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PERCEPTION OF LAND SCARCITY BY PERI-URBAN FARMERS

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Abstract

Farmers in peri-urban regions face many problems, among which land scarcity is a major one according to literature. However, as indicated by a survey among farmers in the peri-urban region around Brussels, land scarcity is not perceived as a problem by all farmers to the same extent. Based on econometric analysis, the survey results show that perception of land scarcity is mainly influenced by differences in landownership and perceived ratio between farm land prices and real land prices. Changes in each of these variables will lead to a shift in the problems a farmer faces and will therefore stimulate different farming or land use strategies.

Keywords and JEL-classification
Peri-urban (018), land availability (R14), land prices (Q11), landownership (Q15)

1 Introduction

It is well known that farmers in peri-urban regions face problems different from those encountered by more rural farmers. Urbanization, mainly defined by a growing population density, creates increased demand in the economy for production factors such as capital and labour, or natural resources like land, water, air or landscape (Reinhard et al., 2003). Competition for these factors between agriculture and other purposes such as infrastructure, housing, working areas, recreation, defence, safety, mineral extraction and storage areas is one of the main elements characterizing peri-urban areas (Reinhard et al., 2003).

Of these factors, land is probably the most important for farmers. It enables them to expand, to make their farm profitable and to attract succession (Luijt, 1997). Moreover, land has some typical characteristics that cannot be found for the other inputs: location and geoclimatic environment are fixed, supply is limited and it is a very heterogeneous resource (soil type, topography, climate etc) (Carlson et al., 1993).

Land scarcity, caused by an increasing population, has been reported as a standard problem for farmers (Luijt, 1997). However, using data collected in the region around Brussels it is shown that only about 65% of all the farmers in this urbanized region indicate land scarcity as a problem. Therefore, the data set has been used to analyze which factors influence this perception of land scarcity problems.

In this paper, differences in landownership as well as expected land sales, land prices, population growth and local policy appear to be explaining factors. The remainder of the paper is divided into five sections. Section 2 defines the impact of urbanization and population growth on farming in general and in a study area around Brussels in particular. In section 3 the influence of these shifts caused by urbanization and population growth on the land market is described. Section 4 reports on the different underlying factors defining land availability perception and in section 5 these variables are combined in a regression model which explains the different perceptions of land scarcity problems. Section 6 provides a conclusion. .

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2 Farmers in urbanized regions

With increasing population, the Belgian and in particular the Flemish area has developed towards a connection of smaller and larger cities with only a few remaining rural 'islands'. Urban activities and urban morphology are spread over a larger area than the historical and administrative city's boundaries. The city has become a combination of urban regions and surrounding municipalities with the commuter towns bordering on the larger urban regions, the regional cities and the rural towns.

This urbanization puts agriculture in a substantially different position. Moreover, in a European context the complete Flemish countryside has an urban character and any distinction between urban and rural areas relates only to the Flemish (micro)level. At this level, the research focuses on the fringe of the Brussels' urban region enlarged with a circle of municipalities around this urban region, excluding the regional cities embedded in the Brussels commuter zone (Boulanger et al., 2004).

Urbanization is often said to be driven by population growth and specific household formations (Heimlich and Anderson, 2001). According to Heimlich, population growth has an effect on farming because urbanization influences the markets (land, labour, commodities etc.) which define the inputs needed by farmers to produce goods or services (De Clercq, 1996; Heimlich and Barnard, 1997). Furthermore, population growth has an impact not only on markets but also on local institutions, which will influence farming through growth control and farmland retention. Therefore, any shift in the functioning of these markets or the local institutions has an impact on farming (see Figure 1).

Heimlich suggests that this is a twofold impact. On the one hand, urbanization creates opportunities for farming, such as a larger labour pool, greater off-farm employment opportunities, and possibilities to grow new crops and to market them. On the other hand, pressure is put onto agriculture, for example intensified neighbours' complaints about noise and odour, increased traffic, higher real estate taxes, increased water- and land-use restrictions and crop yield deterioration (Heimlich and Anderson, 2001).

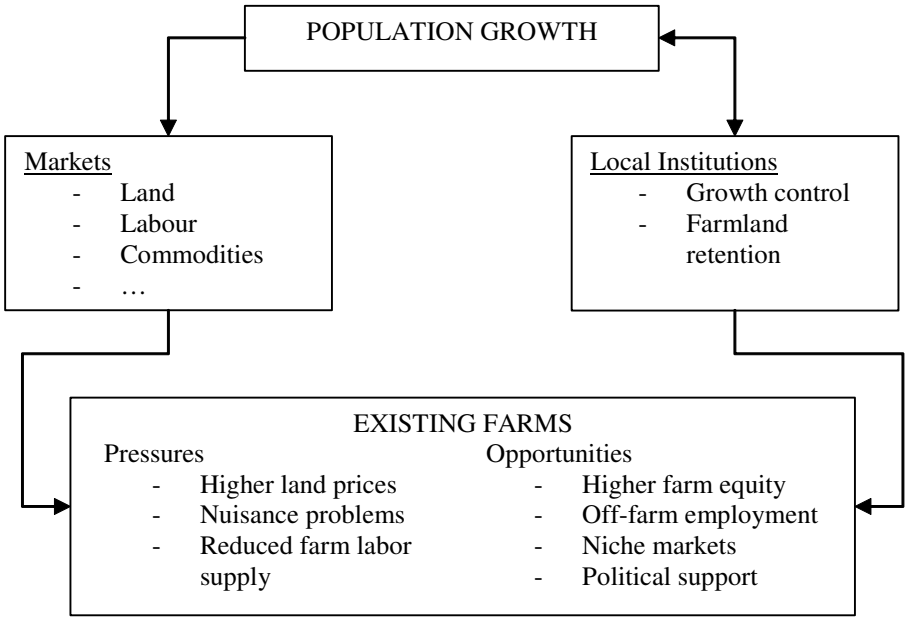

Figure 1 Agricultural Adaptation to Urbanization (Heimlich and Barnard, 1997).

Comparing these (theoretical) findings with the results of the survey in the urbanized region around Brussels leads to many similarities, except for the land market aspects which are more often mentioned by the investigated farmers (see Table 1). Therefore, the aim of the present paper is to describe into detail the perception of land market problems or threats by farmers.

Table 1 Negative and positive impact of urbanization on agriculture.

Negative impact of urbanization	Same as Heimlich	Positive impact of urbanization	Same as Heimlich
- Increased traffic (14%)	Yes	- Increased sales (47%)	Yes
- *Land insecurity and limited expansion possibilities (13%)*		- Better accessibility (6%)	
		- More available labour forces (1%)	Yes
- Change in mentality (12%)	Yes	- Others (4%)	
- Noise and odour (6%)	Yes		
- *High land prices (4%)*			
- Problems with environmentalists and other pressure groups (4%)	Yes		
- Others (7%)			

Note: In the survey, the farmers were first asked if they experience any advantages or disadvantages from urbanization and then if they could give some examples. Consequently, the percentages are expected to be small, considering that not all farmers completed the open end questions.

3 Urbanization and the land market

Land or space can be defined as production space for economic development, residential space for people or strategic stock space for nature and landscape (Reinhard et.al., 2003). This means that space can be used for different aims, which is shown graphically in Figure 2 (Goetgeluk and Schotten, 2000).

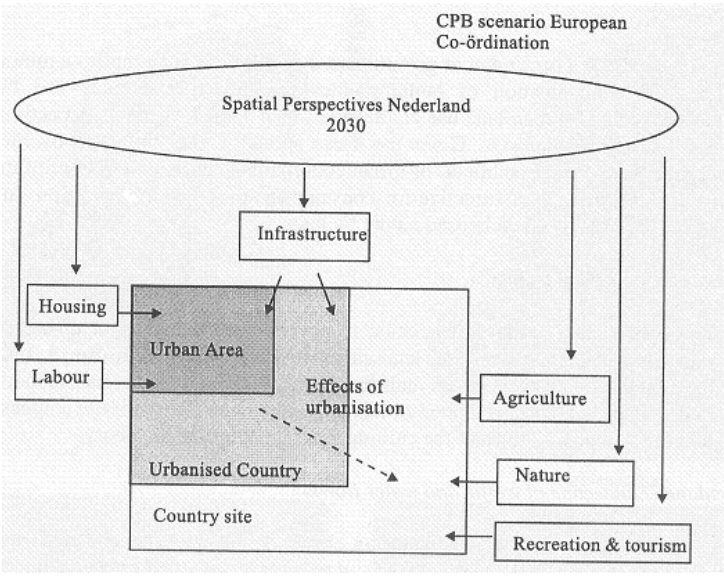

Figure 2 Impact of urbanization on land (Goetgeluk and Schotten, 2000).

The same figure also shows what the impact of urbanization is on the use of land and how this explains the different purposes of land at a different urbanization stage. In the urban area, space is needed for housing and for labour activities. In both the urban area and the urbanised country infrastructure takes up a lot of space. However, in the country side, space is divided between agriculture, nature and recreation or tourism. The effects of recent urbanization therefore consist of the higher number of competitors for the space, namely housing, labour or infrastructure, agriculture, nature, recreation and tourism.

On top of this, every population consists of many different interest groups that want to use the space available for different purposes which create the "need to meet a large number of societal needs on scarce urban land" (Deelstra et al., 2001). Land needs to be used in a multifunctional way, so the space for farming activities in these regions will be limited.

However, not all farmers (out of the survey) think that urbanization is harmful for the land market. When asked to give their opinion on land availability as being a problem, only 65% of the farmers answered positively (the mean of this variable is 0.651 and the standard deviation is 0.477). Although a high percentage, it is far from 100. There seems to be a discrepancy between the actual land shortage (caused by overall urbanization) and the perception of land availability which might even be of higher importance for farmers. This paper therefore wants to define the difference between farmers who perceive the shift in the land market as negative or as positive.

4 The underlying factors defining land availability perception

Data on farming in the urban region around Brussels was collected by use of a survey on 1106 farmers (on a total of 5138 farmers). 516 of these farmers live in the banlieu or agglomeration; the other 423 live in the commuter towns. The obtained data contains different aspects of farming, living, and working in urbanized regions. Hence, the different aspects influencing land availability problems and their relationship can be defined.

Based on literature and on empirical research, amongst others the following variables were chosen to be investigated: landownership, expected land sales, population pressure, prices and future expansions of the farm.

4.1 Landownership

Firstly, the perception of land problems might be influenced by the percentage of land owned or leased by a farmer. On the one hand, a farmer owning most of his land is more certain to have enough land for a longer period of time, while on the other hand, the possibilities to use land for farmers with less capital are increased by land tenancy. Van Vuuren et al. (1994) describe this two-sided aspect of landownership.

> "Land tenancy is regarded as an important institution toward the enhancement of agricultural performance. […] In spite of such advantages, tenancy has been blamed for causing production inefficiency relative to owner operatorship." (Van Vuuren et al., 1994)

Van Vuuren et al. (1994) explain how the decision to own or rent land might affect efficient land use. A farmer, not able to buy all the land he needs, might benefit from land tenancy because it releases him from land shortages without creating high ownership risks. Therefore, creating tenancy opportunities in a certain area will lead to a maximal use of all available land. However, this maximal use might not enhance efficiency because farmers with a short term permit will base their farm strategies on their individual and short term preferences. Therefore, tenancy, by creating landownership on the short term, might even decrease the efficiency of land use.

In the survey, the farmers where asked to state how many hectares they own, lease on a long term or on a short term permit. Table 2 shows that most of the farmers (almost 90%) lease between 0% and 20% of their land for a short term. This means that most of the farmers either don't lease for a short term or complement a small land shortage with short term leases. The distribution within the other two types of land acquisition, landownership and long term permits, is more uneven: 40% owns (25% leases) less than 20% of their land, while about 20% owns (resp. 33% leases) more than 80%. These results suggest that long term permits and owning land are the most frequent ways for using land and will therefore be used in further analyses.

Table 2 Ownership versus long term permit versus short term permit.

%	*Ownership*	*Long term permit*	*Short term permit*
0-20%	*42.6*	*26.8*	*89.5*
20-40%	*17.4*	*8.9*	*5.1*
40-60%	*11.1*	*11.2*	*2.5*
60-80%	*8.1*	*20.5*	*1.1*
80-100%	*20.9*	*32.5*	*1.9*

The impact of the type of land acquisition on the perception of land scarcity is analysed using cross tabulations. In the following table it is shown how the perception of problems with land quantity increases when the percentage of land owned by the farmer decreases (when not considering the group of 60-80% which has fewer observations). For example, of all farmers owning less than 20% of their land, 75% believes that land quantity is a problem, whereas of the farmers owning at least 80%, only 43% perceives this as a problem.

Table 3 Landownership versus land availability problems.

% in ownership	*Land availability is a problem*			
	No	*N*	*Yes*	*N*
0-20%	*25.2%*	*99*	*74.8%*	*270*
20-40%	*31.9%*	*60*	*68.1%*	*131*
40-60%	*44.4%*	*47*	*55.6%*	*69*
60-80%	*26.3%*	*30*	*73.7%*	*47*
80-100%	*57.5%*	*76*	*42.5%*	*56*
Pearson's Chi square	43.394			
Degrees of freedom	4			
p-value	0.000			
Cramers V	0.221			

Note: More information on two-way tables and the Chi-square Test can be found in 'Statistics, Concepts and Controversies' (Moore, 2000, pp. 465-484).

The analysis indicates the expected negative relation, which means that the higher the percentage of land owned by a farmer, the lower the perception of the land scarcity problem. The cramers v statistic shows that the found relationship is quite strong so that further research on landownership and tenancy is needed.

4.2 Expected land sales

Secondly, the perception of land availability is influenced by the prospect of land sales: a farmer expecting to sell some of his land in the near future (whether this is voluntary or obliged) will worry much more about land availability and will probably mention land availability as a problem. The analysis shows that about 44% of all farmers expect to sell some land in the near future (the mean of this variable is 0.44 and the standard deviation is 0.50).

Table 4 describes the significant relationship between expected sales and land availability, which was found using cross tabulations and chi-square statistics. The relationship appears to be linear, indicating that whenever there are expected sales, more farmers think of land availability as a problem.

Table 4 Land sales versus land availability problems.

	Land sales in the near future	
Land availability is a problem	*No*	*Yes*
No	*44.7%*	*24.6%*
Yes	*55.3%*	*75.4%*

Chi-square statistic: 21.566, df: 1, sign. 0.000
Cramers v: 0.211

For further analysis, a variable was build dividing the amount of hectares a farmer expects to sell by the amount of hectares he uses now. This is expressed as a percentage, with a mean of 0.08, and gives an idea of how much land a farmer will sell in the near future.

4.3 Population pressure in an area

A third important variable for explaining land availability perception is the population pressure in a region, since a high population density will create a high demand for land. Reinhard et al. (2003) explain how population pressure leads to more people wanting to use available land to build on, to live on, to use for a job or recreation, etc. Often, population pressure is being measured by dividing the population in a municipality through the land area of that municipality. However, there are limitations to this type of measurement because it doesn't take into account the demand for land by people from outside a municipality, which leads to extra land pressure in this municipality, nor the demand by people living in this municipality for land in another municipality, what decreases the land pressure in the first municipality. It might be expected that some of these actions will cancel each other out, especially when the municipalities are aggregated to a regional level. However, the demand for land by people from outside this region might remain to be a large problem. In this paper, especially the inflow from the city centre of Brussels into the study area should not be neglected. Therefore, a population growth measure, for the period 2001 until 2003, is used instead of the population density at a single moment in time. The used measure shows the annual average percentage growth of the population in a community and has a mean of 0.84 and a standard deviation of 0.91.

Using non-parametric tests (because the dependent variable, land availability, is a dichotomous variable and therefore by definition not normally distributed) it is shown that there is a relationship between population growth and land availability problems. The Mann-Whitney U statistic is 22277 with a z-value of -2.344 and significance of 0.019.

4.4 Prices

When considering land quantity, one cannot leave out land prices, especially when talking about land quantity perception. When the price of land is too high, farmers might perceive this as if there is no land available, even though in a strict sense, there is still available land. In this analysis we first investigate what the impact is of actual land prices on perception of land availability. Then we use a qualitative measure of price because land availability was also measured qualitatively.

a Real farm land prices

Cavailhès and Wavresky (2003) have studied the impact of urban influences on periurban farmland prices. Their main idea was that "the arrival of urban households in rural areas, especially in periurban areas, entails a demand for land that is very costly in comparison with remote farmland prices". Or put differently, the increasing urbanization creates disequilibrium between farmland

quantity, quality and price. They analysed the effects on land price of distance to the city, parcel size and location characteristics.

In Belgium a distinction should be made between prices of sold farm land which will reflect the price of land in ownership and special tenant coefficients which after multiplying by the rateable value will give the price of tenancy.

Prices of owned farm land

The prices per are of any sold farm land were collected over the last three years. The same analysis as the one from Cavailhès and Wavresky was applied, but on an aggregated level (the level of the municipalities). The different variables used are described in the following table:

Table 5 Variables influencing real farm land prices.

	Name	*Description*	*Mean Value*
Dependent variable	*Price (P)*	*Price in euro per m² of farm land*	*1.99*
Independent variables	*Living space (L)*	*Represents living space in this area (m² per inhabitant)*	*3.49*
	Flemish (F)	*Represents legislation (dummy is 1 for Flanders)*	*0.44*
	Sand (S)	*Represents location specific characteristics (dummy is 1 for sand soil)*	*0.29*
	Loam (Lo)	*Represents location specific characteristics (dummy is 1 for loam soil)*	*0.42*
	Distance (D)	*Distance to the city divided by the mean distance to the city*	*1*

Note: It was attempted to use the same type of variables as Cavailhès and Wavresky but urbanization is contained in distance and population density is contained in living space.
Next to sand or loam, the region also has sand-loam soils.
Data source: dataset from survey and NIS statistics (2003)

The results of the analysis are described in the next table. Although this analysis has a low adjusted R^2 (goodness of fit measure) of 0.12, meaning that there are other important factors not yet discovered, some conclusions can be made (Gujarati, 2003, pp. 217-221).

Table 6 Regression results of real farm land prices.

Name	*B*	*Sig*
Constant	*2.618*	*0.000*
Living space (L)	*-0.081*	*0.000*
Flemish (F)	*0.260*	*0.001*
Sand (S)	*0.484*	*0.000*
Loam (Lo)	*-0.205*	*0.019*
Distance (D)	*-0.141*	*0.233*
Method	OLS	
Adjusted R^2	0.11	
F statistic (p-value)	26.68 (0.000)	

The results are in agreement with the ones found by Cavailhès and Wavresky. Whenever the region is more urbanized, has more buildings and therefore has less living space, the price is higher. When the land is situated in the Flemish region the price will also be higher (so legislation might be important). The region and spatial typology are also important because on sand soil the price is higher

than on sand-loam soils or loam soil brings the price down. This might seem strange, because loam soils normally have a better quality, but in Belgium the more intensive farm types (pig, chicken and cattle farming) are frequently situated on sand soil. These farm types have, due to the European nitrate regulations ("Mestactieplan") which limits the amount of manure per ha soil, a large demand for land, which will increase the price. Lastly the closer towards the city, the higher the price of farm land, although this coefficient is not significant. One explanation is that the whole study area is peri-urban and that therefore the difference between 'close' and 'very close' to the city is not significant. It however shows that there is tendency towards a negative relationship.

To research the relationship between perceiving land availability as a problem and land prices, the mean real prices are compared. The following table shows that when people believe land availability is a problem, the prices of farmland in that municipality are higher. The difference is significant at a 10% level.

Table 7 Real farm land prices versus land availability problems.

Land availability is a problem	*Mean price of sold land*
Yes	*2.04 euro per m²*
No	*1.93 euro per m²*
t-test for equality of means	-1.793
p-value	0.087

Note: comparing two populations, using independent samples t-test (Oude Voshaar, 1994, pp. 21)

Prices of tenant farm land

To analyse prices for tenancy, we need information on the rent value of land. This is not easily collected because the rent is different for every plot and no aggregated information was available. However, the tenant coefficients can be used as a proxi that differs per province and per soiltype. In the study case, the coefficients are 3.6 for sand soil, 2.9 for loam soil and 3.28 for sand-loam soil (Pachtprijzencommissie, 2004). The different soil types are used to find out if tenancy prices have an impact on land availability problems.

Table 8 Soil versus land availability problems.

Land availability is a problem	*Sand soil*	*Sand-loam soil*	*Loam soil*
No	*26.7%*	*34.9%*	*40.8%*
Yes	*73.3%*	*65.1%*	*59.2%*
Chi-square (p-value)	5.825 (0.054)		
Cramers V (p-value)	0.079		

The table shows that in sand soil, which has a high tenant coefficient, the problem of land availability is high. Farmers living in loam soil areas (which have a low tenant coefficient) perceive less problems with land availability.

However, the former paragraph suggests that real prices are also influenced by soil type. This is confirmed by comparing real land prices of the different soil types. In the sand area the mean price is 2.55, in the sand-loam area the price is 2.07 and in the loam area the price is 1.57 euro per are (or 100 m²). Using One-Way-Anova and the Tukey statistic, it is found that the land prices for these different types of soil are significantly different (Gujarati, 1999, pp. 276-279). Because both owned land prices as well as tenant land prices are correlated with soil type, it will not be possible to use both in one analysis.

b Perception of land prices

Next to real land prices, a qualitative measure of perception of land price is used because land availability problems are also measured by perception. This measure has a mean of 0.73 (with a standard deviation of 0.45) meaning that 73% of all farmers believe that land prices are a problem for farming.

Before further analysis we want to check if perceiving land price as a problem is related to perceiving land quantity as a problem. This is done by use of cross tabs and shows that there is in fact a relation. Both the real prices as well as the perception of land prices will be considered for the complete model.

Table 9 Land prices versus land availability problems.

	Land prices are a problem	
Land availability is a problem	*No*	*Yes*
No	*72.8%*	*21.1%*
Yes	*27.2%*	*78.9%*

Chi-square statistic: 216.67, df: 1, sign. 0.000
Cramers v: 0.483

4.5 Future expansions of the farm

A fifth independent (exogenous) variables that might influence land availability perception is the possible future expansions of the farm which was measured by use of Standard Units of Dimension (SUD)[†]. The average SUD is 12.79 (with a standard deviation of 14.26).

The underlying idea is that a farm which is doing well will be much more interested in expanding then a farm that is just surviving. A high SUD shows that the economic value of a farm is high which might indicate a high willingness to expand. This expansion cannot be done without land and so these farmers will be much more sensitive to land availability. The results based on the analysis of the dataset are given in Table 10. This table shows that the higher the SUD, the more often a farmer thinks of land availability as a problem. In further analysis, the SUD/ha will be compared with the mean SUD/ha for each farm type.

Table 10 SUD versus land availability problems.

	SUD-class			
Land availability is a problem	*Class 1*	*Class 2*	*Class 3*	*Class 4*
Yes	*52.5%*	*65.4%*	*69.1%*	*75.4%*

Chi-square statistic: 28.585, df: 3, sig.: 0.000
Note: class 1 regroups the farmers with the lowest 25% of the SUD, class 4 regroups those with the highest 25%.

[†] Standard gross margins (SGM) of a cultivation by arable area or by cattle units is understood as an average monetary value for the entire proceeds reduced with certain associated specific costs (seed and young plants, fertilizer, pest management, veterinary costs, the costs of medicaments, feed, heating charges, specific sale costs and other specific costs). To avoid fluctuations in prices and output the SGM are calculated as an average of five years. The economic dimension (or Standard Unit of Dimension, SUD) of a farm is stipulated by multiplying the surfaces of the cultivations or the number of animals with the matching standard gross margins. (Georges et.al., 2002)

4.6 Other variables

The perception of land availability might be influenced by many more factors than those described above. In this paragraph it is being researched if there is a relationship with items like land policy, farm type, expansion of residential areas, industrial zones, Walloon versus Flemish region, distance to the city, age, …

One variable that might explain land availability perception is age. There is a positive relationship between age and ownership, meaning that older farmers own much more of their land than younger farmers.

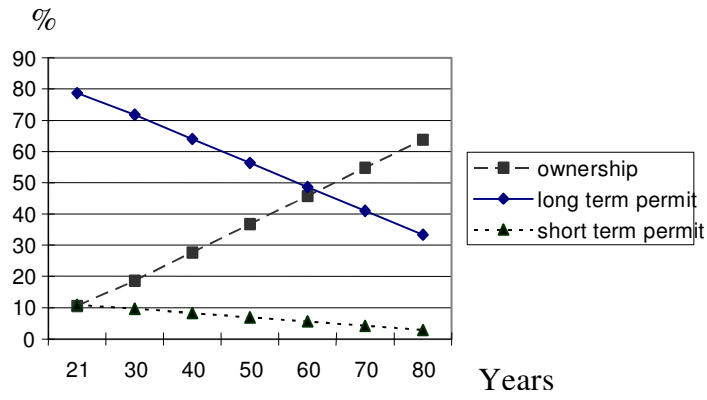

Figure 3 Ownership, long term permit, short term permit and age.

A farmer of 21 years old, on average owns only 10% of his land, while a farmer of 80 years old owns about 64%. The same farmer of 21 years old, accomplishes his ownership with 79% long term permits and 11% short term permits. The farmer of 80 years old has 33% long term permits and only 3% short term permits. A farmer of 60 years old has the most equal distribution between owning land (46%) and renting land (49%).

Although this relationship limits the use of both variables in one analysis, it enables conclusions about both variables because they are linked.

Another relationship was found between local land policy and land availability perception. It can be shown that in municipalities who support sustainable farming systems such as organic farming, the perception of land problems rises, because these systems go together with much more stringent regulations. However, the data available on this kind of support is (up to now) limited, which would in turn limit the available data for the whole system and therefore this variable was not used.

The impact of the distance towards the city (capital city of Brussels) was also incorporated. It is expected that distance towards the city reflects urbanization and population growth which is confirmed by the data showing that distance towards the city is correlated with population pressure (Pearsons Correlation Coefficient of -0.695 and p-value of 0.000). Since it was already established that higher population pressure leads to a higher perception of land availability problems, it is expected that farmers closer to the city perceive more land availability problems. However, a first analysis doesn't reflect this idea and therefore the distance to the city will be incorporated in the final model.

Other variables were researched but either no relationship with land availability perception was found or the relationship was too complex to be taken up in this paper. This was true for other types of policy, like expropriation, expansion of industry or residential areas, Walloon versus Flemish region etc.

5 Perception of land availability

The perception of land availability as a problem is now put into a regression which, on the one hand, will give us more information on what we already expect (positive or negative relationship) and, on the other hand, will show which aspect is more important then the others and in how far the fluctuation of the perception can be explained by use of the formerly described variables.

Table 11 Descriptive statistics on the variables used in regression on land availability problems.

Name	*Description*	*Min*	*Max*	*Mean*	*Mean -/+ St. Dev.*	*Expected sign*
Owned	*Percentage of land owned (%)*	*0.00*	*1.00*	*0.391*	*0.05/0.73*	-
Sales	*Area expected to sell divided by total arable surface*	*0.00*	*1.00*	*0.086*	*-0.08/0.26*	+
Popul	*Average annual population growth in the municipality between 2001 en 2003 (%)*	*-1.25*	*4.66*	*0.840*	*-0.07/1.75*	+
Realprice	*Price of farmland in 2003 in euro/ha divided by the mean price*	*0.11*	*5.23*	*1.000*	*0.52/1.48*	+
Percprice	*Perception of farmland prices as a problem*	*0.00*	*1.00*	*0.730*	*0.28/1.18*	+
SUD	*SUD divided by mean SUD per farm type*	*0.00*	*11.29*	*1.000*	*-0.17/2.19*	+
Km	*Distance towards the city divided by the mean distance*	*0.30*	*1.89*	*1.000*	*0.67/1.34*	/

Note: the different variables sometimes are correlated f.ex. sales and owned, or owned and SUD; but the correlation coefficient is never higher then 0.25 and therefore these correlations do not cause any problems for the model.

Multivariate analysis is used to find the relationship of perception of land availability and the explanatory variables. Because some dependent variables can only adopt the values 0 or 1 (problem or no problem) they will not be normally distributed. Therefore a binary logistical regression analysis (Metcalfe, 2000, pp. 149-153) is used to value the probability that the dependent variable will adopt the value 1, i.e. that land availability is a problem. In this analysis, the natural logarithm of the probability of a problem divided by the probability of no problem (= 'log odds') can be written as a linear function of the explanatory variables (see Equation 1). This regression then calculates the changes in the 'log odds' of the dependent variable caused by a change in the explanatory variables (Gujarati, 2003, pp. 596).

$$\ln\left(\frac{p}{1-p}\right) = b_1 * Var_1 + b_2 * Var_2 + \ldots + b_n * Var_n + b_0 \qquad \text{eq.1}$$

With p = probability for land availability perception
With b_1 , b_2 … = coefficients
With Var_1, Var_2 ... = explanatory variables

The whole model is verified on accuracy and forecast strength by means of the following test statistics: Chi-square, Cox & Snell R^2, Nagelkerke R^2 and the Hosmer-Lemeshow tests and the results are described in Table 12.

Table 12 Results for Binary Logistical Regression.

Name of Variable	*b*	*Sig.*
Owned	*-0.888*	*0.002*
Sales	*1.326*	*0.038*
Popul	*0.177*	*0.106*
Realprice	*0.342*	*0.112*
Percprice	*2.051*	*0.000*
SUD	*0.157*	*0.098*
Km	*-0.179*	*0.459*
Constant	*-0.997*	*0.015*
Chi-square for model (p-value)	169.937 (0.000)	
Nagelkerke R^2	0.303	
Cox & Snell R^2	0.220	
Chi-square for Hosmer Lemeshow (p-value)	4.181 (0.840)	

The Chi-square statistic tests if the null hypothesis, which states that the explanatory variables determined in the model do not imply a difference in predicting the dependent variable, is correct (Garson, 2005). When the probability is lower than 0.05, which is the case in this model, then the null hypothesis can be rejected i.e. in our model the explanatory variables make a difference in predicting the probability of perceiving land as a problem.

The statistics Cox & Snell R^2 and Nagelkerke R^2 try to simulate determination coefficients which, when used in linear regression, give the percentage variation of the dependent variable explained by the model. Because a binary logistical model is used, the interpretation of R^2 is not quite the same (Gujarati, 2003, pp. 586-589). In this case, the statistics give an idea on the strength of the association between the dependent and independent variables (Garson, 2005). The Cox & Snell R^2 for the model is 0.220 and the Nagelkerke R^2 is 0.303, which leads us to believe that there is at least some association between the dependent and independent variables.

The Hosmer Lemeshow Goodness-of-fit test tries to find out if there is a difference between the observed values of the dependent variable and the predicted values by the model. Whenever the statistic is higher than 0.05 the null hypothesis is accepted, namely that the difference is not significantly large, which in terms points to a well-fitting model (Garson, 2005). In this case the statistic is 4.181 with a significance value of 0.840 and therefore we accept the null hypothesis, meaning that the predicted perception of a land problem is not significantly different from the observed perception of a land problem.

The results can be best interpreted by use of a graph (see Figure 4). First of all, a mean estimated probability of land problems is calculated by replacing the independent variables by their mean value. In that way, the mean predicted value becomes 67.6% which lies very close to the observed 65% of farmers perceiving land problems. To increase the accuracy of this value, the mean is replaced by the median for all dummy variables (or in this case just for price perception), and this gives a median value of 78.3%. Then, the rate of change of probability can be calculated by changing the values of the independent variables (Gujarati, 2003, 603-604). It was chosen to use a shift of one standard deviation unless when the mean minus standard deviation was lower than the minimum value, in which case the minimum value was used.

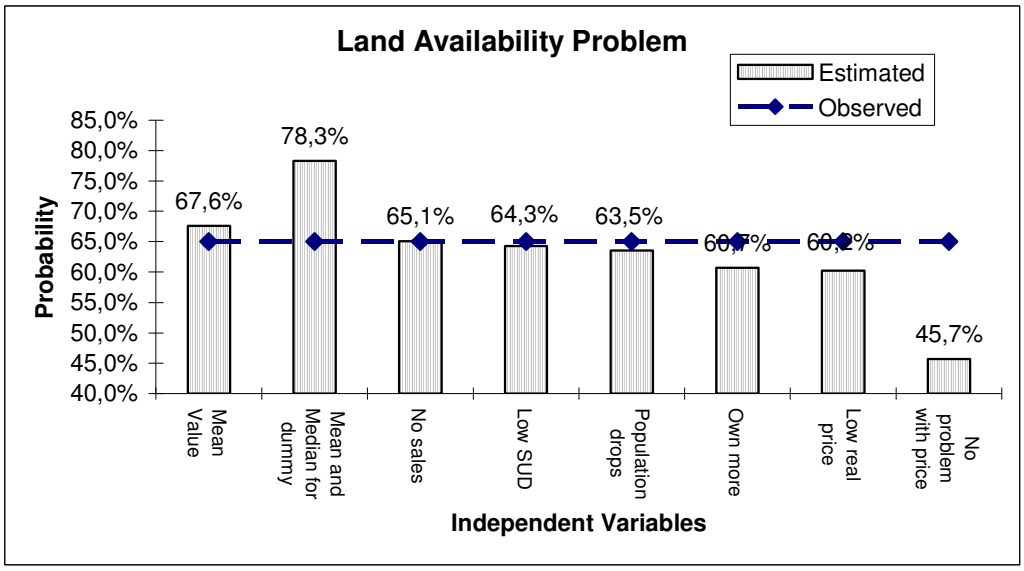

Figure 4 Changes in probability of land availability problems.

Firstly, it can be seen that whenever a farmer doesn't think he has to sell land in the near future, the estimated probability becomes 65.1% or drops 2.5% from the mean value. When the farm has a low SUD, and therefore less intention to expand, the probability drops to 64.3% and when the population growth is less than the mean value, the perception of a problem falls to 63.5%.

Secondly, the table shows that ownership and prices are important, creating a rather large drop in probability. When the farmer owns a larger proportion of his land (at least 74%), the perception of a problem drops with 7% to 60.7%. This significant drop confirms the idea that farm landownership has a significant impact on the perception of land availability as a problem.

What we cannot see in the table is the impact of age. However, as mentioned before, age is related to ownership: an older farmer has a larger part of his land in ownership. Figure 3 shows that owning less land will lower the perception of problems and therefore older farmers are assumed to have fewer problems with land availability. On top of this, older farmers use less land in general which might indicate that they are thinking about cutting back on farming activities and therefore worry less about land availability.

Another thing not mentioned in the figure is the impact of distance to the city, this because the coefficient for distance was not significant and therefore would lead to fault interpretations. However, the analysis did show that there is a tendency towards perceiving fewer problems when further away from the city. It should be mentioned that the whole database contains peri-urban farmers, which explains why the difference between a farmer 'very close' to a city and 'close' to a city exists but is not significant.

Thirdly, the regression can be used to find out which type of price measuring has the most explaining power, and therefore the highest impact on land availability perception. We see that a shift in the real prices by a standard deviation leads to a drop to 7.4% while a shift in the price perception causes a drop of 21.9%. The perception of land prices therefore is more important in defining the perception of land scarcity than the actual price of land. It shows that in this case perception is more important than objective information.

6 Conclusion

It is often described how increased urbanization and population growth has such an impact on the land market, that farming becomes very hard. However, the nearness of the city entails disadvantages as well as advantages (Heimlich and Barnard, 1997) and this is no different for the land market. Hence for some farmers the shift in land demand is not seen as a problem.

The analysis shows that the whether land availability is perceived as a problem depends on landownership, on future expansions of the farm, on land prices, on expected sales and on population pressure in an area. Especially land prices are important which is not surprising because of the inherent relationship between prices and quantities for all marketable goods. However, it can be shown that the real land prices are of lesser importance than the perception of farm land prices.

Besides these land prices, the amount of land in ownership or under tenancy also seems to be important: a farmer owning a lot of land will not worry about land shortages. A farmer under tenancy might be more vulnerable to any wilful acts by the land owner. Even though, the Belgian tenancy regulations are supposed to protect the farmers by law, the analysis shows that farmers are not sure of having this land in the future and they still perceive land availability more often as a problem than land owners. The age of a farmer is also of some importance. On the one hand, older farmers own a larger percentage of their land and therefore face fewer land availability problems and on the other hand, these older farmers have less land in total, indicating that they might be thinking about retirement and therefore worry less about land availability.

The results confirm that in peri-urban areas land is perceived as a problem by a majority of the farmers and suggest that land protective measures or policies are necessary. These results lead us indeed to the conclusion that if we acknowledge the multifunctional role of farming in peri-urban areas (See Vandermeulen et al., 2005) an effective protection of the land market in peri-urban areas is a necessity. If indeed it is believed that besides food production, farmers contribute in a peri-urban environment to the living and recreation conditions of citizens, a protective policy on agricultural land is needed.

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