact of age is insignificant in the regression corrected for heteroskedasticity.

The results are in large part consistent with the results of the heckman regression. The production dummy significantly and positively influences commercial orientation. There is a surprising result: although the number of products produced in the household is expected to negatively influence commercial orientation, it has a positive sign and is significant. This result is contrary to the impact of the number of products on the amount sold respectively commercial orientation in the OLS regression, suggesting that the number of products produced by the household must have a strong impact on the decision of sales. Indeed it is likely that the decision of sales would be positively influenced by the number of products, since the higher the number of products the more likely is that one or another product will be sold.

Table 6. Tobit regression for share of sales from production value

Independent variables	Not corrected for heteroskedasticity		Corrected for heteroskedasticity	
Age head (years)	-0.01	**	0.00	
Gender (1-male, 0-female)	0.06		0.08	
Education (1-lowest, 5-highest)	-0.04		-0.01	
Production dummy (1-the production is at least 900 euro per person, 0-else)	0.26	*	0.18	*
Total production (thou Rol)	0.00		0.00	
Number of agr. products produced by the household	0.04	**	0.05	***
Cultivated land size (ha)	0.01		0.01	
Livestock	0.01		0.02	
Machinery	-0.05		-0.02	
Ownership of car (1-yes, 0-no)	0.12		0.02	
Per capita non agricultural income (thou Rol)	0.00	***	0.00	***
Village average share of products sold to a low transaction cost alternative (processor, wholesaler)	1.17	***	0.64	***
Village average distance for transportation of agr. products	-0.04	***	-0.02	***
Best road leading to the village (1-european, 4-village road)	-0.08	**	-0.07	**
Constant	0.00		-0.32	
R square	0.17		0.22	

Notes: *** significance level 1%, ** significance level 5%, * significance level 10%

Most factors of production, cultivated land size, livestock, machinery and ownership of a car have no significant impact on commercial orientation, while per capita non-agricultural income positively and significantly influences the commercial orientation index. The transaction and transportation cost variables are significant and have the expected sign. The higher the share of products sold to a low transaction cost buyer the higher is commercial orientation. Transportation costs like the distance to the sales point and road quality significantly and negatively influence commercial orientation.

4.3. Summary of results

Table 7 summarizes the results discussed above. It presents the impact of household characteristics, production variables, production factors, transaction and transportation costs on sales and commercial orientation in the heckman regression as well as on commercial orientation

in the tobit regression. The "+" sign represents a positive significant impact, the "–" sign a negative significant impact and the question mark "?" an insignificant impact.

Table 7. Summary of results of the heckman and tobit regressions.

	Heckman				**Tobit**
	Dec. of sales		OLS		
	Total sales	**Com. Orientation**	**Total sales**	**Com. orientation**	**Com. orientation**
Household head characteristics:	**?**				
age, gender	?	?	?	?	?
Education			?	?	?
Production related variables:					
Minimum production level	+	+			+
Total production			+	?	?
Production per hectare				+	
Number of agricultural products			-	-	+
Production factors:					
Family labor	+	+	-	-	
Hired labor	+	+	+	+	
Cultivated land size	?	+	?	?	?
Machinery			?	?	?
Livestock	+	+	-	?	?
Non agricultural income per capita	+	+	?	?	+
Ownership of car	?	?			?
High transportation costs:	**-**				
Distance to sales point	-	-	?	?	-
Bad road quality	-	-	?	?	-
Low transaction costs:	**+**				
Share of products sold to low transaction cost buyer	+	+	?	+	+

The results illustrate that low transaction costs and transportation costs positively influence sales and commercial orientation. A minimum production level and hired labor positively influence commercial orientation and sales. Factors of production like family labor, hired labour, cultivated land size, livestock and non-agricultural per capita income positively impact the decision of sales.

5. Conclusion

The paper addresses the question what factors determine commercial orientation. It uses a heckman estimation as well as a tobit regression to find the determining factors of sales and of commercial orientation approximated as share of sales from total production. It finds that low transaction costs and low transportation costs are important determinants commercial orientation. Moreover a minimum production level is necessary, as well as basic endowment with factors of production so that the household would decide to sell.

The results suggest that increase in demand from the part of low transaction cost buyers, like wholesalers, processors and traders will increase commercial orientation. Moreover, an improvement in infrastructure, as well as decrease in the distance of transportation to the sales point will positively influence commercial orientation. In order to promote a commercial viable agriculture, policy makers should encourage the replacement of malfunctioning processing companies with viable ones, the improvement of their functioning, the establishment of new processing factories and collection points and improvement of infrastructure.

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