THE INFLUENCE OF THE NATIONAL DEVELOPMENT AXES ON THE TRANSACTION VALUE OF RURAL LAND IN SLOVENIA

VPLIV NACIONALNIH RAZVOJNIH OSI NA TRANSAKCIJSKO VREDNOST KMETIJSKIH IN GOZDNIH ZEMLJIŠČ V SLOVENIJI

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ABSTRACT

This paper addresses rural land market as a specific case of real property market, where the rural land encompasses agricultural as well as forest land. The article is intended to introduce the basic characteristics of Slovenian rural land market in the period 2001–2005. The main stress is on the location characteristics of land, as geographical location is the basic characteristic making the land different from other assets on the market. In the article, the impact of the accessibility of plots to the central places of Slovenia on rural land market has been evaluated. The hypothesis has been emphasized that the market value of rural land depends on the accessibility to the National Development Axes and along that axes to the central places of a higher level in Slovenia. The National Development Axes are considered as the axes of the Slovenian motorway network. Using GIS tools and the methodology for modelling accessibility to the nearest motorway connection for any plot and by allocation of the land market data (transaction value) for that plot in the spatial system of Slovenia, the rural land market on the NUTS 3 (statistical regions) level has been analysed. The correlation analysis between the market price of rural land and the accessibility to the motorway connections shows a moderate linear relationship. Based on the test of contingency, it has been proved that the accessibility of land plots to the motorway connections significantly influences the market (transaction) value of rural land in Slovenia ($\alpha \ll 0.001$).

POVZETEK

Članek obravnava trg podeželskih zemljišč, ki obsega kmetijska in gozdna zemljišča in predstavlja poseben primer nepremičninskega trga. Glavni namen prispevka je predstaviti osnovne značilnosti slovenskega trga kmetijskih in gozdnih zemljišč v obdobju 2001– 2005 s posebnim poudarkom na lokaciji zemljišč. Lokacija zemljišč predstavlja osnovno lastnost, ki loči zemljišča od drugih dobrin, s katerimi je mogoče trgovati na trgu. V članku je prikazan vpliv dostopnosti zemljišč do centralnih krajev Slovenije na trg s kmetijskimi in gozdnimi zemljišči. Domnevali smo, da je tržna vrednost obravnavanih zemljišč odvisna od dostopnosti do nacionalnih razvojnih osi v Sloveniji in vzdolž teh osi do centralnih krajev Slovenije na višji ravni. Nacionalne razvojne osi pri tem obravnavamo kot osi slovenskega avtocestnega omrežja. S pomočjo orodij GIS in lastne metodologije za modeliranje dostopnosti do najbližjih avtocestnih priključkov za zemljiške parcele in s prostorsko umestitvijo tržnih podatkov (transakcijsko vrednost) o zemljiščih v prostorskem sistemu Slovenije smo analizirali zemljiški trg na nivoju NUTS 3 (statističnih regij). Rezultati analize korelacije med tržno ceno kmetijskih in gozdnih zemljišč ter dostopnostjo do avtocestnih priključkov kažejo na zmerno linearno odvisnost. S pomočjo testa kontingence smo dokazali, da dostopnost zemljiške parcele do avtocestnega priključka značilno vpliva na tržno (transakcijsko) vrednost kmetijskih in gozdnih zemljišč v Sloveniji ($\alpha \ll 0,001$).

KEY WORDS

nepremičnina, zemljišče, podeželsko zemljišče, kmetijsko zemljišče, gozdno zemljišče, zemljiški trg, lokacija, dostopnost, Slovenija

KLJUČNE BESEDE

real estate, land, rural land, agricultural land, forest land, market price, land market, location, accessibility, Slovenia

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1 INTRODUCTION

The sustainable social, economic as well as environmental development is strongly linked with the land, which has always been the crucial foundation for human existence. Land must be seen not as an isolated physical unit of the surface of the Earth, but as something integrated into the whole of society with its rule, institutions, and socio-economic characteristics (Larsson, 1997). Land is considered as a kind of social good in the way of providing food, providing the space, where a human lives; but in the market oriented society it also presents a fundamental source of the capital (Soto, 2000). From the legal point of view, land is an abstract thing that is manifested as a set of rights to its use with a value that can be traded even though the physical object cannot be moved (Dale and McLaughlin, 1999). Monitoring and analyzing real property market have become very important issues in every market economy in order to support transparency and consequently efficiency of real property market, and to provide guidance for the decision makers in private and public sector (Lisec, 2007). Without a solid understanding of the land rent behaviour we are not able to assess the value of land rent properly.

In the economies of the developing and developed countries, land rent contributes a significant portion of value, which increases, if the country is becoming more developed. In the highly developed countries, land rent represents nearly half of gross annual production. Land rent is the price paid annually for the exclusive right (monopoly) to use a certain location, piece of land or other natural resource in/on the land. People receive wages for work, the capital receives interests for investment, but the land receives rent for the exclusive use of a location. If a land owner uses the land for his own needs and does not rent it, the potential land rental remains his profit or other kind of benefit. Through the history and developed legislation, equity and efficiency require that the local general public, who have created and improved land value by improving accessibility to the other locations, which have a spill over effect on the increase of rent for the particular land site, should be paid for the exclusive use of this land site. The payment is in the form of a land tax.

The collection of land rent, by the public for supplying public needs, returns the advantage an individual receives from the exclusive use of a land site to the balance of the community. The community contributes to land value by determining its exclusive use and also improves the accessibility to some rented land sites by increasing public investments in transportation infrastructure, which increases the profit and other benefits on the particular locations. The land market value of a site is the net present value of the expected land rental value for this site in the future, minus expected land taxes, which can be well determined when the capitalization rate is estimated well enough (Bogataj, 1982; Bogataj, 2000).

The issues concerning land have different focal points in the rural and urban areas. Land in rural areas is used for cultivation and is vital for livelihoods such as agriculture and forestry. The land use is often combined with other, primarily recreational uses, and uses that are predominant in the urban areas (Larsson, 1997). Although urban areas are considered as the concentration of human activities and capital, the importance of the rural areas should not be overlooked. Properly functioning rural land markets are of vital importance to the development of rural areas in the market oriented economies (Swinnen and Vranken, 2005). The market value of the rural land

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depends on physical and legal characteristics of the land, and on expected land use in the future, where the process of urbanisation can be reflected in the characteristics of land market (Lisec and Lobnik, 2007). Furthermore, to be able to understand the land market properly, the spatial characteristic of the land has to be studied. The multi-attribute analysis and GIS, which have been developed largely independently, nowadays allow the aggregation of geo-referenced data, involving a variety of both qualitative and quantitative dimensions (Lisec and Drobne, 2007). The multi-attribute analysis in GIS environment enable not only the inclusion of spatial and physical characteristics of land, spatial planning regulations etc., but also locations in terms of accessibility, where transportation networks can be analyzed on different levels of spatial hierarchy.

Johann Heinrich von Thünen (1783–1850) introduced the basic study of agricultural land rent, and also the study of net present value of expected flow of rentals, as the land value at transactions, concerning the availability of land at different locations. He developed the model of agricultural land rent differentials. In his model, location was considered in terms of accessibility to the market under the assumption that accessibility can be described using the Euclidian distance functions in the homogeneous space. This is not the case in reality, and today location can be better studied by using GIS tools.

In (Drobne, Lisec and Bogataj, 2008), we analyzed the impact of accessibility to the main central place in Slovenia (the capital of Ljubljana) on the transaction value of the rural land, where it was proven that location, in terms of accessibility to the capital city, played a significant role in the rural land market of Slovenia. In this paper, we analyzed the influence of the accessibility to the National Development Axes (motorway network) for the rural land market in Slovenia. We hypothesized that the market value of rural land depends on the accessibility to the nearest motorway connection. The correlation analysis between the mean time-spending distance to the motorway connections for the Slovenian statistical regions in 2005 and the average transaction rural land value in 2005 showed that there is a very weak correlation (or none whatsoever). Under the assumption that the improvements of the road network (new motorway) do not directly affect the rural land market in time, the reference year 2001 regarding the state of the motorway network construction in Slovenia was taken into consideration for the rural land market analysed in the period 2001–2005. Here, the time delay between the construction and its reflection in land value was taken in consideration while the anticipation of rent increase was not considered.

2 LAND RENT AND LOCATION THEORY

The theory of land rent and location originates from agricultural economics, where the German agricultural economist Albrecht Thaer (1752–1828) is regarded as the founder (Persson, 1975). His main contribution was the identification of quantitative fertility indicators for evaluating the sustainability of cropping and farming systems. Thaer used this approach to assess the effect of major German cropping systems on soil fertility. In his contributions location was studied implicitly, mostly concerning the problem of fertility. David Ricardo (1772–1823), who was a contemporary of Thaer, developed the economic theory based upon the relative productivity of sites. According

to his theory, land rents were related to differences in the productivity of land, soil. A shortcoming of the Ricardian land rent theory is that it does not account for location (Thaller, 2002). In Thaer's theory land rent is determined as the surplus between revenue and costs, therefore the location was studied more implicitly. He mentioned that the basic values could subsequently be adjusted by taking into account various factors, also the distance to markets and fields etc. (Persson, 1975).

Johann Heinrich von Thünen (1783–1850), who followed Ricardo's and Thaer's idea of land rent theory, emphasized the importance of the expectations regarding future profitability, and focused on the importance of location. This was how he explained the transaction value as a net present value of expected profits in use of land. His theory, introduced in *The Isolated State* (1826), has provided the first treatment of spatial economics in connection with the theory of rent. In his mathematical model of land rent, the main assumptions were perfect spatial homogeneity with respect to productivity and transportation. These are the same ingredients as in the classical location theory, but we should note an important difference between von Thünen's outlook and the outlook implicit in the writings by Launhardt (1832–1918), Weber (1864–1920), Christaller (1893–1969), the founder of central place theory, and Lösch (1906–1945), who followed Christaller's idea and concentrated on industrial location where the firm was an effective monopoly, surrounded by atomistic consumers (Puu, 2003). While von Thünen's indicators of location have one dimension (scalar distance to the market) the others enable us to study the value of land as the result of many distances in polycentric systems, but they have not been able to continue von Thünen's approach to land rent assessments in spatial networks. Although a simplified theoretical approach based on scalar models of location and where the location, i.e. transport costs, was considered as the simple Euclidian distance to the market, von Thünen's theory provided a background for developing urban land theory in the second half of the last century by Alonso (1960, 1964) and others, when the importance of studying the urban land and the rural–urban relationship was increasing. In the last decades, the simple mathematical algorithms for determination of location have been replaced by more complex mathematical models, where terrain, land use, transportation networks etc. have been considered. Consequently, the geometric (mostly Euclidean) distance was replaced by remoteness or accessibility and its changes in time in the statistical analysis of land rent.

In this paper we focused on the importance of the accessibility to the National Development Axes (motorway network) for the Slovenian rural land market. As Slovenia is a small country with a total area of 20,273 km², we presume that the travel time by car inside the motorway network is of little importance for the transportation of agricultural produce to the central places when comparing to the accessibility to the motorway. Our statement is that the main transport obstacles to the central places derive from the accessibility to the motorway on the National Development Axes.[1] Therefore, the accessibility to the motorway connections influences the rural land market value. The accessibility to the motorway is determined using the raster-based GIS approach, measuring the travel time by car as modelled by Drobne (Drobne, 2003; Drobne, 2005; Drobne

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[1] More about the hierarchy and development of central places in Slovenia is discussed in (Bogataj and Drobne, 1990).

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et al., 2005). This approach is, substantially expanded, based on the methodology of Donnay and Ledent (1995), measuring accessibility for the urban region of Ličge (Belgium) and Julião (1999) for the Tagus Valley Region (Portugal).

3 METHODOLOGY AND MATERIALS

3.1 Market data

The analysis of the Slovenian rural land market is based on the transaction data acquired from the Tax Authority of the Republic of Slovenia for the period 2001–2005. Under the Slovenian legal framework, the elementary unit of land transaction is a land plot (land parcel). Data relating to the land plot have characteristics of personal data, and according to the personal data protection there is limited accessibility to land market data with the spatial accuracy to the land plot in Slovenia. The spatial attributes of the real property transactions database at the Tax Authority comprise data at the municipality level and also smaller spatial unit – cadastral community, which is the elementary administrative unit in the land information system in Slovenia (Land Cadastre). In our research, the spatial component of rural land transaction data is determined through the spatial unit of municipality. The main reason was the missing attributes on cadastral community. Although the incompleteness of the database was partly avoided using this step, there was on average 10% of data records that were unsuitable (Table 1).

Year	All records	Incomplete records	Transactions with the price (p): $p > 1000.00$ €/m² or $p < 0.05$ €/m²	Excluded transaction	
	[No.]	[No.]	[No.]	[No.]	[%]
2001	7396	638	122	760	10.3
2002	7299	654	81	735	10.1
2003	10727	810	101	911	8.5
2004	10081	1330	74	1404	13.9
2005	10232	1032	25	1057	10.3
Total	**45735**	**4464**	**403**	**4464**	**10.6**

Table 1: *Quality of real property transaction database and data integrity at the Tax Authority of the Republic of Slovenia – the rural land transactions in Slovenia in the period 2001–2005.*

The data attributes of the real property transaction database at the Tax Authority are structured for the real property transfer taxes assessment and control. Consequently, some records have missing attributes, which are crucial for the real estate market analysis. Table 1 shows the main information on data integrity and quality of the real property transaction database at the Tax Authority, for the data on rural land transactions in the period 2001–2005. For the purpose of rural land market analysis the transactions were limited to the transaction value (market price p) of land between 0.05 and 1000.00 €/m², where only the complete records of rural land transactions

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(municipality, date of transaction, transaction value, land use and land area) were taken into account (Table 1).

Beside the market data, a set of data on population, supply, households, farms, land use, market conditions etc. is significant for the real property market analysis. In most cases, catchments are based on administrative areas such as NUTS (Nomenclature of Territorial Units for Statistics), which have been introduced by The Statistical Office of the European Commission (Eurostat). In this paper, the Slovenian rural land market is analysed on the NUTS 3 level, where the NUTS 3 regions are equivalent to the twelve Slovenian statistical regions that have been used as spatial units for the Slovenian regional statistics for several years. Therefore, the spatial determination of rural land transaction on the municipality level was adequate for the purpose of our study. Figure 1 shows the activity of rural land market in Slovenia in the period 2001–2005; the market activity is determined as the frequency of transactions per square meter of a municipality area. In addition, the statistical regions with their identification numbers are presented (as explained in Table 2).
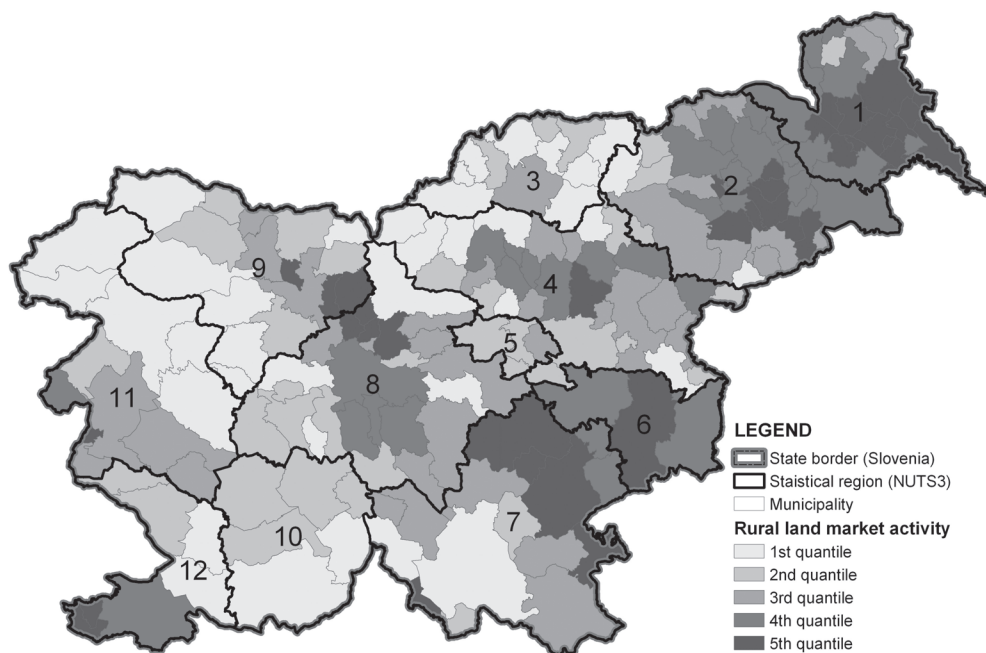

Figure 1: *Rural land market intensity by Slovene municipalities in 2001–2005, and statistical regions.*

As evident from Figure 2, the intensity of the rural land market in Slovenia is higher in the areas with prevailing agricultural use, where flat land dominates, and also in the vicinity of large cities. In the paper, we focus on the rural land market value.

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3.2 Modelling accessibility

In the analysis of land market, the spatial reference is crucial. In the article, location is discussed in terms of accessibility to the National Development Axes, where on the National Development Axes the parts of motorway network exist. Therefore, the accessibility to the National Development Axes is considered as the accessibility to motorway connections on these axes. The accessibility can be measured in several different ways, such as composite measures, comparative measures, and the time-space approach based on the determination of travel time. In our case, the raster-based accessibility evaluation GIS methodology is used, which requires data layers describing the public road network, the spatial position of motorway connections and borders of the statistical regions. In our application, the vector layers on public roads as well as motorway connections for 2001 and 2005 were rasterized with a resolution of 100 m.

The accessibility model is based on the cost surfaces, whose evaluation requires a friction surface that indicates the relative cost of moving through each cell. The costs of movement are expressed by travel time, which represents the time needed to cross the areas with certain attributes. The cell crossing time in the road network is determined by an average travelling speed determined for each category of the road network separately. For every cell outside the road network the average driving speed has been taken as a constant value (for details see Drobne 2003; Drobne, 2005; Drobne et al., 2005). The cost value (time distance) has been calculated as the less cumulative costs starting from the origin (motorway connection) moving through a friction surface. Each raster cell has been determined by the least cost value (travel time) needed to travel by car to the motorway connections. Based on the travel time for each raster cell the mean time-spending distance to the nearest motorway connections has been calculated separately for every statistical region in Slovenia in 2001 and 2005.

4 RESULTS AND DISCUSSION

4.1 Rural land market in Slovenia

Similar to most developed countries, the multipurpose function of the rural landscape for the society is reflected in the Slovenian legislation, which regulates the agricultural and forest land management. Besides restrictions of real property rights, such as recreation and free access, hunting, the transactions of rural land are strictly regulated. The rural land market is mainly regulating by The Agricultural Land Act (2003). Each intended transaction of rural land has to be announced publicly. The relevant local office, which presents the state administration office, Department of Agriculture (hereinafter administration office), has to approve the purchase with a special provision that resolves the pre-emption rights. The approval of the purchase is not required in some specific cases (The Agricultural Land Act, 2003).

The current Agricultural Land Act (2003) has its origin in 1996. The main changes of this Act were introduced in 2002, during our study period. These changes were reflected in the rural land market activity, as it is evident from the chart (Figure 2), where a jump in the frequency of the number of transactions is evident in 2003 in almost all classes of land transaction value (from A

to F). Since big changes in the rural land market activity appeared in 2003, the number of transactions with higher transaction price per m² was increasing (transactions with the land price $p > 2.00$ €/m²), while the number of transactions with a lower price per m² was decreasing (transactions with the land price $p \leq 2.00$ €/m²) after 2003.
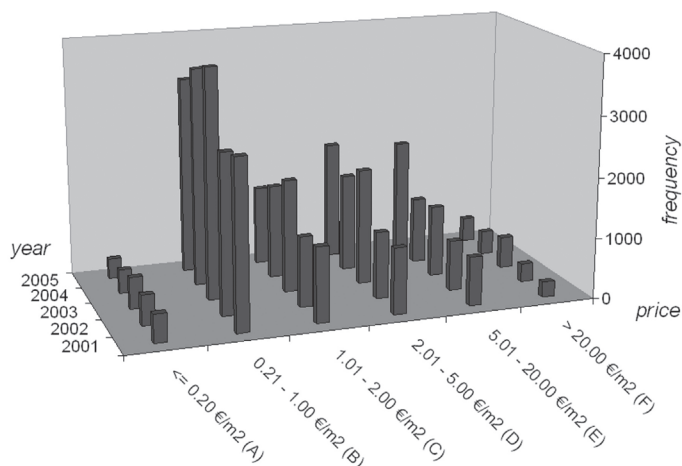
Figure 2: *Distribution of land market prices in transactions of rural land in Slovenia (2001–2005).*

The first important legal change in 2002 was related to the reduction of rural land market restrictions on the base of provision of the Constitutional Court, which has invalidated the article that the purchaser of rural land has to be a farmer or is qualified for agricultural/forest production. The second important change of the Agricultural Land Act (1996) was related to the public announcement of intention of sale of rural land (agricultural and forest land), where the administration office now has to announce the public offer also through internet (state administrative portal) and not only with a notice on the administration office board. This has been an important step towards the transparency of rural land market in Slovenia. In addition, on the base of the Spatial Planning Act (2002) (replaced with the new Spatial Planning Act in 2007) and the Construction Act (2002), the special payment for agricultural land use change, which had its origin in 1984 and was kept in the Agricultural Land Act (1996), was abolished. The main purpose of this special payment was the protection of the best quality agricultural land from the urbanisation pressure. The influence of the cancellation of this special payment on the process of urbanisation and rural land market was partly presented by Lisec and Lobnik (2007).

4.2 Accessibility to the motorway network

In the accessibility analysis the mean time-spending distance to the nearest motorway connections was determined for every statistical region in Slovenia separately for 2001 and 2005. But, there is a very weak correlation between the accessibility to the motorway connections in 2005 and the rural land transaction value in period 2001–2005. For that reason, only the accessibility in 2001

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has been included in statistical analysis. Figure 4 shows the time-spending distance from each location in the RS (determined by raster cells) to the motorway connections in 2001. However, for the statistical analysis the regions were ranked according to the mean time-spending distance to the motorway connections in 2001 (see Table 2).

Region ID	Statistical region/State	Mean time-spending distance [min]	Rank
	Slovenia	*73*	
12	Obalno-Kraška	20	1
8	Osrednjeslovenska	24	2
4	Savinjska	37	3
2	Podravska	37	4
9	Gorenjska	38	5
5	Zasavska	42	6
10	Notranjsko-Kraška	49	7
11	Goriška	61	8
7	Jugovzhodna (JV) Slovenija	78	9
3	Koroška	87	10
1	Pomurska	99	11
6	Spodnjeposavska	99	12

Table 2: *Mean time-spending distance to the motorway connections by statistical regions in Slovenia in 2001.*

On the base of determined the average travel time by car from land plots (raster cell) to the motorway connections for each statistical region in 2001, the impact of accessibility to the development axes (motorway network) on the transaction value (market price *p*) of Slovenian rural land was studied for the period 2001–2005.

4.3 Correlation between the accessibility to the development axes and rural land market price

We supposed that there is a time delay between the improvements (constructions) of motorway and the rural land price changes. The regression analysis between the mean time-spending distance to the motorway connections for the Slovenian statistical regions in 2001 and the average price of rural land in transactions, show a moderate to fairly strong linear relationship. The positive value of the correlation coefficient is slightly decreasing for the period from 2001 to 2005 (see Figure 3). The exception is 2002, with a correlation coefficient of 0.47, which can be understood in the light of significant changes of the legal framework regulating the rural land management.

Because of the anomaly in 2002, the spatial allocation of land transactions has been analyzed. It has been ascertained that there were over-average number of transactions along the Dolenjska part of the Slovenian Development Axes, X Corridor (Trebnje, Novo mesto, Krško), where the transaction values were higher than the average when comparing to transactions in 2001, 2003, 2004 and 2005 in the areas. The reason can be found in the

systematic state land acquisition for the purpose of the motorway building. When eliminating the transactions in 2002, a linear decreasing trend of absolute value of correlation coefficient can be perceived, which indicates a weak influence of the time delay between the investments and capitalisation of land rent (Figure 3).
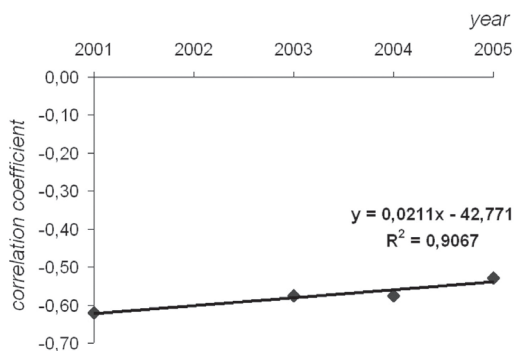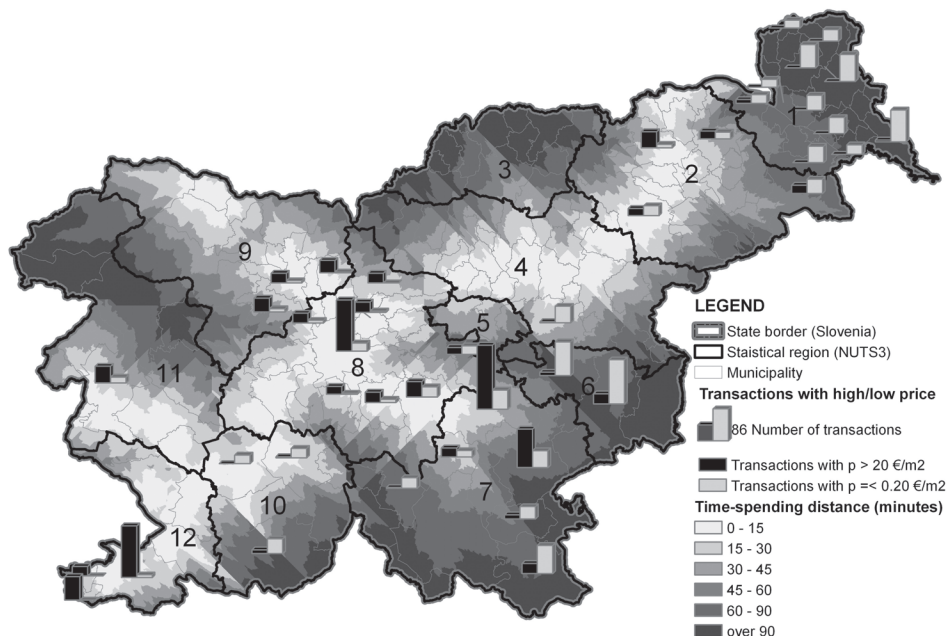

Figure 3: *Regression line of the annual correlation coefficient between the mean time-spending distance to the motorway connections in 2001 and the average transaction rural land value for the period 2001–2005 (two- to four-year period shows the fall of the determination coefficient between the land price and the motorway network in 2001).*

4.4 Connection between rural land market price and accessibility to the development axes

Focusing on the rural land market price in dependence on the accessibility to the National Development Axes (motorway, motorway connections), a simple graphical presentation (Figure 4) shows that rural land transactions with high (low) market price are frequent in the municipalities with better (weaker) accessibility to the motorway connections. The transactions with very high ($p \geq 20.00 \, €/m^2$) and very low ($p \leq 0.20 \, €/m^2$) transaction values are shown for the municipalities, where more than 20 such transactions appeared in the period 2001–2005 (Figure 4).

The influence of the accessibility to the motorway on the rural land market value is further evident from the frequency distribution of the number of rural land transactions (Table 3). The frequency distribution is determined for the statistical regions, which are ranked according to the mean time-spending distance to the motorway connections for the region, and for six value classes (from A to F) as regards the transaction value of rural land. The value classes were determined on the base of intervals of rural land transaction value (market price p), defined as follows (see also Figure 2):

- A: $p \leq 0.20 \, €/m^2$,

- B: $0.20 \, €/m^2 < p \leq 1.00 \, €/m^2$,

- C: $1.00 \, €/m^2 < p \leq 2.00 \, €/m^2$,

- D: $2.00 \, €/m^2 < p \leq 5.00 \, €/m^2$,

- E: $5.00 \, €/m^2 < p \leq 20.00 \, €/m^2$,

- F: $p \geq 20.00 \, €/m^2$.

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Figure 4: *Time-spending distance to the motorway connections in 2001, statistical regions and number of rural land transactions with market price* p *> 20.00 €/m² (dark column) and* p ≤ *0.20 €/m² (light column) by municipalities in the period 2001–2005.*

ID	Statistical region	Rank	Classes of rural land transaction value						Total
			A	B	C	D	E	F	
12	Obalno-Kraška	1	38	281	248	579	679	237	2062
8	Osrednjeslovenska	2	194	1245	863	947	864	482	4595
4	Savinjska	3	191	1582	1023	822	432	71	4121
2	Podravska	4	270	2555	859	866	662	223	5435
9	Gorenjska	5	80	618	498	594	378	218	2386
5	Zasavska	6	11	117	69	89	69	12	367
10	Notranjsko-Kraška	7	122	758	271	107	61	14	1333
11	Goriška	8	103	646	556	529	456	134	2424
7	JV Slovenija	9	345	2100	1623	1250	835	398	6551
3	Koroška	10	34	267	170	188	104	32	795
1	Pomurska	11	602	4451	382	1027	962	28	7452
6	Spodnjeposavska	12	222	1508	586	691	289	51	3347
		Total	**2212**	**16128**	**7148**	**7689**	**5791**	**1900**	**40868**

Table 3: *Frequency distribution of the number of rural land transactions in accordance to the rank of the mean time-spending distance to the motorway connections in 2001 and the transaction value of rural land in the period 2001–2005.*

From Table 3 it is evident that in the statistical regions with a higher rank (weaker accessibility) of the time-spending distance to the motorway connections, there are prevailing transactions with lower transaction values of rural land (Jugovzhodna Slovenija, Koroška, Pomurska and

Spodnjeposavska), while in the regions with better motorway accessibility the percentage of rural land transactions with a higher transaction value is higher.

For the purpose of the test of contingency between the mean time-spending distance to the nearest motorway connections for statistical regions and transaction values of rural land, the statistical regions were grouped into four classes according to the rank of the mean time-spending distance to the motorway connections in 2001. The transactions of the rural land were grouped into three classes referring to the rural land market price (price p) (Table 4):

- transactions with land market price $p \leq 1.00 \ \text{€}/\text{m}^2$,

- transactions with land market price $1.00 < p \leq 5.00 \ \text{€}/\text{m}^2$, and

- transactions with land market price $p > 5.00 \ \text{€}/\text{m}^2$.

Accessibility (group of ranks)	Group according to the transaction value			Total
	A and B $p \leq 1.00 \ \text{€}/\text{m}^2$	C and D $p > 1.00 \ \text{€}/\text{m}^2$ and $p \leq 1.00 \ \text{€}/\text{m}^2$	F and G $p > 5.00 \ \text{€}/\text{m}^2$	
1–3	3531	4482	2765	10778
4–6	3651	2975	1562	8188
7–9	4074	4336	1898	10308
10–12	7084	3044	1466	11594
Total	18340	14837	7691	40868

Table 4: *Contingency between the mean accessibility in the region to the motorway connections and the rural land market price.*

From Table 4 it follows that the number of rural land transactions (as well as the percentage of transactions) with a low transaction value ($p \leq 1.00 \ \text{€}/\text{m}^2$) is increasing with the increasing mean time-spending distance to the motorway connections for the statistical regions. On the other side, there is a decreasing percentage of transactions with a high transaction value ($p > 5.00 \ \text{€}/\text{m}^2$) by increasing the mean time-spending distance to the motorway connections for the statistical regions. As the χ^2 value of contingency table is $1.9 \cdot 10^4$, we can conclude that the accessibility from the rural land plot to the motorway connections in 2001 significantly influenced the rural land market prices in the period 2001–2005 ($\alpha \ll 0.001$).

5 CONCLUSION

The results of our research indicate that the location in terms of accessibility to the National Development Axes (motorway network) plays a significant role in the rural land market value in Slovenia. The correlation analysis between the mean time-spending distance to the motorway connections for the Slovenian statistical regions in 2001 and the rural land transaction value indicated a moderate linear relationship for the period 2001–2005. In this period, the absolute value of the correlation coefficient is slowly decreasing, which can be linked to a short or higher time delay in the impact of the improved transportation network on the rural land market and, on

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the other hand, to the anticipation of new investments. It has been shown that there is a very weak (or none) correlation between the mean time-spending distance to the motorway connections for the Slovenian statistical regions in 2005 and the transaction value of rural land in 2005, while this value is higher correlated with the accessibility in 2001.

Furthermore, the test of contingency between the accessibility in 2001 and the land price in the period 2001–2005 shows that the rural land in the statistical regions situated closer to the National Development Axes (motorway connections), in terms of accessibility, had on average higher market prices. Therefore, the investments and modernization of the road network on the National Development Axes, and the motorway construction program have to be monitored in the future, in order to determine the delay between the investments and their impact on the local land market and anticipation of increasing rent.

As mentioned above, equity and efficiency of the society require that the owner of land pays the local general public, who created and improved land value by improving accessibility to the other locations which have spill over effect on the increase of rent and market value for the particular land site, for the exclusive use of this land site. The payment is in the form of land tax (see Bogataj, 1982). These taxes can become an important generator for investments in land use improvement (infrastructure) and the growth of economy in the society in general. GIS and our methodological approach to the evaluation of accessibility can contribute to suitable regulation of urban-rural continuity.

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