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Impact of Agricultural Profitability, Productivity and Interest Rate on Farmland Value for Selected U.S. and Slovak States

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IMPACT OF AGRICULTURAL PROFITABILITY, PRODUCTIVITY AND INTEREST RATE ON FARMLAND VALUE FOR SELECTED U.S. AND SLOVAK STATES

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ABSTRACT

This thesis examines agricultural factors which may have impact on agricultural land values. Based on theory, three primary factors are considered to have an impact on land value: agricultural productivity, agricultural profitability and interest rate. The study is of two countries: the US, where data are from 16 states and Slovakia with 6 states. The ten-year period from 2000 until 2009 is used in the analysis. A capitalization model is used to estimate the relationship between agricultural productivity, profitability and interest rate and land value. Three types of agricultural land are used: cropland and its value in relationship with crops, grassland and its value in relationship with animals and agricultural land and its value in relationship with animals and crops. The estimated results indicate profitability, when proxied by revenue and expenses, and interest rate as significant variables in all US models. Profitability proxied by profit is an insignificant variable. Productivity is significant only in the US crop models. Results from the Slovak models indicate the interest rate as the only significant variable. Unfortunately, the collection of land value data in Slovakia is not very functional, which can be seen in huge differences in values between years and very high values in some states, such that the validity of the data is questionable.

This thesis is approved for recommendation
to the Graduate Council.

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DEDICATIONS

I dedicate this thesis to my family. Thank you for your love, patience, moral and financial support.

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I. INTRODUCTION

1.1 Purpose of Study and Hypothesis

Land is an important and valuable resource for human life. Its contribution is not only in terms of urbanization and environment but also in agriculture.

Agricultural land is strongly connected to agricultural production, and we can say that is its main factor. Consequently, agricultural production has an impact on the value of agricultural land. There is a very strong relationship between them.

In this study the focus is on agricultural factors which may have an impact on agricultural land value. Agricultural land values in two countries are compared: the U.S. where data from 16 states are used and Slovakia with 6 states. Based on theory, three primary factors are considered to have an impact on land value: agricultural profitability, agricultural productivity and interest rate. Three types of agricultural land are used: cropland and its value in relationship with crops, grassland and its value in relationship with animals and agricultural land and its value in relationship with animals and crops. The theoretical model used is the capitalization model, which relates land values to agricultural profitability, productivity and interest rate. To measure profitability, several proxies are used: profit, revenue and expenses, cash rent, or output and input price indices. For productivity, yield is used for crops or weight gain is used for animal production. The ten-year period of 2000 through 2009 is used in the analysis.

The objective is to estimate the relationship of land value with agricultural profitability, productivity and interest rate. This includes testing three hypotheses.

The first null hypothesis is agricultural land (cropland or pasture land) value is not related to agricultural (crop or animal) profitability. The second null hypothesis is

agricultural land (cropland or pasture land) value is not related to agricultural productivity (crop or animal). Finally, the third null hypothesis is agricultural land is not related to interest rate.

Based on the theory and study of previous literature concerning this topic, the corresponding alternative hypotheses are agricultural land (cropland and pasture land) value is: 1) positively related to agricultural (crop or animal) profitability, 2) positively related to agricultural (crop or animal) productivity, and 3) negatively related to interest rate.

1.2 Forthcoming Chapters

In the first part of the study, the focus is on all possible factors having an influence on U.S. land value, some of them with very strong and some with slightly less impact. Included in this part are descriptions of the history of farmland price development, private and federal land ownership in the U.S., major use of land, urban development of the land, ambition of the U.S. government to protect highly productive agricultural land through conservation programs, and the impact of commodity policies.

While the U.S. land market is developed and land values have experienced an increasing trend within the study period, the land market in Slovakia is still developing after the period of centrally planned economy where land was managed mainly by the state. Nowadays, the Slovak government has had to deal with situations like unknown owners of land or disinterest by people to cultivate the land. One of the problems is also collecting the data concerning land value, profitability and productivity. Statistical offices and networks, which collect data, are not really functional. This can be seen in the land

value data, where the percentage change in land value from one year to the next within the study period is highly variable.

In the second part of the study, the methods I used to collect and compute data and to estimate missing data are described. The data are mostly taken from official government websites like the U.S. Department of Agriculture's (USDA) National Agricultural Statistics Service (NASS) and Economic Research Service (ERS) in the U.S. and the Statistical Office of the Slovak Republic and regional statistical offices in Slovakia.

Also in the second part, the methodology for modeling the relationship between the dependent and independent variables is described. Also possible violations in the model's underlying assumptions, such the presence of autocorrelation, heteroskedasticity and multicollinearity and ways to deal with them are discussed.

The next part of the study is about empirical results. In the case of the U.S., most of the results are in accordance with the expectations, especially for agricultural revenue, where there was a strong relationship with land value. In contrast, profit and productivity did not show a consistently significant relationship with land value. In the case of Slovakia the results are not satisfying. The main reason may be a result of possibly unreliable data collected by the statistical offices.

II. REVIEW OF PREVIOUS STUDIES

2.1. History of Farmland Price Development

During the period of "the Golden Age'' of American agriculture, from 1910 till 1914, the value of farmland almost doubled as a result of the increasing trend in the farm product price. During the next period, from 1921 till 1933, the agriculture sector faced problems which caused a fall in farm product prices and also a decrease in farmland prices. The farmland value always followed the farm product price (Cochrane, 2003).

During 1963-1982 the price of land almost doubled. Alston (1986) describes two main competing reasons of this increase. The first one was connected with the real growth of land rental income and the second one was connected with inflation and tax laws. According to his research, inflation has a very small influence on land price while the main factor in increasing the land price is the real growth of rental income.

Just and Miranowski (1993) see different variables affect the rise and decline in land value. They describe the role of inflation and the opportunity cost of capital as the most important variables. During the 1970s, there was an increase in the inflation rate, and this effect explained 25% of the predicted price increase. The opportunity rate of return on capital fell and that had an impact on the attractiveness of land as an investment which caused an increase in the land price. Another variable with a high impact on land value is returns to farming which explained 30% of the predicted land price change. The impact of government payments on capitalized land values is around 25%, but government payments do not have a significant impact on year-to-year changes.

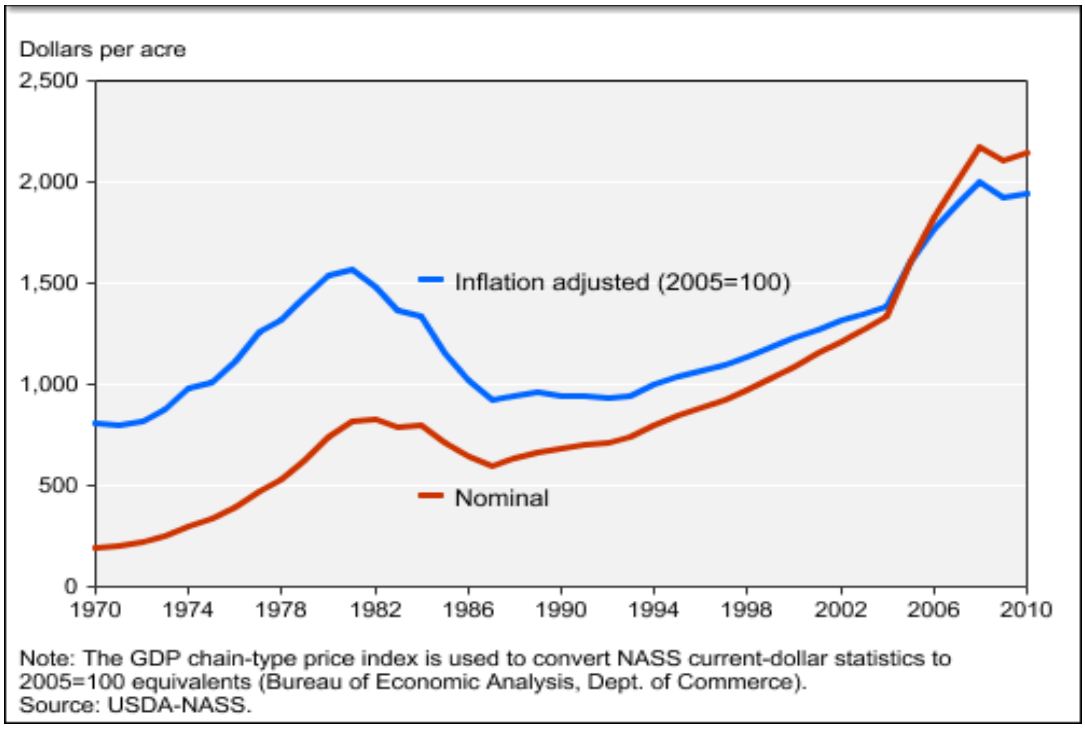
Adoption of new farm technology, a free land market and a fixed supply of land were typical for the period 1933 till 2003. Farmers were interested in increasing their

asset portfolio by buying more land. Price of land together with production costs were increasing. Supply of products also had an increasing trend and prices of products were decreasing. The profit of farmers was really low. Government decided to help them by supporting output prices. The result of this aid had an impact of increasing the price of land (Cochrane, 2003).

2.2 Agricultural Land Values in U.S.

From 1970 to 1981, real farm real estate values increased 94%, which was the result of high returns and federal policies (Figure 2.1). This period was following by a decline in farm real estate values, which was in response to increased interest rates that was a result of monetary policy to lower inflation. This period of declining farm real estate values coincided with a period that is often referred to as the farm financial crisis during the 1980s. For 1987-1993, real land values were relatively stagnant before starting a slow increase until 2004. A sharp increase followed from 2005 to 2008. Then real farm real estate values decreased slightly because of world economic crises (USDA, ERS, 2011).

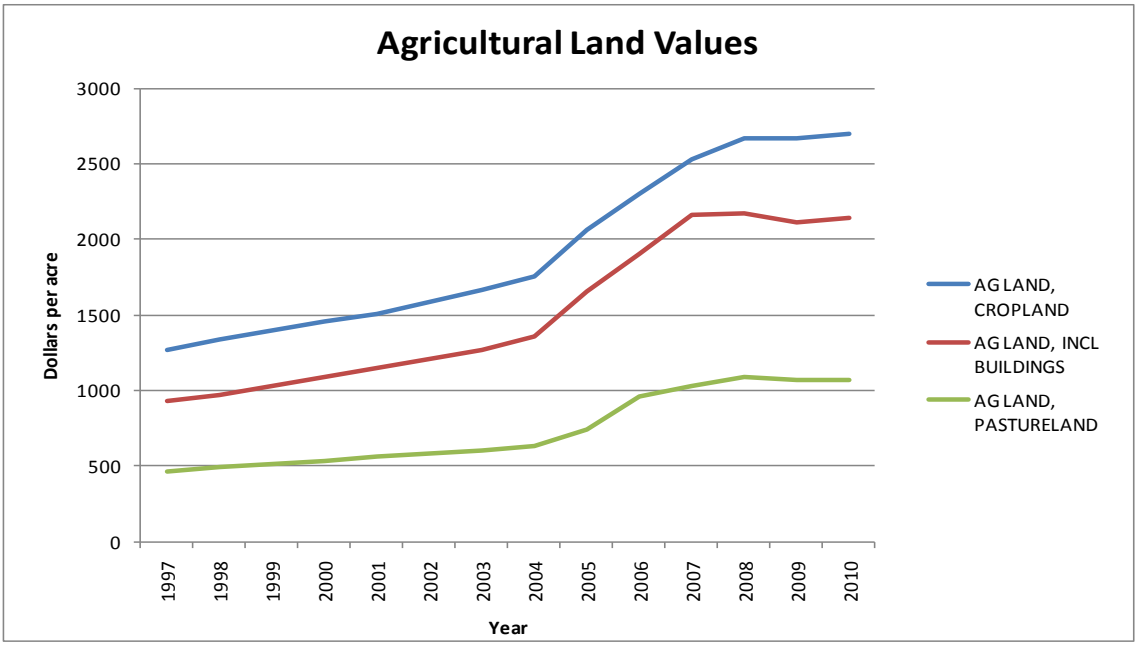
Figure 2.1 Average U.S. Farm Real Estate Value, Nominal and Real (Inflation Adjusted), 1970-2000



Source: USDA, ERS, Agricultural Land Values, 2011

Usually cropland values are two-three times higher than pastureland values (Figure 2.2). There is a continuous increase in agricultural land values from 1997 through 2008.

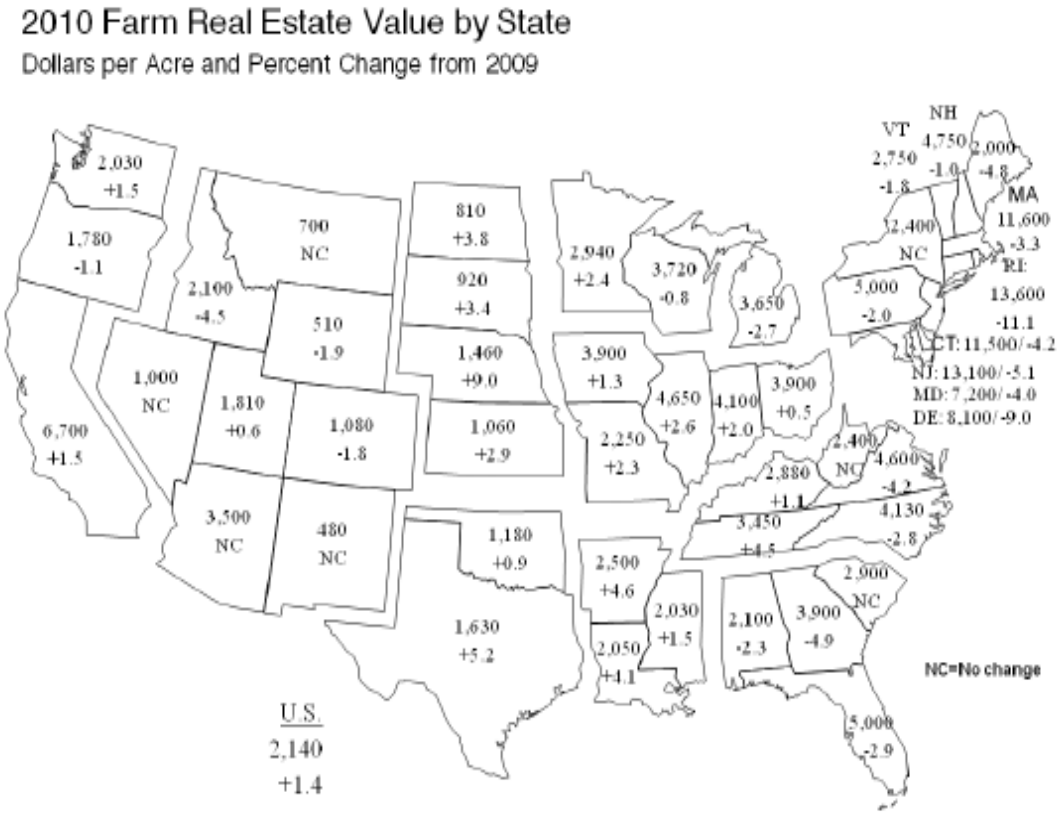
Figure 2.2 U.S. Agricultural Land Values



Source: USDA, NASS, 2010

Figure 2.3 shows the Farm Real Estate Value, which is a measurement of the value of all land and buildings on farms, by each state and the change in value between the years 2009 and 2010. The highest values, with averages of more than $10,000 per acre, are in Rhode Island, New Jersey and Connecticut and the smallest values, with averages less than $800 per acre, are in Wyoming, New Mexico and Montana. In general, states with the highest values are in the Northeast region of the US with an average of $4,690 per acre in 2010. States with the lowest values are in the Mountain region with an average of $911 per acre. The region which is closest to the U.S. average of $2,140 per acre is the Delta region with an average value of $2,230 per acre (USDA, NASS, 2010).

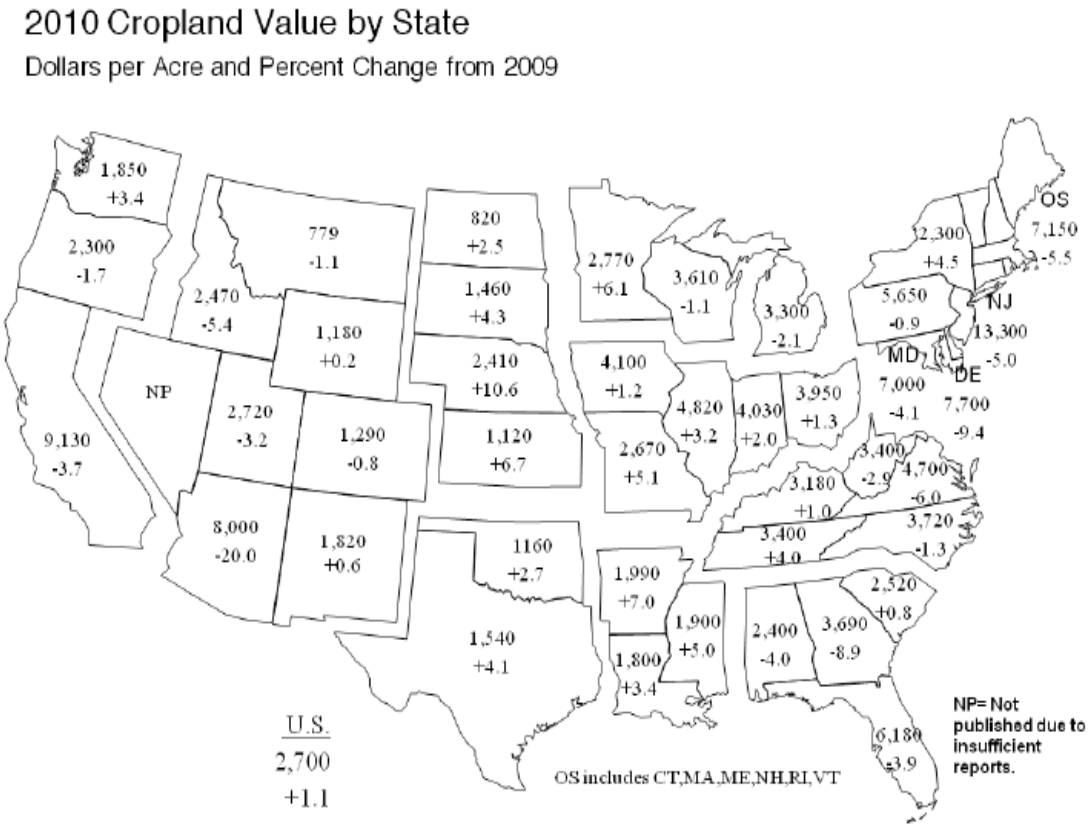
Figure 2.3 Farm Real Estate Value in U.S.



Source: USDA, NASS, 2010

Figure 2.4 shows 2010 cropland values by each U.S. state. New Jersey is the only state with an average cropland value more than $10,000 per acre. The Northeast region again has the highest average cropland value at $5,220 per acre, which is more than the average farm real estate value. Montana has the lowest cropland value at less than $800 per acre. However, the region with the lowest average value is not in the region where Montana is located, but it is in the Northern Plains (USDA, NASS, 2010).

Figure 2.4 Cropland Value in U.S.



Source: USDA, NASS, 2010

2.3 Factors Determining Land Value

Earlier studies already determined many different variables and factors which could have a possible impact on increasing or decreasing land value, for instance: expansion pressure, net returns, capitalized government payments, market (operating) returns, farm enlargement, number of transfers, capitalized rent, etc. All of these factors can influence the land price in different ways and different intensity.

According to Weerahewa et al. (2008) *"Land values are based on discounted expected future returns to land, which is composed of revenue from production and subsidies."* They were examining the relationship of farmland value with income from

the market and government payments for chosen provinces of Canada. He found that there is no connection between earning per acre and farmland value. Also, even though there was an increase in farmland values during 2007, the cash flow generated from farmland did not change so much. They found that any impact of government payments depends on including or excluding time trend in model. If a time trend is included in the model, government payments show no significance on land values. If a time trend is omitted, government payments are significant. They also found that if there is a decrease in the interest rate, land values tend to increase.

Schmitz and Just (2003) describe farm income as one of the factors having an impact on land value. They found that between 1910 and 1950 the relationship between land value and farm income was positive, but during years 1960-1970s the relationship was negative. They concluded that farm income is not the only and not the strongest factor affecting land value, and using farm income as the only factor to describe land value is not recommended. In contrast, they describe inflation as one of the major factors increasing land value. They also found that the available cash for purchasing land also has a positive impact on raising land value. Cash availability can be influenced by many other factors like farmland collateral value, net farm income, and anticipated appreciation of land value for nonfarm uses.

Moss (1997) examines the importance of different variables in explaining the variation in land values. He finds that inflation explains most of the differences in land values, and its relative explanation is around 80% in almost all U.S. regions. Agricultural returns have explanatory power in the regions which rely on government payments, which are part of the net farm income.

Table 2.1 The Impact of an Increase in Certain Variables on Land Value

Variable	Change in land value
Population density	Increase
Real Interest Rate	Decrease
Government Payment	Increase
Net Farm Income	Increase
Cash Rent	Increase
Risk of income	Decrease
Tenure level of counties	Ambiguous
Productivity	Increase
Size of farm	Decrease
Returns to farming	Increase
Inflation	Increase
Interest rate	Decrease

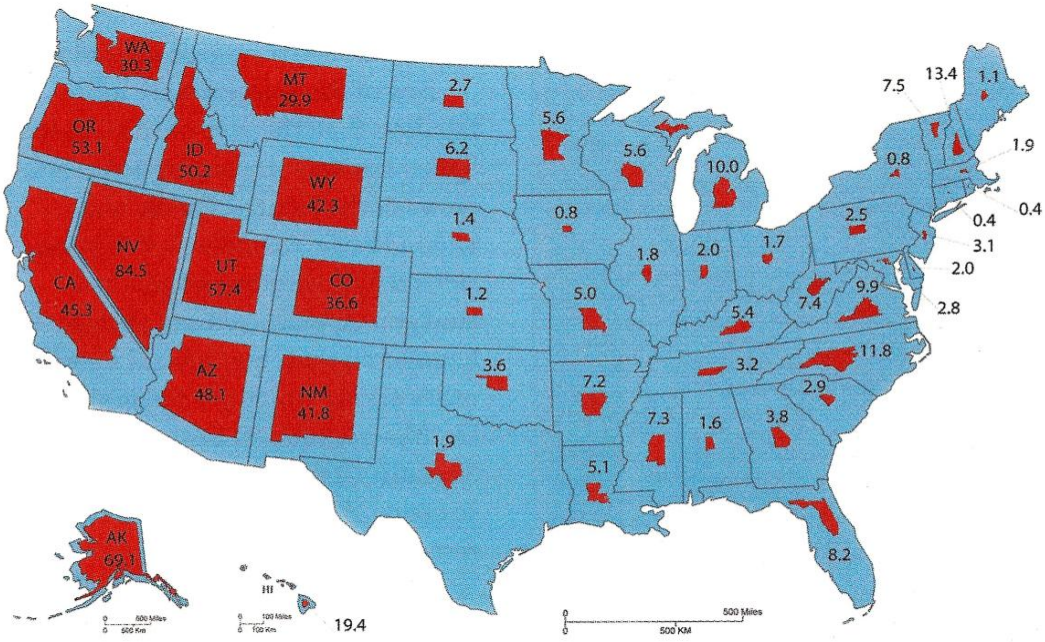
Source: Weerahewa, et al. (2008); Katchova, Sherrick and Barry (2002)

2.4 Land Ownership and Usage in U.S.

The land area of the U.S. is 2.3 billion acres. Land can be divided into two types of ownership, federally (public) owned lands and privately (nonfederal) owned lands. The impact of ownership on land is very high in economic, social, and ecological terms. Public lands are mostly used to bring public good while private lands serve to increase market return (Ahearn and Alig, 2005a).

Most of the federal land is concentrated in the western United States (Figure 2.5). In 2004, almost 28% of the whole U.S. land is considered to be owned by the federal government (Jacobs, 2008). This land is managed by the Bureau of Land Management, the Forest Service, the Fish and Wildlife Service, the National Park Service, and several others. Nevada has the highest percentage of federally owned land (almost 85%), followed by Alaska with 61% and Utah with 57%. Connecticut has the lowest percentage of federally owned land with 0.4%, followed by Rhode Island with 0.4% and Iowa with 0.8%. Privately owned land is mostly concentrated in the East and the West, and in 1997, it covered about half of the land base, including 406 million acres of rangeland, 377 million of cropland, 120 million acres of pastureland, and 33 million acres of other agricultural land (Ahearn and Alig, 2005a).

Figure 2.5 Federal Land as a Percentage of Total State Land Area

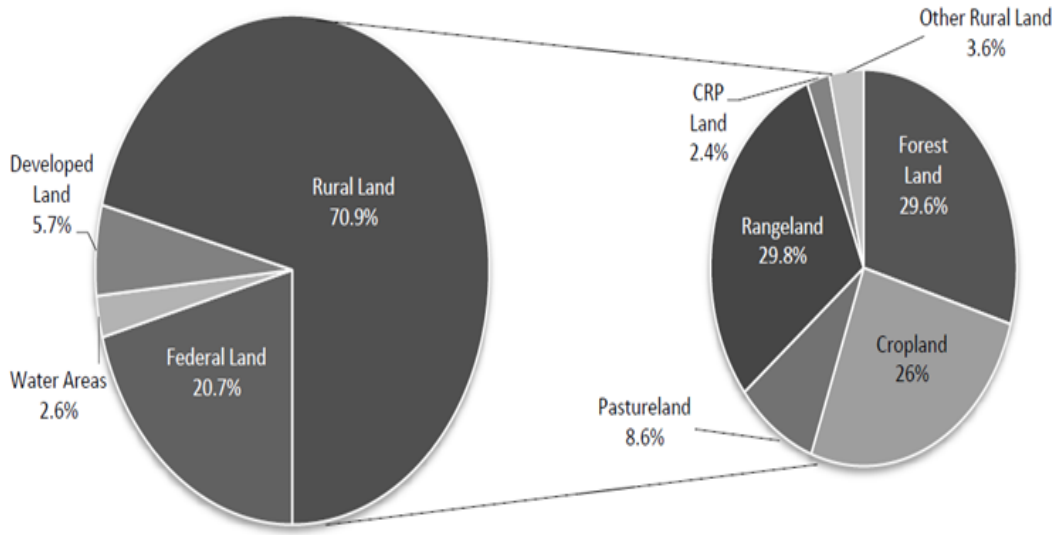


Data source: U.S. General Services Administrataion, *Federal Real Property Profile 2004,* excludes trust properties.

Source: Jacobs, 2008

Rural land covers 1,373,658,800 acres, which is 70.9% of the entire land surface area (Figure 2.6). Of rural land, cropland covers 357,023,500 acres, rangeland covers 409,119,400 acres, forest land covers 406,410,400 acres, pastureland covers 118,615,700 acres and CRP (the Conservation Reserve Program) covers 32,850,200 acres (Farmland Information Center, 2007).

Figure 2.6 Total Surface Area by Land Cover/Use in 2007



Source: Farmland Information Center, 2007

2.5 Land Quality

To create new policies, policymakers cannot focus just on quantity of land but also on quality. Their main attention is focused mostly on when quality, productive land is converted for another use. During the measurement of land quality it is necessary to pay attention to the particular use or goal of the land. *"Soil quality is often used as a proxy for suitability for agricultural use."* (Ahearn and Alig, 2005a).

In general, there are eight land classes (Ahearn and Alig, 2005a). The main indicators of suitability are erosion risk, wetness, and shallowness. When land has the best combination of physical and chemical attributes, it is considered as prime farmland, which is the most appropriate class for crop production. The amount of prime farmland has decreased through time. In 1982, it was 342 million acres, but by 1997 it had fallen by about ten million acres.

2.6 Land-use Regulations

Wu and Bell (2005) describes the impact of regulations on land use. The difference between the local and federal government is that the local government focuses mostly on land use control, and the federal government controls changes in the land use conversion. Government can be involved in land regulations in different ways, for example through the conservation program for agricultural and forestry land, the promotion of industrial and commercial investments, and support for compact development by creating country comprehensive plans, urban growth boundaries, housing caps, and agricultural, forestry, and rural residential zoning. The effectiveness of these regulations may vary. Previous studies found that traditional regulations such as zoning are not as effective as fiscal policies and price regulations. The only way how zoning could increase land value is *"that residential land values rise as the proportion of the block that is in residential use increases.''* However, zoning in general does not increase land values. Other studies have tried to observe the impact of the purchase or exchange of development rights, but unfortunately, it is very difficult to isolate a specific program to see its influence.

Most of the studies are focused on urbanization sprawl, and they evaluate its impact very negatively. Urbanization sprawl results in reducing wildlife habitat, poorer water quality but also in increasing obesity. However, some authors say that urbanization sprawl is *"a result of consumer choices''* (Wu and Bell, 2005).

2.7 Urbanization and Land Value

"Continued in destruction of cropland is wanton squandering of an irreplaceable resource that invites tragedy not only nationally, but on a global scale.''

Bergland (The U.S. Secretary of Agriculture), retrieved from Plantinga, Lubowski and Stavins, 2002.

Plantinga, Lubowski and Stavins (2002) focus on the impact of urbanization on agricultural land. Decreases in agricultural land as the result of urbanization could cause problems with production of food, which could also have a negative influence on national security. They found that future development rents in areas close to urban center are much higher than agricultural land values. The U.S. government would have to apply strong policies to restrict the purchase of land for development purposes and to keep the land under cultivation. They also found that there is an impact of unpredictable future development rents on the farmland value.

In 1996, the U.S. government ratified the Federal Agriculture Improvement and the Reform Act and the Soil Conservation Service was re-established as the Natural Resource Conservation Service (NRCS). The NRCS has many programs and activities focused on protection of land and soil, like preservation, retiring and working lands programs. One of the easement programs of the NRCS is the Farm and Ranch Land

Protection Program (FRPP). The main role of this program is to maintain productive farm and ranch land for agriculture production by supporting the purchase of development rights from owners of agricultural land (USDA, NRCS, 2010).

The FRPP aims to avoid transformation of agricultural land to non-agricultural land. Farmers can make a choice to continue with agricultural development or start urban development. They can sell their development rights and keep their land for agricultural uses. The FRPP was also part of the 2002 Farm Bill and was continued by the 2008 Farm Bill where direct payments are even higher than they were in the 2002 Farm Bill (The Environmental Defend Fund, 2006).

The U.S. government is using two different policies to prevent the loss of land to urbanization: conservation programs and direct government subsidies to farmers. Receivers of direct payments are mostly farm operators of the land. These government payments are capitalized into the value of the land. The main impact of the government payment on land value is to increase farmland value (Ahearn and Alig, 2005b).

2.8 Land Policies

The U.S. government uses many factors to influence private land use. Some of the most used ones are land-use taxes, subsidies, easement, transfer of development rights and different regulations. The government also creates many public policies, which have different aims and an additional impact on land use. The main role of today's U.S. land policy is to ensure land use in parallel with social, economic and environmental needs (Ahearn and Alig, 2005b).

In terms of the land policy, the USDA is responsible for:

- Retaining an adequate size of land for cultivation and to assure high quality food at reasonable production costs and in sufficient supply.
- Protecting the most profitable lands and forests from urbanization, but at the same time helping landlords with development so they can meet their needs.
- Looking after quality of environment (Ahearn and Alig, 2005b).

To avoid the loss of profitable agricultural land and forests due to "urban sprawl'', the USDA uses different tools like agricultural zoning, agricultural districts, transfer of development rights, urban growth boundaries, comprehensive land use planning, etc. (Ahearn and Alig, 2005b).

In the past, almost all producers were also owners of the land so an increase in land values made them wealthier and helped them ensure capacity for their crops and livestock activities. Also, there was less global competition, so they faced fewer unexpected situations. Nowadays, international competitiveness has to be taken into consideration and all the U.S. farm policies must be established in that context. It is important to notice that the higher land values are, the less competitive U.S. farmers are towards the international market. Other issues rising up today are the very high rent for land and the inability of young farmers to get started (Yeutter, 2005).

2.9 The Impact of Government Payments on Farmland Values

Government payments have a positive impact on farmland value. However, if farmland price increases, production cost increases too. Unfortunately, because of the

strong connection between agricultural production and land ownership, most benefits accrue to landowners. So even though government payments are intended for producers, landowners receive the largest part of them through increasing land rents (Weerahewa et al., 2008). They refer to research where the main aim was to measure capitalization of the government payment into U.S. land value. They found that *"the highest degree of capitalization of government payments is 50%, many areas have capitalization rates of 10-20%."*

Different government payments and distributions have different impacts on farmland values. Usually government program payments have positive effects on farmland values, but the effects vary by region, crop and year. Differences by regions can also be influenced by urbanization, soil quality, and availability of irrigation (Weerahewa et al., 2008).

2.10 Commodity Policies

Gardner (2003) discusses what would be the difference in the land value if the U.S. government did not establish a commodity program. If the government implements a commodity program to support market price, the effect of this program will be passed to land where the commodity grows. Even if in some cases producers are not involved in the program, the land gets the benefits because the market price is supported. If the program does not support the market price, the value of the land of nonparticipants will be affected (Gardner, 2003).

Gardner (2003) tries to estimate the correlation between land values and government payments per acre. He uses regression analysis to estimate the relationship

between land value and government payments for eight commodities. *"Land values were not expected to reflect payment levels of a single year, but were to discount expected future benefits.''* In his model he had per acre land value as a function of commodity program payments received, soil quality, availability of irrigation, and urban influence. He used county-level data on 315 counties, observed from the period of 1950 until 1992. Final results found that each $1 of payment generates $3 of land value.

Changes in farmland values can have different impacts on the well-being of farmers and farmers access to credit. In case there is a decrease in land value and farmers do not have enough credit market access, they could quit their business (Featherstone and Moss, 2003).

2.11 Land Value Models

One of the basic models to determine land value, which is based on the capitalized values of expected future streams of net income generated by the asset, is described by Goodwin and Mishra, (2003); Gloy et al. (2011).

The income capitalization model of farmland value is:

Farmland value = $\frac{Income}{discount\ rate\% - growth\ rate\%}$,

where *Income* is assumed to be future end-of-year net income growing at a constant *growth rate* without end. The discount rate represents "*the opportunity costs of invested funds or the rate of return that an investor requires in order to own this asset."*

Interest rates are frequently used as a proxy for the discount rate.

If net returns are constant over time, land value at time t is:

$L_t = \frac{R*}{r} = bR*$

Where R* represents net return and b represents the implied discount factor which is the inverse of the discount rate r.

Net farm income has many different components which can have an impact on land value, like government farm program payments, agricultural earnings and non-agricultural returns to land. We can break the basic previous model into a detailed one:

$L_t = \sum_{i=1}^{\infty}(b_1^{\,i} E_t P_{t+i} + b_2^{\,i} E_t G_{t+i})$

Where E_t represents the expectation operator given information at time t, P_{t+i} represents market returns at time t+i, G_{t+i} represents government payments at time t+i, and b_j represents the discount factor for the j^{th} source of income and equals 1/(1+r) (Goodwin and Mishra, 2003).

Katchova, Sherrick and Barry (2002) describe another theoretical model explaining land value including the rent for leased land and the risk adjusted discount rate in the model:

$L = \sum_{t=0}^{\infty} \frac{R}{(1+i)^t} = R + \frac{R}{i}$

Where L is current price of farmland, R represents the constant, riskless rent for leased land, i is the appropriate risk adjusted discount rate, and t is time period.

Katchova, Sherrick and Barry (2002) also explain the situation in which future rents are not certain and risk aversion can be defined as an ex-ante income compensation for risk:

$L = \frac{R-\gamma\delta 2}{i} = \frac{1}{i} R - \frac{\gamma}{i} \delta^2$

Where γ represents risk aversion coefficient and δ^2 represents the variance of rents. Farmland will reach a lower current price when there is greater rent volatility.

"Changes in independent variables that account for more volatility in farmland prices will imply larger fluctuations in farmland prices than will changes in an independent variable that accounts for less volatility." (Moss, 1997)

2.11 Land Development in Slovakia until 1999

After the 2nd World War Slovakia was one of the countries with a centrally planned economy. Everything including agriculture production was managed mainly by the state. As for ownership of agricultural land during the socialism period, land could be divided in three categories. The first category includes land which was legally always in the ownership of the original owners, but they did not have the right to cultivate it and they did not get any rent for renting it. These land owners were called "*naked owners*". This agricultural land was collectivized. In the second category, land was expropriated from so called *"enemies of state*" like Nazi collaborators and ethnic Germans and Hungarians. In the third category, land was taken away from "*socially undesirable elements*" who owned more than 10 hectares (ha) of land. This land from the second and third categories became part of the ownership of the state and this change was registered by the cadastre of real estate (Bandlerova and Lazikova, 2005b, 2009; Bandlerova and Marisova, 2003).

Agricultural land regardless of its ownership was cultivated by agricultural cooperatives or by state farms which cultivated more than 96% of land in Slovakia (Bandlerova and Lazikova, 2005b, 2009; Bandlerova and Marisova, 2003).

In 1999, the Slovak government started with transformation of the centrally planned economy to a market economy. Part of this transformation was also restitution of

agricultural land to original owners or their heirs. The government established new legislation which allowed original landlords to access their land and also tried to support their interest in the land. It is important to mention that land could be restituted only to landlords who could claim their rights (Bandlerova and Lazikova, 2005b, 2009; Bandlerova and Marisova, 2003).

Basically the agricultural land was returned by the process of privatization, where the agricultural land of state owned farms or so called farm cooperatives was given to original owners. We can say that "*old ownership rights were restored (original or inherited) and new ownership rights were created (for instance co-op property shares)*." The process of returning agricultural land was very different in Slovakia than in other post-socialistic countries. Although land was always legally in the ownership of original owners, the approach to renew the property rights in Slovakia was very specific compared to other post-socialistic countries (Blaas, 2001).

Blaas (2001) describes three different issues of "Slovak land reform":

1. Restitution – land was returned to people whose land was confiscated during the communistic period 1948-1989.
2. Land Use Rights – owners who had preserved their ownership rights even during socialism, but could not use the land, were able to do whatever they wanted with it.
3. Refurbishment of land property registers – many people had a claim of land registration but they had difficulty in presenting evidence of their legal ownership. The government tried to simplify land registration with two different approaches. The first approach in towns where the historical register was preserved and the

second approach in towns where the historical register was destroyed and owners of the land had to have witnesses which proved that the owner is the rightful holder of the specific piece of land.

After the restitution of agricultural land, "new" owners had to learn how to work with it and where to find available information. One of the main issues owners had to deal with was the problem of finding their agricultural land because most of the time they did now know where the land was located and in which condition it was. It happened very often that users provided owners with false information which resulted in lower rent and lower value of agricultural land (Buday, 2010).

2.12 Current Situation

The Slovak Republic covers 49035 km^2, of which agricultural land covers 49% (of which 58% is arable land) and non-agricultural land covers 51% (of which 80% is forest land). According to the Slovak Land Fund (2008), 75% of agricultural land is in private hands, 5% is owned by the state and 20% of the owners are still unknown. The Slovak Land Fund was created in 1991 as a non-profit organization. Its role was to administer agricultural land in state ownership and land of unknown owners, to assist in restitution cases and compensations, to transfer state property to other non state persons, and to manage the land of which owners are still unknown. Land with an unknown owner cannot be sold (Bandlerova and Lazikova, 2005a, 2009; Bandlerova and Marisova, 2003).

The main roles of the Slovak Land Fund are:

- To restitute properties from ownership of state to original owners, and church societies in case these properties were taken in conflict with democratic rules.
- To offer new land to an original owner in case his initial parcel is built up.
- To exchange, sell or rent land in state ownership and use the money for restitution compensation and refill the Slovak Land Funds reserve fund (Slovak Land Fund, 2008).

Land in Slovakia is highly fragmented. There are 9.6 millions parcels of land where the average area of one parcel is 0.45 ha, usually owned by 12-15 people. The main reason for fragmentation was the legal regime that ensured land was inherited by all fathers' heirs. A similar situation occurred in Hungary. In contrast land in Poland and Germany went to the oldest heir or testator. High fragmentation causes many problems in public administration, decision making concerning ownership of an agricultural entity, etc. For instance, if an agricultural cooperative wants to lease the land it has to enter into a contract with many people (Bandlerova and Lazikova, 2005a).

Bandlerova and Marisova (2000) see the main roles of the land market as *"an indicator of investment in rural development,"* transformer of the countryside, and a resource for other uses if there is a decrease in agricultural production. The land market also serves as an infrastructure resource and contributes to improvement of demographic development.

Ahrendsen (2000) describes some problems of land market development in Slovakia. Even though the land market is improving, it still has to deal with large

transaction costs, high land value compared to its earnings, and hesitation of banks to lend money to farmers and then use land as collateral. A developed land market would bring effectiveness in using agricultural land. New functional laws to protect lenders, which want to use land as collateral, would bring more capital to the agricultural sector.

2.13 Owners of Land

Nowadays, there are two main groups of owners in Slovakia:

- Natural persons
- Legal persons consisting of corporate entities-companies, cooperatives, state, and church organizations

Most of the agricultural land is operated by agricultural cooperatives, taking almost 49% of agricultural land, followed by business companies at 37.5% and then natural persons at 12.5% (Lazikova, 2010).

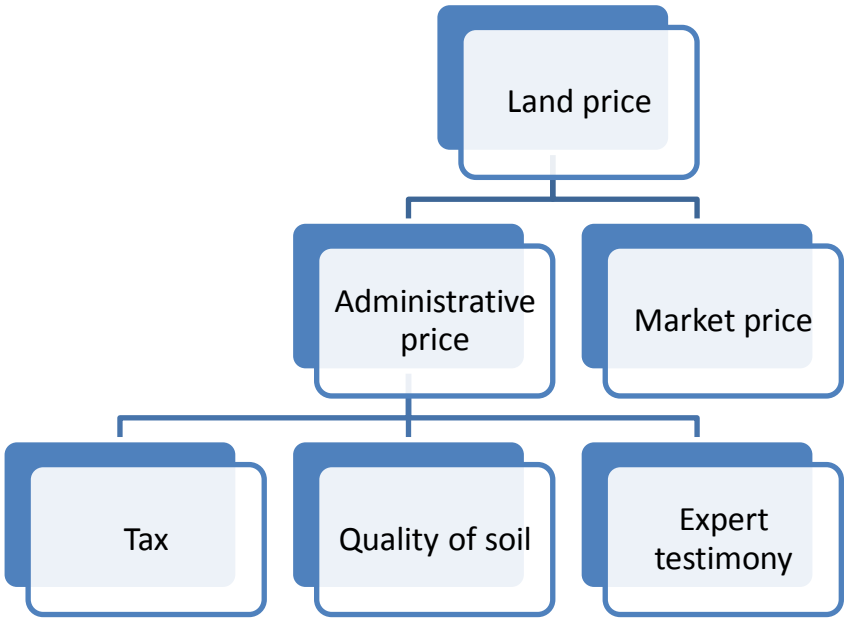
Both natural and legal persons are eligible to buy agricultural land, whereas for instance in Hungary agricultural land can be bought only by natural persons. After Slovakia became part of the European Union (EU) on the first of May 2004, a seven-year period started where foreigners with residence outside of the country were prohibited from buying agricultural land. There are two exceptions. The first exception has three conditions foreigners must satisfy: 1) they must be from one of the countries of the EU, 2) they must have temporary residence in Slovakia, and 3) they must cultivate the land at least for 3 years. The second exception is if a foreigner sets up a business in Slovakia and registers the business in the business register, so the business becomes a legal person and it can purchase the agricultural land (Lazikova and Takac, 2010).

The seven-year period was extended for three years to 2014. Bandlerova, Schwarcz and Marisova (2011) questioned this extended moratorium. They believe that extension of the moratorium will not bring efficiency to the land market. Agricultural land can already be sold to foreigners under the moratorium's exceptions. Without the moratorium, it is more likely that capital may flow into the country to improve efficiency.

2.14 Market and Administrative Prices

There are two different prices used in reporting the price of land in Slovakia: market and administrative price (Figure 2.7). Market price is most of the time higher than administrative price. Market price is based on supply and demand in the market. Administrative price is based on the use and purpose of that price and it is used to determine what the state will pay for land. The amount of this price depends on the purpose for setting the price. If it is for determining taxes, calculation of the amount is different than, for example, in case of land consolidation or setting the minimum price of rent or the purchase price when the state buys land. There are a lot of regulations and it is important to know which one to use in each specific case (Bandlerova, 2005).

Figure 2.7 Price of Land



Source: Bandlerova, 2005

Based on the law, three different groups of land prices are determined:

1. The price of arable land as a minimum basis for taxes for real estate properties (from 0.50 to 1 Euro per $1m^2$).

   "This also implies that the state disproportionately penalizes transactions negotiated at low prices and subsidizes the highest quality land in each class (because those lands face the most accurate assessments for taxation purposes)" (Duke et al., 2004).

2. The price of agricultural land based on quality of soil - ecological credit units. It does not reflect the current market price of land. It is used in the following cases:

a. To determine the value of agricultural land for reason of land consolidation.

b. To determine the value of agricultural land for determining the amount of rent (minimum is 1% of land value).

c. To determine the value of agricultural land for determining the "*fee for fragmentation of the land and for the purposes of payment of contributions for temporary or permanent withdrawal of agricultural land."*

- *"If there will be created a new forest area with less than 20,000 m^2 but more than 10,000 m^2 and agricultural area more than 5,000 m^2, the fee is 10% of the land value."*
- *"If there will be created a new forest area from 5,000-10,000 m^2 or new agricultural area from 2,000-5,000 m^2, the fee is 20% of the land value."*

3. Expert testimony if a state organization wants to buy the land and in the case of a court trial to calculate the fee for the legal proceedings (Bandlerova, 2005; Bandlerova, Schwarcz and Marisova, 2011).

Having too many regulations for determining land value is very confusing. One piece of agricultural land can have four different values based on three different administrative regulations and determined by land market (Bandlerova, 2005).

The administrative price is not taking into consideration profit from the land, locality of land and any other factors which could possibly have an impact on land value. That is the main reason why market participants do not take into consideration administrative price as an initial point in determining market price. In fact, market prices have been found to be from 3.5% to 200% of administrative prices (Lazikova and Takac, 2010).

There are six states in Slovakia where market prices are monitored and collected in cooperation of the Faculty of Natural Sciences at the Comenius University and the Research Institute for Soil Analysis and Protection in Bratislava (Table 2.2 and Figure 2.8). The six states are Dunajska Streda (DS), Topolcany (TO), Liptovsky Mikulas (LM), Rimavska Sobota (RS), Svidnik (SK) and Michalovce (MI) (Buday and Bradacova 2005).

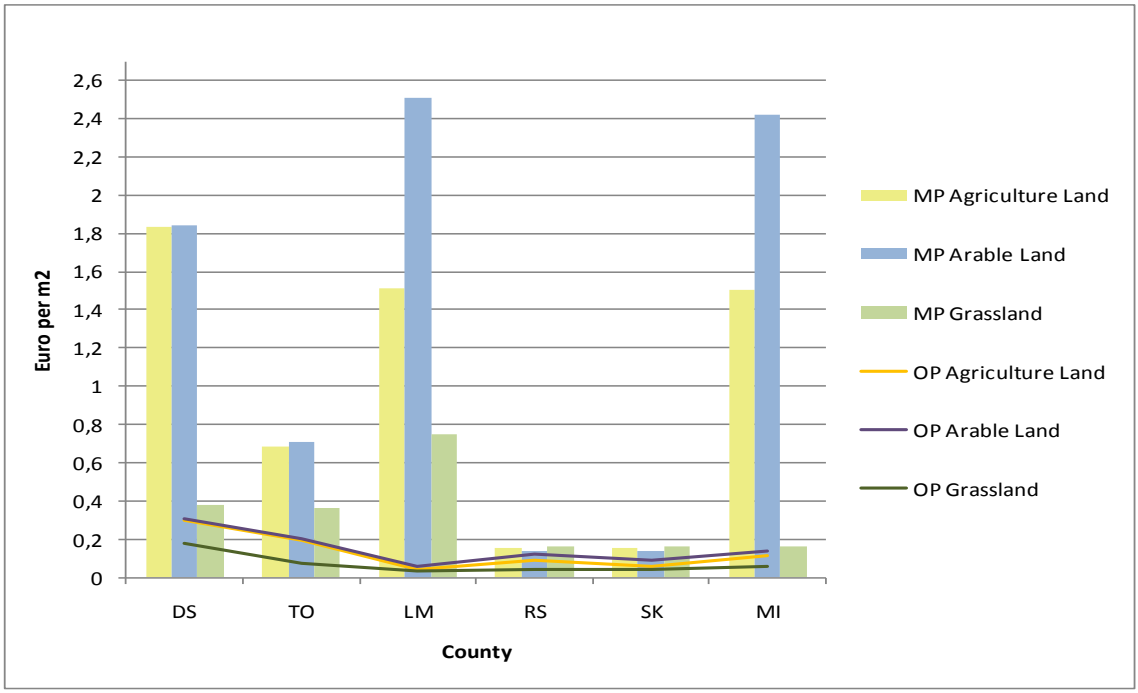
Table 2.2 Market and Administrative Prices for Selected Slovak States in 2009

County	Price		Agriculture Land	Arable Land	Grassland
Dunajska Streda	Administrative Price		0,30	0,31	0,18
	Market Price	to 10 000 m2	4,46	4,60	0,38
		above 10 000m2	1,21	1,21	-
		together	1,83	1,84	0,38
Topolcany	Administrative Price		0,19	0,20	0,07
	Market Price	to 10 000 m2	0,89	0,95	0,57
		above 10 000m2	0,61	0,64	0,18
		together	0,68	0,71	0,36
Liptovsky Mikulas	Administrative Price		0,04	0,06	0,03
	Market Price	to 10 000 m2	1,47	2,49	0,69
		above 10 000m2	1,88	2,67	1,29
		together	1,51	2,51	0,75
Rimavska Sobota	Administrative Price		0,09	0,12	0,04
	Market Price	to 10 000 m2	0,16	0,15	0,20
		above 10 000m2	0,13	0,13	0,13
		together	0,15	0,14	0,16
Svidnik	Administrative Price		0,06	0,09	0,04
	Market Price	to 10 000 m2	0,71	0,89	0,65
		above 10 000m2	0,07	0,52	0,01
		together	0,11	0,57	0,05
Michalovce	Administrative Price		0,11	0,14	0,06
	Market Price	to 10 000 m2	1,97	3,03	0,17
		above 10 000m2	0,12	0,11	0,13
		together	1,50	2,42	0,16

In Euro per m^2
Source: Buday , 2010

Nowadays, mostly average or low quality land is offered for sale on the land market. However, very few sales occur. There are several reasons for this. Demand for land of this quality is lower than supply. The rate of return on the land is lower than the interest rate on savings. And there is a lack of long term credit with an acceptable interest rate. The main reason for absence of available capital is the weak economic situation, fragmentation, inefficiency, low returns, high risk, etc. The restitution process is still not done (Bandlerova and Marisova, 2000).

Figure 2.8 Administrative and Market Price of Land in Chosen States in Slovakia in 2009



Source: Buday, 2010

Lazikova and Takac (2010) were examining factors (profit, single farm payment, less favored areas, taxes and land consolidation) which have an impact on land rent. They found that the impact of profit on rent is insignificant and concluded that changes in profit do not cause changes in rent values. Taxes are also not significant. They found that an increase in single farm payments of 1% results in a 0.14% increase in rent. The most significant impact on rent is clear land consolidation, where the land ownership had been determined and multiple parcels of land had been combined (consolidated) into a larger tract of land. Land in the process of land consolidation is found to have 32% higher rent than land without clear land consolidation. In cases where land consolidation is already complete (what from economic point of view means lowering transaction costs), rent can be almost 64% higher than in cases where land consolidation has not started.

The amount of rent per hectare in Slovakia (Table 2.3) compared to other EU countries is very low. Even so, landlords are willing to rent the land mainly because of the inefficiencies of operating a small acreage. Typically, the parcel is 1 ha per owner. The relatively high costs and low returns usually associated with cultivating a small acreage, causes the owner to rent the land at a low level. That is why renting the land is typically a second income to an owner's main job. The critical decision point, to cultivate the land or rent, is when income from renting the land equals income from cultivating the land (Bandlerova and Lazikova, 2005a).

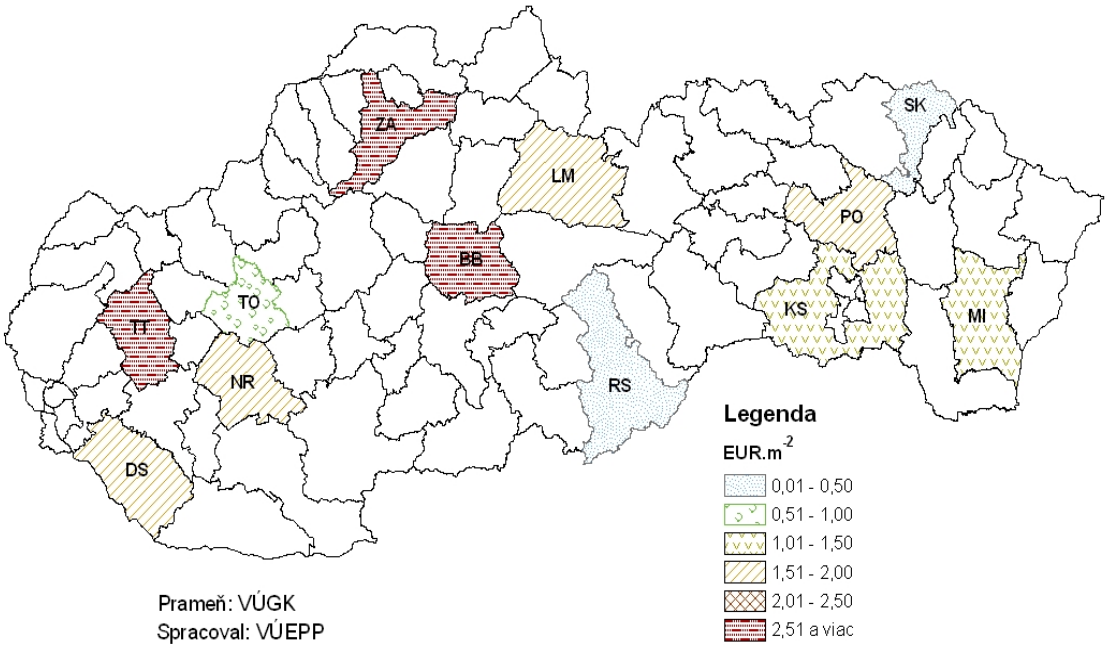
Table 2.3 Price and Rent for Agricultural Land in Slovakia

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Price of agricultural land*	895	877	888	911	945	980	1016	1120	1210	1256
Rent*	13.4	13.1	13.3	13.6	14.2	14.7	15.2	15.8	18.7	18.9

*in Euro per hectare

Source: Eurostat 2011

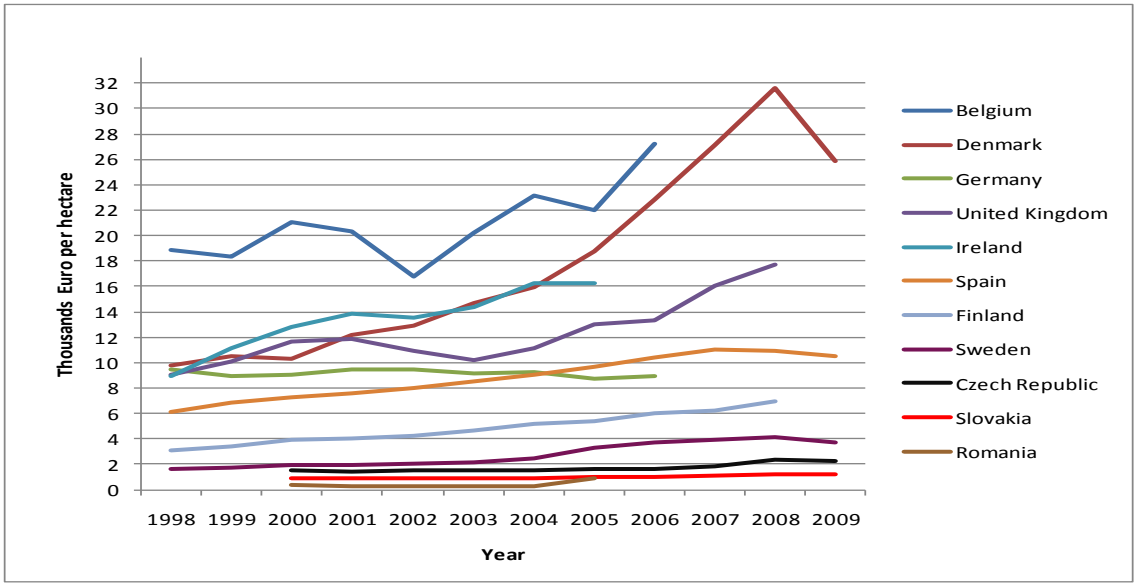
Figure 2.9 Average Market Price of Agricultural Land in Chosen States in Slovakia in 2009



Source: Buday, (2010)

Figure 2.10 describes price of agricultural land in select EU countries. Slovakia is one of the countries with the lowest price per hectare. Not surprisingly, the highest prices are in Belgium, Denmark and the United Kingdom.

Figure 2.10 Price of Agricultural Land in Different Countries of the EU



Source: Eurostat, 2011

2.15 Functionality of Land Records and Information

The land market in Slovakia is still developing. Laws concerning land issues are insufficient, and that has a huge impact on collecting information and data by statistical and cadastre offices. The fines for not informing or misinforming the cadastre office about new land agreements, amount of rent or land price are very low, so each study has to deal with missing or inaccurate data (Buday and Bradacova, 2005).

Statistical surveys and statistical networks concerning land are not very functional. Changes in land ownership are not always recorded, especially in cases where land is not part of the Slovak Land Fund. Access to documentation and registers is very difficult or, many times, impossible. Data and information about land can be mainly obtained by examining specific contracts. However, currently there is no organization which records the real situation and collects proper data concerning land issues (Bandlerova, 2005).

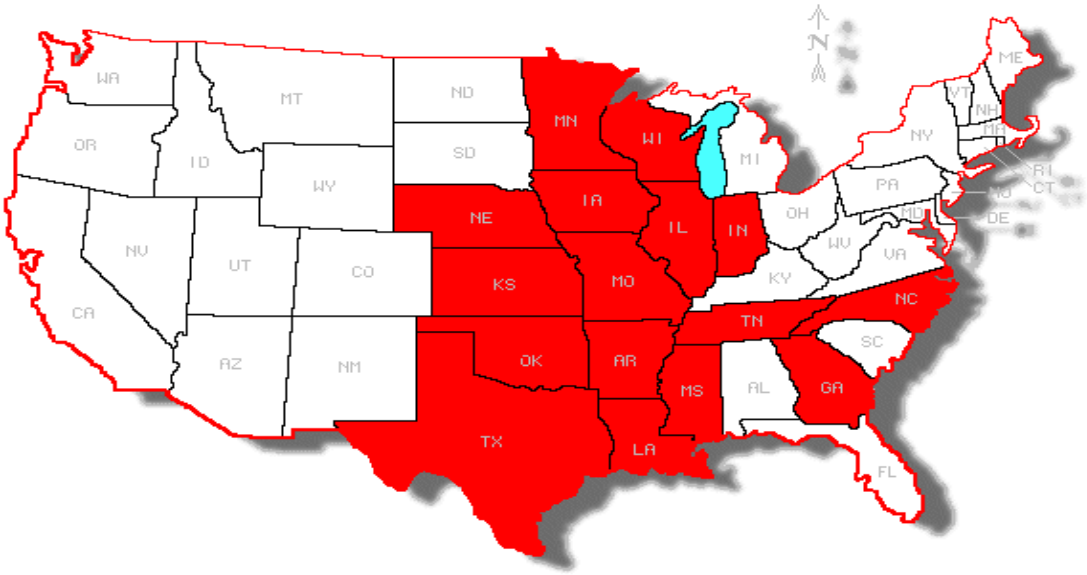
III. DATA AND METHODS

3.1 Data Source

This study compares the situation in two different countries: the U.S. (where sixteen states were chosen) and Slovakia (six states). States in the U.S. were chosen because: 1) they were ranked in the top 15 states in terms of value of agricultural production, although California, Florida and Washington were omitted because of differences in their agricultural production from the other states, or 2) they were neighboring states of Arkansas. In the case of Slovakia, the six states were chosen because more data were available for these states.

The sixteen U.S. states (Figure 3.1) are: Arkansas (AR), Georgia (GA), Illinois (IL), Indiana (IN), Iowa (IA), Kansas (KS), Louisiana (LA), Minnesota (MN), Mississippi (MS), Missouri (MO), Nebraska (NE), North Carolina (NC), Oklahoma (OK), Tennessee (TN), Texas (TX), and Wisconsin (WI).

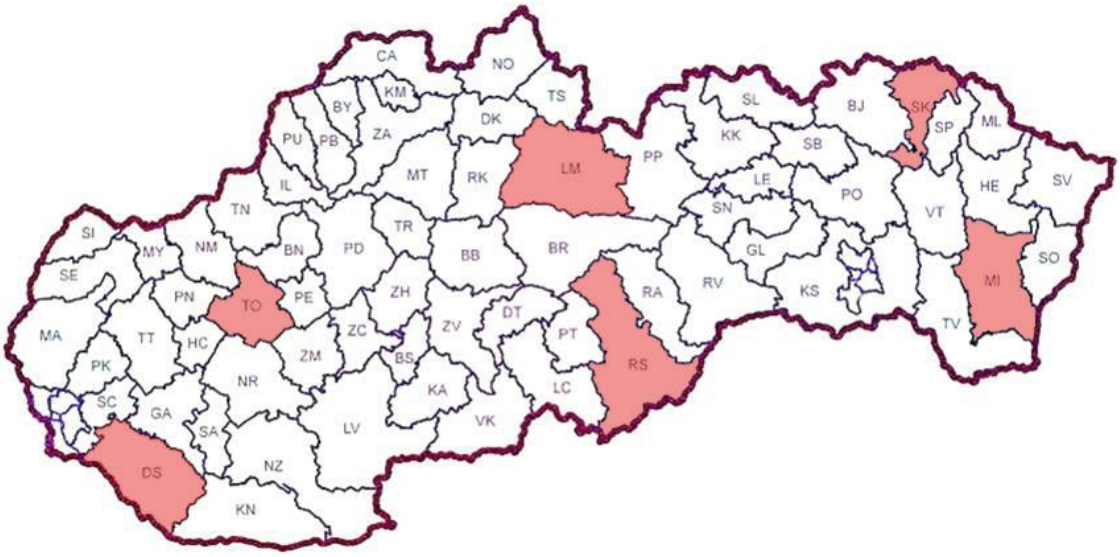
Figure 3.1 The Sixteen U.S. States



Source: Map Maker Utility, 2011

The six Slovakia states (Figure 3.2) are: Dunajska Streda (DS), Topolcany (TO), Liprovsky Mikulas (LM), Rimavska Sobota (RS), Svidnik (SK), and Michalovce(MI).

Figure 3.2 The Six Slovakia States



Source: Mototuristika, 2008

Data for the U.S. states were collected from two sources: The USDA's Economic Research Service (ERS), where data on farm income, costs and profit were found, and the USDA's National Agricultural Statistics Service (NASS), where data on agricultural production and land values were found.

Data for the Slovak states were mostly collected from the Statistical Office of the Slovak Republic (Slovstat and Regstat) and The Economic and Agricultural Research Institute, where data on agricultural production and prices were obtained. Land value data were obtained from the publication "Rozvoj Trhu s podou v podmienkach EU" (Buday, 2010), and in the case of missing data for some years, the data were obtained from Regional Statistical Offices of the different states by e-mail communication.

The research focused on the ten-year period of 2000-2009 in both countries, and yearly observations were used for the models.

3.2 Variables and Variable Specifications

Numerical, categorical and dummy variables are used in the model. Numerical variables include price of land, profitability, productivity, and interest rate. The categorical variable EU is used to differentiate the time periods before Slovakia's entrance into the EU (2000-2004) and after (2005-2009). Dummy variables are used as fixed effects for each of the 16 states in the U.S. and 6 states in Slovakia.

3.2.1 Measure of Profitability

Profitability is measured in different ways:

- Profit
- Revenue, Expenses
- Cash Rent
- Input Price Index, Output Price Index

To calculate the profit I use the "revenue – expenses" equation. There are different data for Slovakia and for the U.S., so the calculation of revenue and expenses is different in both cases.

In the U.S., I have revenue data (Appendix A, Table 8) for each crop so I combine all the revenues for the various crops together to make revenue for each state, and then I divide the state revenue by acres of cropland[1] to get revenue per acre.

$$\text{Crop revenue per acre} = \frac{\text{Revenue per cropA} + \text{Revenue per cropB} + \cdots + \text{Revenue per cropX}}{\text{Acres of cropland}} \qquad (1)$$

For the calculation of animal revenue (Appendix A, Table 9), I included just two groups of animals, which are 1) milk cows and 2) cattle and calves. These two groups of

[1] Cropland is commonly referred to as arable land in Europe

animal agriculture are selected based on the extensive-nature of their production, i.e., their reliance on pasture and roughage for production. Other animal production, such as poultry and hogs, are considered to be intensive production since they are less reliant on pasture acreage. Revenue data from the two animal groups are summed and divided by pasture[2] acreage to arrive at animal revenue per acre:

$$\text{Animal revenue per acre} = \frac{\text{Revenue from cattle and calves} + \text{Revenue from milk}}{\text{Acres of pastureland}} \quad (2)$$

In the case of total revenue per acre (Appendix A, Tables 7 and 28), the total revenue of crop (Appendix A, Tables 8 and 29) and animal production (Appendix A, Tables 9 and 30) is divided by agricultural land acreage, which is the sum of cropland acreage and pasture land acreage. In computing total revenue, animal revenue also includes poultry and hog revenues in addition to milk and cattle and calves revenues.

$$\text{Total revenue per acre} = \frac{\text{Revenue from all crops} + \text{Revenue from cattle and calves,milk,hogs,and poultry}}{\text{Agricultural land acreage}} \quad (3)$$

Data for pastureland acreages were available just for the census years 1997, 2002 and 2007, so I assumed that pasture acreages changed at a constant rate from 1997 to 2002 and then again at a constant rate from 2002 to 2007. The constant rate from 1997 to 2002 is used to impute pasture acreages for 2000 and 2001 using 2002 data. The constant rate from 2002 to 2007 is used to impute pasture acreages for 2003-2006 and 2008-2009 using 2007 data.

Estimating expenses was more complicated. Unfortunately, from the data provided on the ERS website, it is difficult to determine which expenses belong to animal production and which to crop production. That is why I used national data from the

[2] Pastureland is known as grassland in Slovakia

census years (1997, 2002, and 2007) for livestock purchased and feed purchased for cattle in the whole U.S. I estimated this expense for the rest of the years. Then I calculated the ratio of the sum of livestock and feed purchased expense to the total U.S. animal expenses for each year. I calculated this ratio to estimate the annual share of total animal expenses that is being used just for cattle at the national level. Then I assume that the annual share of U.S. expenses for cattle will be the same for all states and applied this annual share to total costs of each state to arrive at the annual animal (cattle and calves) expenses per year (Appendix A, Table 12). Animal production expenses for Slovak states (Appendix A, Table 32) were estimated by using a similar procedure. These state estimated expenses were based on the shares of regional expenses for cattle and milk and the state shares were assumed to be the same as that of the region where the state is located.

Crop expenses (Appendix A, Tables 11 and 31) per state were assumed to be the sum of seed, fertilizer, lime and pesticides purchased. In the model where I used total profit I did not have to make an assumption because data for total revenue and total expenses were available.

In the case of Slovakia I did not have revenue data like in the U.S., so I had to estimate them. The only available data were the amounts of production in number of metric tons for crops, amounts of production in number of heads for animals and the prices of specific crops and animals. For the crop revenue (Appendix A, Table 26) I simply multiplied production in tons per crop by the price per ton of this crop to arrive at crop revenue per crop. Then I summed across the crops to arrive at total crop revenue. For animal revenue, I only had the prices per metric ton of butcher weight. So first I had

to check for carcass utilization of each group of animals. Then the carcass utilization rate was multiplied by the number of head in the group to arrive at total butcher weight. Next the total butcher weight was multiplied by the price per metric ton of butcher weight to arrive at animal revenue per animal group. Then I summed across the animal groups to arrive at the estimate of animal revenue. For the model that explained total agricultural land price[3] as a function of the total profit, both revenue and expenses were available to compute total profit (Appendix A, Tables 23, 25 and 27).

My basic model is run with profit, but I also try three other possibilities: revenue and costs already discussed, cash rent, and output price index and input price index. Values for cash rent (Appendix A, Tables 16 and 17) are available on the NASS website, but I had to calculate the value for the output price index (Appendix A, Tables 18, 19 and 20). Data for the input price index (Appendix A, Table 21) are available.

Output Price Index$_{it}$ =

$$\sum_{k=1}^{K} \frac{\text{Revenue for crop or animal k } (it)}{\text{Total revenue for total } (it)(\text{crops or animals})} * \left(\frac{\text{Price for crop or animal k } (it)}{\text{Price for crop or animal k (i,t=2000)}}\right) * 100$$

(4)

Where i signifies state i, t signifies year t, and K depends on if the output price index is computed for crop, animal or total output. K is the number of crops for the crop output price index, or it is the number of animal groups for the animal output price index, or it is the total number crops and animal groups for the total output price index. For the model where I estimate the relationship between pastureland price and animal profitability, only

[3] Price of agricultural land is defined as Farm Real Estate Value of Farmland and Buildings

extensive animal prices are included, which means cattle and calves price and milk price. To calculate the total output price index, I added poultry and hog prices to cattle and calves and milk prices as well crop prices.

3.2.2 Productivity Index

Equations for calculating productivity index:

$$\text{Crop Productivity Index}_{it} = \sum_{k=1}^{K} \frac{\text{Revenue for crop k } (it)}{\text{Total revenue for crops(it)}} * \left(\frac{\text{Yield for crop k } (it)}{\text{Yield for crop k (i,t=2000)}}\right) * 100 \quad (5)$$

$$\text{Animal Productivity Index}_{it} = \sum_{k=1}^{K} \frac{\text{Revenue for animal k } (it)}{\text{Total revenue for animals}(it)} * \left(\frac{\text{Rate of animal productivity k } (it)}{\text{Rate of animal productivity k (i,t=2000)}}\right) * 100 \quad (6)$$

Where i signifies state i, t signifies year t, K for the crop productivity index is the number of crops, and K for the animal productivity index is the number of animal groups. For the model where I estimate the relationship between pastureland price and animal profit and productivity, only extensive animal production are included, which means cattle and calves productivity and milk productivity. For cattle and calves, daily weight gain is used. For milk, milk production per cow per day is used.

To calculate the productivity index for total agricultural production (Appendix A, Tables 13 and 33), I added poultry (daily weight gain) and hogs (daily weight gain) to animal production and kept crop production the same.

$$\text{Total Productivity Index}_{it} = \sum_{k=1}^{K} \frac{\text{Revenue for crop or animal k } (it)}{\text{Total revenue for total } (it) \text{ (animals and crops)}} * (\text{Crop Yield Index or Animal Gain Index}) \quad (7)$$

Data for daily weight gain for animals in Slovakia were available, but I had to calculate them for the U.S.:

$$\text{Daily Weight Gain Index}_{it} = \frac{Production\ in\ pounds\ it}{Animal\ Inventory\ it} /365 \qquad (8)$$

3.2.3 Deflation of Values and Interest Rate

All variables which have a currency (U.S. dollar or Euro) value are adjusted for inflation. I deflated the values by using the gross domestic product (GDP) price index (Federal Reserve Bank of St. Louis) to arrive at real values:

$$\text{Real value}_t = \frac{Nominal\ Value\ t * 100}{GDP\ index\ t} \qquad (9)$$

To estimate a real interest rate I use the following model:

$$\text{Real Interest Rate}_t = \frac{1+Nominal\ Interest\ Rate\ t}{1+ Inflation\ Rate\ t} - 1 \qquad (10)$$

The nominal interest rate for the U.S. is the 10-Year Treasury Constant Maturity Rate reported by Board of Governors of the Federal Reserve System. The nominal interest rate for Slovakia is the average interest rate on SK/Euro denominated deposit reported by domestic credit institutions.

3.3 Content of data

Table 3.1 Summary Statistics for U.S. Data Used to Estimate Land Price Models (2000-2009 in 2005 Values)

Variable	Mean	Median	SD	Min	Max
Total					
Price of agricultural land ($/Ac)	1967	1480	1090	688	4060
Profit ($/Ac)	151	107	138	7	599
Revenue ($/Ac)	618	586	392	318	1662
Expenses ($/Ac)	467	444	268	239	1251
Productivity Index*	108.03	105.27	9.18	82.08	132.61
Real Interest rate (%)	4.17	4.13	0.51	3.22	4.93
Crop					
Price of cropland ($/Ac)	144	1937	943	677	3545
Profit ($/Ac)	226	185	76	63	408
Revenue ($/Ac)	336	271	113	107	565
Expenses ($/Ac)	110	84	41	40	218
Cash Rent ($/Ac)	226	185	76	63	408
Productivity Index*	111.99	106.30	17.37	76.01	151.21
Real Interest rate (%)	4.17	4.13	0.51	3.22	4.93
Animal					
Price of pastureland ($/Ac)	1659	1144	1294	259	4515
Profit ($/Ac)	378	285	1003	-370	3015
Revenue ($/Ac)	702	391	1230	99	3944
Expenses ($/Ac)	324	203	290	63	982
Cash Rent ($/Ac)	21	16	10	6	41
Productivity Index*	101.52	102.30	8.41	73.75	127.97
Real Interest rate (%)	4.17	4.13	0.51	3.22	4.93

*The value is equal to 100 in the year 2000

Table 3.2 Summary Statistics for Slovak Data Used to Estimate Land Price Models (2000-2009 in 2005 Values)

Variable	Mean	Median	SD	Min	Max
Total					
Price of agric. land (Euro/ha)	5443	2642	7082	259	35596
Profit (Euro/ha)	15	7	93	-145	614
Revenue (Euro/ha)	1185	993	654	308	2444
Expenses (Euro/ha)	1170	967	668	290	2417
Productivity Index*	139.64	135.60	23.96	96.77	220.98
Real Interest rate (%)	2.63	2.55	0.55	2.07	4.23
Crop					
Price of arable land (Euro/ha)	6950	4123	7905	334	39635
Profit (Euro/ha)	194	199	323	-379	1483
Revenue (Euro/ha)	873	891	387	225	2125
Expenses (Euro/ha)	680	696	230	254	1217
Productivity Index*	142.25	141.32	30.20	88.93	224.70
Real Interest rate (%)	2.79	2.56	0.71	2.07	4.23
Animal					
Price of grassland (Euro/ha)	3700	1851	5261	131	27684
Profit (Euro/ha)	-365	-2	633	-2399	84
Revenue (Euro/ha)	2626	320	3786	55	12914
Expenses (Euro/ha)	2991	315	4377	49	14963
Productivity Index*	118.07	116.89	10.51	100.00	138.47
Real Interest rate (%)	2.79	2.56	0.71	2.07	4.23

*The value is equal to 100 in the year 2000

Table 3.3 List of Variables

Variable	Definition/computing	Source	
		U.S.	**Slovakia**
Price of agricultural land	Dependent variable	The NASS Quickstat	Buday, 2010
Profit	Independent variable Profit=Revenue – Expenses Deflation of profit (Equation 9)	The ERS	Statistic Office of SR
Revenue	Independent variable Equations 1,2,3 Deflation of revenue (Equation 9)	The ERS	Statistic Office of SR Agroporadenstvo
Expenses	Independent variable Estimation based on data from census year in the whole U.S. Deflation of expenses (Equation 9)	The ERS 2007 Census of Agriculture	Statistic Office of SR Agroporadenstvo
Rent	Independent variable Deflation of rent (Equat. 9)	The NASS	-
Productivity Index	Independent variable Equations 4,5,6	The ERS The USDA	Statistic Office of SR The Econ. Research Inst.
Real Interest Rate	Deflation of the interest rate Equation 10	Board of Governors of the Federal Reserve System	Domestic credit institutions
EU	Dummy variable Slovakia part of the EU since the May 2004 EU_{it}=0, if t=2000-2004; otherwise EU_{it}=1	-	-
Fixed Effects	Dummy variables: 16 states in U.S. 6 states in Slovakia $State_{it}$=1, if the observation is for state i; otherwise $State_{it}$=0	-	-

3.4 Methodology

Regression analysis is used estimate the model. The regression analysis explains the relationship between variables, where one is called "the response, output or dependent" variable and another one is called "the predictor, input, independent or explanatory" variable. The dependent variable can only be continuous number, but the independent variable can be continuous, categorical or discrete (Faraway, 2002).

There are two known regressions: simple regression, which shows the relationship between one dependent and one independent variable, and multiple regression, which explains the relationship between one dependent and more independent, explanatory variables (Maddala, 2001). In my study I use multiple regression, where the model is:

$$Y_i = \alpha + \beta_1 x_{1i} + \beta_2 x_{2i} + \ldots + \beta_k x_{ki} + u_i, \quad i=1,2,\ldots,n \qquad (11)$$

To check for possible violations to the underlying assumptions of the ordinary least squares (OLS) model, three different tests are performed. The tests performed check for significant presence of:

- Heteroskedasticity – *"when the disturbances do not have the same variance"*
- Autocorrelation – *"when the disturbances are correlated with one another''*
- Multicollinearity- *"two or more independent variables being approximately linearly related in the sample data''* (Kennedy, 2008).

Maddala (2001) describes six different assumptions about error u_i

1. Linearity; $E(u_i)=0$
2. Homoskedasticity; $V(u_i) = \sigma^2$ for all i
3. No serial correlation; u_i and u_j are independent for all $i \neq j$
4. Exogeneity; u_i and x_j are independent for all i and j

5. Normality; u_i are normally distributed for all i
6. No linear dependences in the explanatory variables; $\alpha + \beta_1 x_{1i} + \beta_2 x_{2i} + \ldots + \beta_k x_{ki} = 0$

My model contains panel data so I use panel regression. The main difference between time-series or cross-section regression is in using a double subscript on its variables:

$$Y_{it} = \alpha + \beta_1 X_{it1} + \beta_2 X_{it2} + \ldots + \beta_k X_{itk} + u_{it}, \quad i=1,\ldots,N; \; t=1,\ldots,T \qquad (12)$$

where i can represent households, individuals or in our case states, and t represents the time-series dimension (Baltagi, 2008).

As Baltagi (2008) explains *''most of the panel data applications utilize a one–way error model for the disturbances, with* $u_{it} = \mu_i + v_{it}$ *, where* μ_i *represents unobservable individual specific effect and* v_{it} *represents the remainder disturbance.''*

Kennedy (2008) sees advantages of using panel data in its possibilities in dealing with heterogeneity in the micro units, combining variation across those units with variation over time, and setting up more variability. The benefit of using panel data is it is also better for analysis of dynamic adjustment and examining problems, which cannot be studied by using only cross-sectional data or only time-series data.

Part of my model is created from fixed effects, which in my case are U.S. or Slovak States. Baltagi (2008) sees the best reason to use the fixed effects model is that it focuses on *''a specific set of firms or states and our inference is restricted to the behavior of these sets of firms or states.''*

3.4.1 Capitalization Model

The theoretical model used to select independent variables to explain the variation in the dependent variable, land value, is the capitalization model:

Land Value = Expected net benefits / Discount rate

I adjusted this model for our variables:

$$\mathbf{P_{ijt} = \beta_1 E\ PROF_{ijt} + \beta_2 E\ PROD_{ijt} + \beta_3 E\ INTER_t + \delta_1 DS_1 + \delta_2 DS_2 + \ldots + \delta_{16} DS_{16} + \varepsilon_{ijt}} \quad (13)$$

where

P is land value and is represented by the price of the land

E PROF is the expected net benefits and is represented by profitability

E PROD is the expected productivity and is represented by the productivity index

E INTER is the expected discount rate and is represented by the interest rate

DS is a dummy variable and is included for each state

i is used to indicate the particular state (16 states in U.S. and 6 states in Slovakia)

j is used to indicate the particular type of agriculture (crop, animal, and total)

t is used to indicate the year of the data (2000-2009)

ε is assumed to be normally distributed random error with mean zero and constant variance.

A naïve expectations model is assumed for expected profit, expected productivity and expected interest rate, where the previous year's profit, productivity and interest rate is assumed to equal their respective expected values. Therefore, profit, productivity and interest rate are lagged one year and included in the model:

$$P_{ijt} = \beta_1 PROF_{ijt-1} + \beta_2 PROD_{ijt-1} + \beta_3 INTER_{t-1} + \delta_1 DS_1 + \delta_2 DS_2 + \ldots + \delta_{16} DS_{16} + \varepsilon_{ijt} \quad (14)$$

Then the variables land price, profit, productivity and interest rate are transformed by taking their natural logarithm:

$$\ln P_{ijt} = \beta_1 \ln PROF_{ijt-1} + \beta_2 \ln PROD_{ijt-1} + \beta_3 \ln INTER_{t-1} + \delta_1 DS_1 + \delta_2 DS_2 + \ldots + \delta_{16} DS_{16} + \varepsilon_{ijt} \quad (15)$$

As the result of creating lagged variables, the land price for year 2000 is not included in the estimated model.

In order to take the natural logarithm of the variables and run the regression model, I had to adjust some variables which had negative values. It happened in four cases. Profit had to be adjusted for the U.S. animal model by adding $420, for the SK crop model by adding 380 Euro, for the SK animal model by adding 2400 Euro, and for the SK total model by adding 145 Euro to each of the respective profit values.

In general, Land value = f (profitability, productivity, interest rate, and fixed effects). Although the variables in equation (15) contain a j subscript to indicate three separate types of agriculture (crop, animal, and total), a separate regression model is estimated for each type of land j (cropland, pastureland, and total agricultural land). Moreover, each of the regression models has four specifications, where the specifications differ by the variable(s) used as a proxy for profitability. Specifically, the proxies for profitability are either: 1) operating profit (crop, animal, or total), 2) revenue (crop, animal, or total) and expenses (crop, animal, or total), 3) cash rent (crop, animal, or total), or 4) output price index (crop, animal, or total) and input price index (crop, animal, or total).

IV. EMPRICAL RESULTS

4.1 The Economic Software and Tests for Violations

At the beginning, I decided to use the econometric software – SAS Version 9.2 to run the principal equations and test for multicollinearity, heteroscedasticity and autocorrelation. I performed the test for multicollinearity (Appendix B, Tables 3 and 7) and found that there is a non-harmful level of multicollinearity. The White test for heteroscedasticity (Appendix B, Tables 1 and 5) failed to reject homoscedasticity. Later on I changed to the econometric software – LIMDEP Version 9.0 (Greene, 2007). The Durbin-Watson test for autocorrelation (Appendix B, Tables 2 and 6) supported the conclusion that the errors are not autocorrelated for the Slovak models. However, the test results indicated significant autocorrelation in the U.S. models. That was the main reason, why I chose LIMDEP, which is better for running autocorrelation tests when using panel data.

After a simple graphing of the residuals from a U.S. fixed effects model over time, it is clearly seen that there are trends in the residuals over time and these trends are consistent with positive autocorrelation. However, when I corrected the model for autocorrelation, the sign of interest rate turns unexpectedly positive. I find this result difficult to accept because of the theory, and graphical results show a negative relationship between interest rate and land price. Both fixed effects without autocorrelation and fixed effects with autocorrelation should be providing good estimates of the parameters but the two methods are not doing so. Part of this could be assigned to the short time-series of the samples for a given state and the fact of forcing the model to estimate the same autocorrelation coefficient for each state. More expansive modeling

would allow the autocorrelation coefficients to vary across states but the software did not support this. In addition, autocorrelation coefficients based on nine observations would be suspect.

One source of autocorrelation is an omitted independent variable(s). I did try a variety of independent variables (profit, productivity index, revenue and expenses) but none seemed to eliminate the presence of autocorrelation. I have to accept this as a shortcoming of the empirical results and leave it to other researchers to resolve this problem. Finally I decided to run OLS without taking into consideration the presence of autocorrelation yet recognizing it as a limitation. Although the coefficient estimates are unbiased and consistent, the estimate of a coefficient's variance is biased toward downward. This could potentially result in rejecting the null hypothesis too frequently at a given level of significance when, in fact, the result should be fail to reject. However, the p-values found in this study when null hypotheses are rejected are quite low so that I suspect the problem of autocorrelation is not severe.

In each of the following models, agricultural (crop, pasture or total) land is a function of agricultural (crop, animal or total) profitability, agricultural (crop, animal or total) productivity and interest rate. After lagging and taking the natural logarithm of the continuous independent variables and including fixed effects, the model is:

$$P_{ijt} = \beta_1 \ln PROF_{ijt-1} + \beta_2 \ln PROD_{ijt-1} + \beta_3 \ln INTER_{t-1} + \delta_1 DS_1 + \delta_2 DS_2 + \ldots + \delta_{16} DS_{16} + \varepsilon_{ijt}$$

where P represents price of the land, PROF represents profit, PROD represents productivity, INTER represents interest rate, DS represents dummy state variable, i

indicates 16 states in the U.S. and 6 states in Slovakia, j indicates crop, animal or total agriculture, and t indicates the year of the data (2001-2009) .

4.2 U.S. Total Model with Profitability Proxied by Profit

The results of the estimated model when j = Total are reported in Table 4.1. The R^2 of the model is 92%, which means there is a very high proportion of the total variability in the dependent variable, which is the price of agricultural land, is explained by the independent variables. Adjusted R^2 is 91% and is lower than the R^2 as expected. The only statistically significant continuous variable in this model is the interest rate. Since the continuous variables are in natural logarithms, the coefficient may be interpreted an elasticity. A 1% increase in the interest rate would expect to result in a decrease in the price of agricultural land of 0.56% (-0.56% change). Profit and productivity index are not significant. A potential reason is that lagged profit may be a poor proxy for expected profit. Another potential reason is inaccurate assumptions for the allocation of expenses to arrive at profit, which was calculated as the difference between revenue and expenses. Each of the estimated coefficients for the state dummy variables is statistically significant. A test of the hypothesis that all the intercepts across states are equal is rejected at the 0.0000 level. The coefficients on the state dummy variables are interpreted as intercepts for the respective states. For example, the agricultural land price for Arkansas is expected to be \$1167 ($e^{7.0620}$) per acre if the values for all other independent variables are set to zero.

Table 4.1 U.S. Total Model

Ordinary least squares regression

Standard deviation	0.5166
Number of observations	144
Degrees of freedom	125
Residuals Sum of squares	3.0420
Standard error	0.1560
R-squared	0.9203
Adjusted R-squared	0.9088
Model test F [18, 125] (prob)	80.16 (.0000)

Variable	Coefficient	Standard Error	t-ratio	P[|T|>t]	Mean of X
LAGPROF	0.0117	0.0364	0.3200	0.7496	4.7739
LAGPROD	0.2449	0.1635	1.4980	0.1367	4.6612
LAGINTER	-0.5647	0.1052	-5.3700	0.0000	1.4867
AR	7.0620	0.8058	8.7640	0.0000	0.0625
GA	7.5767	0.7867	9.6310	0.0000	0.0625
IL	7.6644	0.7938	9.6550	0.0000	0.0625
IN	7.6438	0.7934	9.6340	0.0000	0.0625
IA	7.4413	0.7971	9.3350	0.0000	0.0625
KS	6.2983	0.7939	7.9330	0.0000	0.0625
LA	7.0114	0.8074	8.6840	0.0000	0.0625
MN	7.1978	0.7916	9.0920	0.0000	0.0625
MS	6.9579	0.8149	8.5380	0.0000	0.0625
MO	7.0759	0.7914	8.9400	0.0000	0.0625
NE	6.4365	0.8019	8.0270	0.0000	0.0625
NC	7.7776	0.7944	9.7900	0.0000	0.0625
OK	6.3608	0.7938	8.0140	0.0000	0.0625
TN	7.5284	0.8021	9.3860	0.0000	0.0625
TX	6.4997	0.7957	8.1690	0.0000	0.0625
WI	7.5174	0.7892	9.5260	0.0000	0.0625

4.3 U.S. Crop Model with Profitability Proxied by Profit

The results of the estimated model when j = Crop are reported in Table 4.2. Based on R^2, which measures the goodness model fit, it can be said that 92% of the total variability of cropland price is explained by the independent variables. The fit of the model is very good. Productivity and interest rate are significant variables. If there is a 1% increase in the productivity index, the price of cropland is expected to increase by 0.45%. If there is an increase in the interest rate of 1%, the price of cropland is expected to decrease by 0.41% (-0.41% change). Profit, as in the model before, is not significant. Based on the F test, the null hypothesis that all the coefficients equal zero is strongly

rejected. A test of the hypothesis that all the intercepts across states are equal is rejected at the 0.0000 level (Appendix B, Table 4).

Table 4.2 U.S. Crop Model

Ordinary least squares regression

Standard deviation	0.4892
Number of observations	144
Degrees of freedom	125
Residuals Sum of squares	2.6539
Standard error	0.1457
R-squared	0.9224
Adjusted R-squared	0.9113
Model test [18, 125] (prob)	82.6 (.00000)

Variable	Coefficient	Standard Error	t-ratio	P[|T|>t]	Mean of X
LAGPROF	0.0154	0.0740	0.2070	0.8360	5.3248
LAGPROD	0.4526	0.1462	3.0960	0.0024	4.6987
LAGINTER	-0.4114	0.1003	-4.1000	0.0001	1.4867
AR	5.6270	0.7435	7.5680	0.0000	0.0625
GA	6.3380	0.7402	8.5630	0.0000	0.0625
IL	6.5160	0.7256	8.9800	0.0000	0.0625
IN	6.4536	0.7301	8.8400	0.0000	0.0625
IA	6.3365	0.7308	8.6700	0.0000	0.0625
KS	5.1000	0.7214	7.0700	0.0000	0.0625
LA	5.6502	0.7402	7.6330	0.0000	0.0625
MN	6.0030	0.7141	8.4060	0.0000	0.0625
MS	5.5415	0.7564	7.3260	0.0000	0.0625
MO	5.9782	0.7145	8.3670	0.0000	0.0625
NE	5.6842	0.7359	7.7240	0.0000	0.0625
NC	6.5477	0.7205	9.0880	0.0000	0.0625
OK	5.1640	0.7076	7.2980	0.0000	0.0625
TN	6.2720	0.7351	8.5330	0.0000	0.0625
TX	5.3641	0.7376	7.2730	0.0000	0.0625
WI	6.3326	0.7113	8.9030	0.0000	0.0625

4.4 U.S. Animal Model with Profitability Proxied by Profit

The results of the estimated model when j = Animal are reported in Table 4.3. Based on R^2, which is 91%, it can be said that there is a good fit of the model. Profit is significant. The problem is that the result indicates that if there is a 1% increase in profit, the price of pastureland is expected to decrease by 0.39% (-0.39% change). This result is not in accordance with previous studies described in the literature review, which say an

increase in profit should result in an increase in the price of pastureland. Potential reasons may be a poor proxy of expected profit or an improper allocation of expenses in arriving at profit. The interest rate is again highly significant and an increase of the interest rate by 1% is expected to result in a decrease in the price of pastureland of 0.66% (-0.66% change). Productivity index is not significant. A test of the hypothesis that all the intercepts across states are equal is rejected at the 0.0000 level. Based on the F test, the null hypothesis that all the coefficients equal zero is strongly rejected.

Table 4.3 U.S. Animal Model

Ordinary least squares regression

Standard deviation	0 .7145
Number of observations	144
Degrees of freedom	125
Residuals Sum of squares	6.7377
Standard error	0.2321
R-squared	0.9077
Adjusted R-squared	0.8944
Model test F [18, 125] (prob)	68.31 (.0000)

Variable	Coefficient	Standard Error	t-ratio	P[|T|>t]	Mean of X
LAGPROF	-0.3898	0.1575	-2.4750	0.0147	6.3753
LAGPROD	0.5253	0.3329	1.5780	0.1170	4.6139
LAGINTER	-0.6558	0.1520	-4.3140	0.0000	1.4867
AR	8.2405	1.8299	4.5030	0.0000	0.0625
GA	9.2475	1.8428	5.0180	0.0000	0.0625
IL	8.0513	1.8180	4.4290	0.0000	0.0625
IN	8.3873	1.8598	4.5100	0.0000	0.0625
IA	8.1995	1.8849	4.3500	0.0000	0.0625
KS	7.8245	1.9998	3.9130	0.0001	0.0625
LA	8.2573	1.8499	4.4640	0.0000	0.0625
MN	7.9017	1.8894	4.1820	0.0001	0.0625
MS	8.2362	1.7960	4.5860	0.0000	0.0625
MO	8.1495	1.8522	4.4000	0.0000	0.0625
NE	7.4410	2.0461	3.6370	0.0004	0.0625
NC	8.6899	1.7664	4.9200	0.0000	0.0625
OK	7.5369	1.8851	3.9980	0.0001	0.0625
TN	8.9311	1.8587	4.8050	0.0000	0.0625
TX	7.9406	1.8976	4.1850	0.0001	0.0625
WI	8.7602	1.9623	4.4640	0.0000	0.0625

4.5 U.S. Total Model with Profitability Proxied by Revenues and Expenses

The results of the estimated model when j = Total are reported in Table 4.4. The model is showing the relationship between the price of agricultural land and total profitability proxied by revenue and expenses, total productivity and interest rate. R^2 is 95% and is higher than adjusted R^2 as expected. Greater amount of variation in agricultural land price is explained by independent variables when revenues and expenses are included as proxies of profitability than when profit is included as a proxy of profitability as was reported earlier. Revenue and interest rate are highly significant. An increase of revenue by 1% is expected to result in an increase in the price of agricultural land of 1.04% (1.04% change). If there is an increase in the interest rate of 1%, the price of agricultural land is expected to decrease by 0.40% (-0.40% change). Productivity index and expenses are not significant. Most of the estimated coefficients for the state dummy variables are statistically significant. A test of the hypothesis that all the intercepts across states are equal is rejected at the 0.0000 level.

Table 4.4 U.S. Total Model

Ordinary least squares regression

Standard deviation	0.5166
Number of observations	144
Degrees of freedom	124
Residuals Sum of squares	1.8718
Standard error	0.1229
R-squared	0.9509
Adjusted R-squared	0.9434
Model test F [19, 124] (prob)	126.52 (.0000)

Variable	Coefficient	Standard Error	t-ratio	P[|T|>t]	Mean of X
LAGREV	1.0376	0.1574	6.5930	0.0000	6.0524
LAGEXP	-0.0753	0.1438	-0.5240	0.6015	6.3171
LAGPROD	0.1025	0.1302	0.7870	0.4329	4.6612
LAGINTER	-0.4021	0.0860	-4.6770	0.0000	1.4867
AR	1.8014	0.8846	2.0360	0.0438	0.0625
GA	1.6577	0.9343	1.7740	0.0785	0.0625
IL	2.5160	0.8657	2.9060	0.0043	0.0625
IN	2.3656	0.8768	2.6980	0.0079	0.0625
IA	2.0063	0.8919	2.2500	0.0262	0.0625
KS	1.0135	0.8754	1.1580	0.2492	0.0625
LA	1.8600	0.8746	2.1270	0.0354	0.0625
MN	1.9712	0.8711	2.2630	0.0254	0.0625
MS	1.5637	0.9000	1.7370	0.0848	0.0625
MO	2.3762	0.8289	2.8670	0.0049	0.0625
NE	0.8726	0.9047	0.9650	0.3367	0.0625
NC	1.6062	0.9593	1.6740	0.0966	0.0625
OK	1.4103	0.8496	1.6600	0.0995	0.0625
TN	2.5211	0.8570	2.9420	0.0039	0.0625
TX	1.2152	0.8807	1.3800	0.1701	0.0625
WI	2.0678	0.8890	2.3260	0.0216	0.0625

4.6 U.S. Crop Model with Profitability Proxied by Revenues and Expenses

The results of the estimated model when j = Crop are reported in Table 4.5. The results show the relationship between the price of cropland and crop revenue, crop expenses, crop productivity index and interest rate. R^2 is 96%, which again means that even a greater amount of variation in cropland price is explained by independent variables when revenues and expenses are included as proxies of profitability. All independent variables in this model are significant. If there is an increase in the revenue of 1%, the price of cropland will increase by 0.79% (0.79% change). If there is an increase in expenses of 1%, the price of cropland will decrease by 0.31% (-0.31 change).

An increase in the productivity index by 1% is expected to result in an increase in the price of cropland of 0.39% (0.39% change). An increase in the interest rate by 1% is expected to result in a decrease in the price of cropland by 0.21% (-0.21% change). A test of the hypothesis that all the intercepts across states are equal is rejected at the 0.0000 level. Each of the estimated coefficients for the state dummy variables is statistically significant.

Table 4.5 U.S. Crop Model

Ordinary least squares regression

Standard deviation	0.4892
Number of observations	144
Degrees of freedom	124
Residuals Sum of squares	1.5408
Standard error	0.1115
R-squared	0.9550
Adjusted R-squared	0.9481
Model test F [19, 124] (prob)	138.42 (.0000)

Variable	Coefficient	Standard Error	t-ratio	P[|T|>t]	Mean of X
LAGREV	0.7858	0.0894	8.7910	0.0000	4.5821
LAGEXP	-0.3119	0.0938	-3.3270	0.0012	5.7200
LAGPROD	0.3865	0.1120	3.4510	0.0008	4.6987
LAGINTER	-0.2125	0.0796	-2.6710	0.0086	1.4867
AR	3.9227	0.6112	6.4180	0.0000	0.0625
GA	4.2471	0.6228	6.8190	0.0000	0.0625
IL	4.7378	0.6008	7.8860	0.0000	0.0625
IN	4.7331	0.6047	7.8270	0.0000	0.0625
IA	4.6343	0.6016	7.7040	0.0000	0.0625
KS	3.6759	0.5833	6.3020	0.0000	0.0625
LA	3.7906	0.6146	6.1680	0.0000	0.0625
MN	4.2930	0.5883	7.2970	0.0000	0.0625
MS	3.6955	0.6244	5.9190	0.0000	0.0625
MO	4.3824	0.5844	7.4980	0.0000	0.0625
NE	4.0781	0.6016	6.7780	0.0000	0.0625
NC	4.5506	0.6064	7.5050	0.0000	0.0625
OK	3.7382	0.5728	6.5260	0.0000	0.0625
TN	4.4952	0.6059	7.4190	0.0000	0.0625
TX	3.7846	0.6012	6.2950	0.0000	0.0625
WI	4.6354	0.5862	7.9080	0.0000	0.0625

4.6 U.S. Animal Model with Profitability Proxied by Revenues and Expenses

The results of the estimated model when j = Animal are reported in Table 4.6. The model shows the relationship between pastureland and the animal profitability, productivity and interest rate. R^2 is 0.96 which means that 96% of variability in price of pastureland is explained by independent variables. There are two significant variables which are revenue and interest rate. If there is an increase of the revenue by 1%, there will be an increase in the price of pastureland by 2.22% (2.22% change). The revenue has a really strong impact on the price of pastureland. Another significant variable, which is the interest rate, is positive. It indicates that if the interest rate increases by 1%, the price of pastureland will increase by 0.34% (0.34% change), which is not in accordance with previous literature. Expenses and productivity are not significant. Most of the estimated coefficients for the state dummy variables are statistically significant. A test of the hypothesis that all the intercepts across states are equal is rejected at the 0.0000 level.

Table 4.6 U.S. Animal Model

Ordinary least squares regression

Standard deviation	0.7146
Number of observations	144
Degrees of freedom	124
Residuals Sum of squares	2.9408
Standard error	0.1540
R-squared	0.9597
Adjusted R-squared	0.9536
Model test F [19, 124] (prob)	155.51 (.0000)

Variable	Coefficient	Standard Error	t-ratio	P[|T|>t]	Mean of X
LAGREV	2.2213	0.1694	13.1120	0.0000	5.4530
LAGEXP	-0.1257	0.1294	-0.9710	0.3335	5.9076
LAGPROD	0.0421	0.2240	0.1880	0.8511	4.6139
LAGINTER	0.3397	0.1278	2.6570	0.0089	1.4867
AR	-3.7240	1.3460	-2.7670	0.0065	0.0625
GA	-3.7970	1.4264	-2.6620	0.0088	0.0625
IL	-6.5781	1.5357	-4.2830	0.0000	0.0625
IN	-5.7589	1.5112	-3.8110	0.0002	0.0625
IA	-6.7827	1.5677	-4.3270	0.0000	0.0625
KS	-7.3777	1.6278	-4.5320	0.0000	0.0625
LA	-3.3439	1.3416	-2.4920	0.0140	0.0625
MN	-6.1353	1.5165	-4.0460	0.0001	0.0625
MS	-3.9125	1.3280	-2.9460	0.0038	0.0625
MO	-2.3656	1.3067	-1.8100	0.0727	0.0625
NE	-8.8289	1.6985	-5.1980	0.0000	0.0625
NC	-5.5072	1.4939	-3.6860	0.0003	0.0625
OK	-3.1191	1.3574	-2.2980	0.0232	0.0625
TN	-1.8360	1.3199	-1.3910	0.1667	0.0625
TX	-3.8406	1.4176	-2.7090	0.0077	0.0625
WI	-4.9913	1.5440	-3.2330	0.0016	0.0625

Table 4.7 Summary of U.S. Models

	Model with profit as a measure of profitability			Model with revenue and expenses as a measure of profitability		
	Price of land			**Price of land**		
Land	**Agricul.**	**Crop**	**Pasture**	**Agricul.**	**Crop**	**Pasture**
Expl. variables						
Profit	0.01	0.01	-0.38**	-	-	-
Revenue	-	-	-	1.03***	0.78***	2.22***
Expenses	-	-	-	-0.07	-0.31***	-0.12
Prod. index	0.24	0.45***	0.52	0.10	0.38***	0.04
Interest rate	-0.56***	-0.41***	-0.65***	-0.40***	-0.21***	0.33***
AR	7.06***	5.62***	8.24***	1.80**	3.92***	-3.72***
GA	7.57***	6.33***	9.24***	1.65**	4.24***	-3.79***
IL	7.66***	6.51***	8.05***	2.51***	4.73***	-6.57***
IN	7.64***	6.45***	8.38***	2.36***	4.73***	-5.75***
IA	7.44***	6.33***	8.19***	2.00***	4.63***	-6.75***
KS	6.29***	5.10***	7.82***	1.01	3.67***	-7.37***
LA	7.01***	5.65***	8.25***	1.85***	3.79***	-3.34**
MN	7.19***	6.00***	7.70***	1.97***	4.29***	-6.13***
MS	6.95***	5.54***	8.23***	1.56**	3.69***	-3.91***
MO	7.07***	5.97***	8.14***	2.37***	4.38***	-2.36**
NE	6.43***	5.68***	7.44***	0.87	4.07***	-8.82***
NC	7.77***	6.54***	8.68***	1.60*	4.55***	-5.50***
OK	6.36***	5.16***	7.53***	1.41*	3.73***	-3.11**
TN	7.52***	6.27***	8.93***	2.52***	4.49***	-1.83
TX	6.49***	5.36***	7.94***	1.21	3.78***	-3.84***
WI	7.51***	6.33***	8.76***	2.06**	4.63***	-4.99***
R^2	0.92	0.92	0.91	0.95	0.95	0.96
Adjusted R^2	0.91	0.91	0.89	0.94	0.95	0.95

*Statistically significant at the 0.10 level
**Statistically significant at the 0.05 level
***Statistically significant at the 0.01 level

Based on R^2, the goodness of fit for the models is very good (Table 4.7). The proportion of total variability in the dependent variable, which is the price of land, is explained by the independent variables in all six models is quite high at 91% or more.

Profit as a measure of profitability is significant in only one of three models, and then it is unexpectedly negative. In contrast, in models with profitability measured by revenue and expenses, revenue is highly significant and positive as expected in all three models. Expenses are only significant in its relationship with the price of cropland and the relationship is negative as expected. The insignificance of expenses in the other two models may be, as mentioned before, explained by inaccurate allocation of the expenses.

The productivity index only shows significance in the case of crop productivity in both cropland price models.

The interest rate is significant in all six models. However, it has an unexpectedly positive sign in the pastureland price model when revenue and expenses are used as a measure of profitability.

4.7 SK Total Model with Profitability Proxied by Profit

The results of the estimated model when j = Total are reported in Table 4.8. Based on R^2 which is 62%, we can say is a high proportion of total variability in the dependent variable, which is the price of agricultural land, is explained by the independent variables. As expected R^2 is higher than adjusted R^2. The fit of the Slovak model is not as good as in the U.S. models. The only significant variable is interest rate. Since the continuous variables are in natural logarithms, the interpretation of the coefficient is that of elasticity. If there is an increase of the interest rate by 1%, agricultural land will decrease by 1.72%

(-1.72% change). Profit and the productivity index are not significant. The EU variable is included to test if there is any impact on land values from Slovakia joining the EU in May 2004. The EU variable equals 0 if t equal 2000-2004, and 1 otherwise. Since the estimate of the EU coefficient is statistically insignificant, the impact is not significant. A test of the hypothesis that all the intercepts across states are equal is rejected at the 0.0000 level.

It is important to mention that in the case of Slovakia, the data appear to be very inaccurate. As it was explained in the literature review, the statistical networks are not very functional and there is a question of the reliability of the data obtained from the official statistic sources. Especially suspect are land price data since they have unexplainably large changes between the years. That is why I do not really trust results I got in any of the Slovak models.

Table 4.8 SK Total Table

Ordinary least squares regression

Standard deviation	1.0821
Number of observations	54
Degrees of freedom	45
Residuals Sum of squares	23.3328
Standard error	0.7200
R-squared	0.6240
Adjusted R-squared	0.5571
Model test F [8, 45] (prob)	9.34 (.0000)

Variable	Coefficient	Standard Error	t-ratio	P[|T|>t]	Mean of X
LAGPROF	-0.2610	0.4227	-0.6180	0.5400	4.9732
LAGPROD	0.1904	0.9252	0.2060	0.8379	4.8794
LAGINTER	-1.7161	0.6937	-2.4740	0.0173	1.0277
EU	-0.1071	0.3501	-0.3060	0.7612	0.5556
DS	11.1349	4.5008	2.4740	0.0173	0.1667
TO	9.9764	4.5674	2.1840	0.0343	0.1667
LM	11.4515	4.4494	2.5740	0.0135	0.1667
RS	9.2052	4.6322	1.9870	0.0531	0.1667
SK	9.5621	4.6642	2.0500	0.0463	0.1667
MI	10.4588	4.5239	2.3120	0.0255	0.1667

4.8 SK Crop Model with Profitability Proxied by Profit

The results of the estimated model when j = Crop are reported in Table 4.9. The model reflects the relationship between the price of cropland and crop profit, crop productivity index and interest rate in Slovakia. R^2 is 0.68, which means that 68% of variability in dependent variable, which is arable land, is explained by independent variables. The only significant variable is the interest rate. If there is an increase of the interest rate by 1%, the price of cropland will decrease by 1.95% (-1.95% change). Profit, productivity index and the EU variable are insignificant. A test of the hypothesis that all the intercepts across states are equal is rejected at the 0.0000 level (Appendix B, Table 8).

Table 4.9 SK Crop Model

Ordinary least squares regression

Standard deviation	1.0743
Number of observations	54
Degrees of freedom	44
Residuals Sum of squares	19.4432
Standard error	0.6647
R-squared	0.6822
Adjusted R-squared	0.6171
Model test F [9, 44] (prob)	10.49 (.0000)

Variable	Coefficient	Standard Error	t-ratio	P[|T|>t]	Mean of X
LAGPROF	0.2364	0.3372	0.7010	0.4869	6.3103
LAGPROD	-0.7488	0.8122	-0.9220	0.3616	4.9199
LAGINTER	-1.9575	0.6845	-2.8600	0.0065	1.0277
EU	-0.0237	0.3844	-0.0620	0.9511	0.5556
DS	13.3542	3.4421	3.8800	0.0003	0.1667
TO	12.2357	3.4801	3.5160	0.0010	0.1667
LM	13.5977	3.3380	4.0740	0.0002	0.1667
RS	11.4205	3.5387	3.2270	0.0024	0.1667
SK	12.2624	3.5512	3.4530	0.0012	0.1667
MI	12.9478	3.5398	3.6580	0.0007	0.1667

4.9 SK Animal Model with Profitability Proxied by Profit

The results of the estimated model when j = Animal are reported in Table 4.10. Based on R^2, in the model, 67% of the variability in the dependent variable, which is the price of pastureland, is explained by the independent variables, which are animal revenue, expenses, productivity index and interest rate. The only significant variables are profit and EU. If there is an increase in profit by 1%, the price of pastureland decreases by 0.21% (-0.21% change). This result is not in accordance with previous studies described in the literature review, which say an increase in profit should result in an increase in the price of pastureland. Productivity is not significant. The variable EU shows significance and it is negative, which indicates that after Slovakia became part of

the EU, there was a decrease in the price of pastureland. A test of the hypothesis that all the intercepts across states are equal is rejected at the 0.0000 level.

Table 4.10 SK Animal Model

Ordinary least squares regression

Standard deviation	1.0666
Number of observations	54
Degrees of freedom	44
Residuals Sum of squares	19.9915
Standard error	0.6665
R-squared	0.6684
Adjusted R-squared	0.6095
Model test F [8, 45] (prob)	11.34 (.0000)

Variable	Coefficient	Standard Error	t-ratio	P[|T|>t]	Mean of X
LAGPROF	-0.2112	0.0975	-2.1660	0.0357	7.4152
LAGPROD	3.2360	2.4363	1.3280	0.1909	4.7609
LAGINTER	-1.5971	0.9700	-1.6460	0.1068	1.0277
EU	-0.5620	0.3089	-1.8200	0.0756	0.5556
DS	-3.7385	12.3800	-0.3020	0.7641	0.1667
TO	-3.9808	12.4469	-0.3200	0.7506	0.1667
LM	-3.0585	12.4977	-0.2450	0.8078	0.1667
RS	-5.1207	12.4615	-0.4110	0.6831	0.1667
SK	-4.6838	12.3677	-0.3790	0.7067	0.1667
MI	-4.4536	12.4472	-0.3580	0.7222	0.1667

4.10 SK Total Model with Profitability Proxied by Revenues and Expenses

The results of the estimated model when j = Total are reported in Table 4.11. Based on R^2, 67% of the variation in the dependent variable, which is the price of agricultural land, is explained by the independent variables, which are the total revenue, expenses, productivity index and interest rate. And the R^2 is higher than adjusted R^2 as expected. As indicated by the adjusted R^2s from the two SK total agricultural land models, a greater proportion of the variation in agricultural land price is explained by

independent variables when revenues and expenses are included as proxies of profitability than when profit is included as a proxy of profitability. The only significant variable is the interest rate. If there is an increase in the interest rate by 1%, the price of agricultural land will decrease by 1.73% (-1.73% change). All other variables like revenue, expenses, productivity index and the EU variable are not significant. A test of the hypothesis that all the intercepts across states are equal is rejected at the 0.0000 level.

Table 4.11 SK Total Model

Ordinary least squares regression

Standard deviation	1.0821
Number of observations	54
Degrees of freedom	43
Residuals Sum of squares	20.2446
Standard error	0.6862
R-squared	0.6738
Adjusted R-squared	0.5979
Model test F [10, 43] (prob)	8.88 (.0000)

Variable	Coefficient	Standard Error	t-ratio	P[|T|>t]	Mean of X
LAGREV	4.8094	3.9367	1.2220	0.2285	6.9136
LAGEXP	-4.9129	3.9167	-1.2540	0.2165	6.9232
LAGPROD	0.7178	1.0494	0.6840	0.4976	4.8794
LAGINTER	-1.7336	0.6900	-2.5130	0.0158	1.0277
EU	-0.0929	0.3420	-0.2720	0.7871	0.5556
DS	8.1152	8.2817	0.9800	0.3326	0.1667
TO	6.9280	8.2880	0.8360	0.4078	0.1667
LM	8.3995	7.7186	1.0880	0.2826	0.1667
RS	6.0772	7.9309	0.7660	0.4477	0.1667
SK	6.3611	7.3255	0.8680	0.3900	0.1667
MI	7.3140	7.6728	0.9530	0.3458	0.1667

4.11 SK Crop Model with Profitability Proxied by Revenues and Expenses

The results of the estimated model when j = Crop are reported in Table 4.12. Based on R^2, 69% of the variation in the dependent variable, which is the price of cropland, is explained by independent variables, which are crop revenue, expenses,

productivity index and interest rate. The only significant variable is the interest rate. If there is an increase of the interest rate by 1%, the price of cropland will decrease by 2.00% (-2.00% change). Revenue, expenses, productivity index and the EU variable are not significant. A test of the hypothesis that all the intercepts across states are equal is rejected at the 0.0000 level.

Table 4.12 SK Crop Model

Ordinary least squares regression

Standard deviation	1.0743
Number of observations	54
Degrees of freedom	43
Residuals Sum of squares	19.0063
Standard error	0.6648
R-squared	0.6893
Adjusted R-squared	0.6170
Model test F [10, 43] (prob)	3.87 (.0015)

Variable	Coefficient	Standard Error	t-ratio	P[|T|>t]	Mean of X
LAGREV	-0.2958	0.6624	-0.4470	0.6574	6.4507
LAGEXP	0.7042	0.6473	1.0880	0.2827	6.7238
LAGPROD	-0.9617	0.8383	-1.1470	0.2577	4.9199
LAGINTER	-2.0007	0.6731	-2.9720	0.0048	1.0277
EU	0.1119	0.4023	0.2780	0.7822	0.5556
DS	12.9591	6.0593	2.1390	0.0382	0.1667
TO	11.8039	6.2000	1.9040	0.0636	0.1667
LM	13.0835	6.0771	2.1530	0.0370	0.1667
RS	11.0738	5.9737	1.8540	0.0706	0.1667
SK	12.2217	5.4733	2.2330	0.0308	0.1667
MI	12.7652	5.7163	2.2330	0.0308	0.1667

4.12 SK Animal Model with Profitability Proxied by Revenues and Expenses

The results of the estimated model when j = Animal are reported in Table 4.13. Based on R^2, 65% of the variation in the dependent variable, which is the price of pastureland, is explained by the independent variables, which are animal revenue, expenses, productivity index and interest rate. The only significant variable in model is

productivity. If there is an increase in the productivity index by 1%, the price of pastureland will increase by 6.00% (6.00% change). The rest of the variables are not significant. A test of the hypothesis that all the intercepts across states are equal is rejected at the 0.0000 level.

Table 4.13 SK Animal Model

Ordinary least squares regression

Standard deviation	1.0666
Number of observations	54
Degrees of freedom	43
Residuals Sum of squares	21.2053
Standard error	0.7022
R-squared	0.6483
Adjusted R-squared	0.5666
Model test F[10, 43] (prob)	7.93 (.0000)

Variable	Coefficient	Standard Error	t-ratio	P[|T|>t]	Mean of X
LAGREV	-0.0382	1.7615	-0.0220	0.9828	6.5298
LAGEXP	1.2404	2.2648	0.5480	0.5867	6.5419
LAGPROD	5.9974	2.9615	2.0250	0.0491	4.7609
LAGINTER	-0.9304	1.0453	-0.8900	0.3784	1.0277
EU	-0.2645	0.4213	-0.6280	0.5334	0.5556
DS	-30.0313	20.8069	-1.4430	0.1562	0.1667
TO	-29.8913	20.4218	-1.4640	0.1505	0.1667
LM	-25.9101	18.6276	-1.3910	0.1714	0.1667
RS	-27.3416	18.2228	-1.5000	0.1408	0.1667
SK	-25.7408	17.5268	-1.4690	0.1492	0.1667
MI	-26.6946	18.1881	-1.4680	0.1495	0.1667

Table 4.14 Summary of Results for SK Models

	Model with profit as a measure of profitability			Model with revenue and expenses as measures of profitability		
	Price of land			**Price of land**		
Land	**Agricultural**	**Arable**	**Pasture**	**Agricultural**	**Arable**	**Pasture**
Explanatory variables						
Profit	-0.26	0.23	-0.21**	-	-	-
Revenue	-	-	-	4.80	-0.30	-0.03
Expenses	-	-	-	-4.91	0.70	1.24
Productivity index	0.19	-0.74	3.23	0.71	-0.96	5.99**
Interest rate	-1.71***	-1.95***	-1.59	-1.73***	-2.00***	-0.93
EU	-0.10	-0.02	-0.56**	-0.09	0.78	-0.26
DS	11.13	13.35***	-3.73	8.11	12.96*	-30.03
TO	9.97	12.24***	-3.98	6.92	11.80*	-29.89
LM	11.45	13.60***	-3.05	8.39	13.08*	-25.91
RS	9.20	11.42***	-5.12	6.07	11.07*	-27.34
SK	9.56	12.26***	-4.68	6.36	12.22*	-25.74
MI	10.45	12.94***	-4.45	7.31	12.77*	-26.69
R^2	0.69	0.68	0.67	0.67	0.69	0.65
Adjusted R^2	0.66	0.62	0.60	0.60	0.62	0.57

*Statistically significant at the a=0.10 level
**Statistically significant at the a=0.05 level
***Statistically significant at the a=0.01 level

Even if I do not have confidence in the results provided by the Slovak models because of inaccurate data, they show significance of the interest rate in the total and crop

models. There are only three other significant variables in all Slovak models. Profit and the EU variable are significant in animal model with profitability proxied by profit, but profit has an unexpected negative sign. The other significant variable is the productivity index, which is positive as expected, in animal model with profitability proxied by revenue and expenses.

V. SUMMARY AND CONCLUSION

In this study, three null hypotheses are tested:

1. Agricultural land (cropland or pastureland) value is not related to agricultural (crop or animal) profitability.
2. Agricultural land (cropland or pastureland) value is not related to agricultural (crop or animal) productivity.
3. Agricultural land (cropland or pastureland) is not related to interest rate.

All U.S. model results fail to reject the first hypothesis when profit is used as a proxy for profitability. When revenue and expenses are used as proxies for profitability, support for the theory is for the most part improved. In the case of revenue, the null hypothesis is rejected and the alternative hypothesis that revenue has a positive impact on land price is accepted. In the case of expenses, the null hypothesis is only rejected in the cropland model of the three models and the alternative hypothesis of a negative impact on land price is accepted.

The second null hypothesis about no relationship between land price and productivity is failed to be rejected in the total agricultural land and pastureland models. However, this hypothesis is rejected and the alternative hypothesis is accepted in the cropland price models where there is a significant, positive relationship with crop productivity.

The third null hypothesis is consistently rejected. There is a significant, negative relationship between interest rate and land price in five of the six U.S. models. The lone

exception is for the pasture land model when revenue and expenses are used to proxy profitability.

In the case of Slovak models, the first and second hypotheses are failed to be rejected in favor of the alternative hypotheses in all but one case. In that case, the alternative hypothesis of pastureland price is positively related to animal productivity is accepted when revenue and expenses are used as a proxy for profitability.

The third null hypothesis is rejected in favor of the alternative hypothesis that land values are negatively related to interest rates in four of the six models. The exceptions are the pastureland price models where the interest rate is statistically insignificant.

It is important to say that I do not trust the Slovak model results because of I suspect data are inaccurate. The way of collecting land value data is not very functional. There are huge differences in the values between years, and there are very high values in some states. The high prices may be explained by new investors coming to Slovakia during the ten-year period and buying agricultural land for new factories. Subsequently, the price of the agricultural land increases rapidly. Unfortunately, this is not an explanation for all states and for the high variability over the years. The high variability could be explained by investors repeatedly entering and exiting the Slovakian market. However, this explanation seems unlikely. The fluctuation in price can also be caused by the unstable legislation, which is frequently changing according to the particular government holding office.

A law that regulates the uses of the land, forces the buyers to pay extra fees if they are planning to change the use of the land, for example, from agricultural land to a

construction site. This law has had a negative effect on the prices of land, where on one side buyers do not want to pay for the elevated extra fees and on the other side landowners negotiate lower prices in order to be able to sell their land. (Bandlerova, personal communication, June, 29, 2011)

I also had problems with getting data for profitability, where I had to make assumptions for allocating expenses between crop and animal production since only total expenses were reported. Even after e-mail communication with six different regional statistical offices, they were not able to provide the data needed, because "these data are not collected or calculated at state level". Even after Slovakia became part of the European Union in 2004 and the statistical networks have developed because of the EU requirements, collecting data on regional or state levels still needs to be improved. Collecting and monitoring data just on a country level or, in some cases, on a regional level makes it difficult to do analysis and provide recommendations for solving problems experienced at the smaller state levels.

The main problem to deal with in collecting information for the U.S. model was in allocating expenses. There are not data reported separately for crop production expenses and animal production expenses. The insignificance for some the results may be because of improper assumptions regarding the allocation of expenses. It would be very useful if the USDA would provide this kind of information.

In the U.S. models, I also had to deal with violation of the non-autocorrelation assumption and the difficulty in correcting for this violation, which may be attributable to the shortness of the sample, where only nine years were used in estimating the models. Unfortunately, there was not enough data for including previous years. The lack of time

series data was also the case for Slovakia. Data on state land prices are not available from years before 2000.

It would be interesting to repeat this study in the future with additional years and maybe with additional states and with more accurate data. Also of interest may be to include additional independent variables, such as unemployment rates and measures of wealth and liquidity. Finally, it would be interesting to focus on disaggregated data from one state and to collect more variables that may have an impact on land prices. This may result in more precise estimates in support of the impact of profitability, productivity and interest rate on agricultural land price.

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VII. Appendices

Appendix A

Table 1 Price of Agricultural Land in the USA

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
AR	1376.23	1378.87	1411.31	1498.42	1529.42	1650.00	1810.91	1928.49	2062.65	2207.67
GA	1838.73	2073.82	2279.81	2178.56	2273.46	2350.00	3098.88	3668.83	4005.60	3922.71
IL	2538.13	2625.37	2746.63	2497.37	2511.13	2610.00	3224.78	3574.75	3701.73	4150.78
IN	2504.29	2592.27	2714.06	2614.27	2655.81	2770.00	3040.78	3414.83	3351.81	3740.26
IA	1996.66	2007.63	2062.68	2040.40	2077.11	2200.00	2566.26	2756.32	3103.19	3603.42
KS	654.27	650.83	662.23	706.70	707.87	715.00	823.14	874.87	902.41	930.50
LA	1364.95	1378.87	1378.74	1530.30	1550.08	1580.00	1714.07	1787.38	1795.61	1870.13
MN	1387.51	1411.96	1476.45	1594.07	1653.42	1800.00	2033.64	2257.74	2486.23	2709.41
MS	1240.86	1301.65	1357.03	1413.41	1446.74	1480.00	1636.60	1740.34	1814.03	1897.50
MO	1274.70	1378.87	1498.16	1466.54	1519.08	1580.00	1733.44	1862.64	1998.20	2098.20
NE	755.80	766.65	792.50	807.66	800.88	825.00	910.30	1025.39	1049.74	1213.30
NC	2538.13	2757.74	3039.74	3081.86	3203.51	3300.00	3815.50	3998.08	3987.18	4059.55
OK	705.04	699.36	727.37	722.64	728.54	745.00	871.56	912.50	994.49	1049.10
TN	2199.71	2371.65	2431.80	2444.23	2480.13	2500.00	2759.94	2888.03	2992.69	3147.29
TX	688.11	694.95	738.22	823.60	837.04	855.00	997.45	1175.91	1270.74	1414.00
WI	1545.44	1875.26	2171.25	2284.83	2376.79	2500.00	2759.94	3010.32	3351.81	3512.20

Farm real estate value including land and buildings as of January 1 in $ per acre in 2005 values

Source:http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1446

http://www.nass.usda.gov/Publications/Ag_Statistics/2010/Chapter09.pdf

Table 2 Price of Cropland in the USA

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
AR	1240.86	1257.53	1281.04	1296.51	1322.74	1440.00	1501.02	1580.42	1629.86	1696.80
GA	1804.89	1963.51	2138.68	2284.83	2314.79	2700.00	3505.61	4035.71	4180.56	3694.65
IL	2650.93	2614.34	2638.06	2656.78	2738.48	3250.00	3524.98	3904.01	4466.01	4260.25
IN	2538.13	2570.21	2648.92	2709.91	2821.15	2980.00	3147.30	3424.24	3812.22	3603.42
IA	2188.43	2184.13	2214.67	2252.95	2387.13	2760.00	3002.04	3386.61	3922.72	3694.65
KS	751.29	742.38	737.14	726.89	710.97	806.00	827.01	859.82	939.24	957.87
LA	1274.70	1279.59	1291.89	1317.76	1322.74	1450.00	1481.65	1589.83	1685.11	1587.33
MN	1443.91	1489.18	1552.44	1615.32	1736.09	1920.00	2062.69	2276.55	2486.23	2381.00
MS	1111.14	1147.22	1194.19	1232.74	1240.07	1370.00	1481.65	1608.64	1666.70	1651.19
MO	1466.47	1522.27	1606.72	1679.08	1715.43	1830.00	1946.49	2191.89	2302.07	2317.14
NE	1274.70	1279.59	1302.75	1285.88	1302.07	1420.00	1510.71	1655.68	1887.70	1988.72
NC	2650.93	2812.89	2985.46	3135.00	3203.51	3350.00	3340.98	3499.50	3545.18	3439.22
OK	676.83	682.82	698.06	709.89	718.21	845.00	860.91	920.97	1022.12	1030.85
TN	2391.48	2426.81	2464.36	2497.37	2469.80	2590.00	2730.89	3010.32	3130.81	2983.09
TX	867.48	887.99	945.58	995.76	992.05	1030.00	1152.40	1279.39	1381.24	1350.14
WI	1804.89	1985.57	2171.25	2337.96	2397.46	2540.00	2808.36	3170.24	3314.98	3329.75

As of January 1, $ per acre in 2005 values

Source: http://quickstats.nass.usda.gov/#C89B03B9-7912-3B71-B4E5-B4CB3643902D

Table 3 Price of pastureland in the USA

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
AR	1150.62	1180.31	1248.47	1285.88	1343.41	1570.00	1685.02	1956.71	2025.82	2006.97
GA	2312.52	2515.06	2714.06	2922.45	3017.50	5500.00	6875.65	7384.69	6860.16	5473.55
IL	1128.06	1114.13	1118.19	1126.47	1126.39	1660.00	1878.70	2210.70	2348.11	2189.42
IN	1579.28	1621.55	1693.57	1764.10	1839.43	1890.00	1936.80	2097.82	2311.28	2216.79
IA	789.64	805.26	825.07	850.17	909.38	1070.00	1355.76	1674.49	1906.11	1715.05
KS	428.66	430.21	434.25	435.71	434.02	500.00	571.36	620.88	690.62	684.19
LA	1376.23	1367.84	1378.74	1392.15	1364.07	1600.00	1636.60	1862.64	1896.90	1915.74
MN	535.83	579.13	624.23	664.19	723.37	920.00	1084.61	1251.16	1362.82	1277.16
MS	1116.78	1158.25	1226.75	1275.25	1291.74	1570.00	1723.75	1984.93	2025.82	1870.13
MO	947.57	1003.82	1063.91	1115.85	1157.40	1310.00	1452.60	1627.45	1657.49	1550.84
NE	259.45	264.74	265.98	270.99	279.01	310.00	338.94	376.29	442.00	410.52
NC	2763.74	2912.17	3072.31	3198.76	3255.17	3880.00	4260.96	4515.48	4484.43	4196.39
OK	468.14	468.82	472.25	478.22	496.03	640.00	735.98	846.65	920.83	921.38
TN	2312.52	2371.65	2442.65	2497.37	2480.13	3150.00	3292.56	3461.87	3572.81	3329.75
TX	637.35	645.31	651.37	658.88	661.37	840.00	997.45	1147.68	1289.16	1240.67
WI	930.65	1047.94	1139.90	2337.96	1240.07	1450.00	1685.02	1881.45	1961.36	1870.13

As of January 1, $ per acre in 2005 values

Source: http://quickstats.nass.usda.gov/#C89B03B9-7912-3B71-B4E5-B4CB3643902D

Table 4 Total profit in the USA

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
AR	142.44	168.97	98.94	201.96	241.19	156.84	125.93	150.35	197.14	104.38
GA	378.22	458.57	327.44	424.21	463.23	468.53	316.89	342.88	445.39	333.76
IL	74.20	69.09	32.30	72.11	169.90	62.49	70.39	108.33	194.37	128.25
IN	74.36	92.67	35.99	99.35	188.28	107.91	91.94	116.03	207.83	164.38
IA	97.40	92.15	78.37	80.50	209.02	144.93	98.75	132.89	214.59	156.60
KS	53.86	62.66	18.29	97.84	95.12	106.72	47.25	61.65	118.17	78.97
LA	101.24	109.72	55.50	151.46	147.60	124.62	108.75	126.46	113.26	105.37
MN	69.01	43.87	35.05	74.66	119.27	136.03	111.45	109.15	211.13	109.05
MS	110.17	232.85	88.09	179.58	275.62	258.36	115.29	154.25	162.05	143.51
MO	49.48	52.79	30.29	62.50	127.13	79.58	66.39	61.96	97.81	73.54
NE	81.04	104.39	46.33	149.60	184.49	149.77	96.88	139.45	186.15	149.33
NC	588.69	598.73	248.02	292.10	469.82	589.60	461.37	383.50	411.22	375.26
OK	75.91	70.94	87.32	89.00	104.13	100.39	54.59	48.86	55.96	6.94
TN	70.87	84.78	32.66	47.24	71.45	98.41	64.28	13.72	52.05	56.33
TX	131.21	170.30	165.27	197.02	221.75	185.30	104.81	129.33	80.04	50.83
WI	81.99	100.46	83.55	142.97	155.12	141.80	108.53	156.54	135.07	55.40

$ per acre in 2005 values

Source: http://www.ers.usda.gov/Data/farmincome/FinfidmuXls.htm

Table 5 Crop profit in the USA

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
AR	208.36	242.73	187.04	348.60	261.49	243.06	244.48	299.08	332.13	268.70
GA	318.62	312.74	320.98	409.58	236.09	304.32	195.61	248.26	314.63	185.34
IL	235.08	221.59	200.82	228.05	236.72	238.68	210.30	288.94	347.21	324.12
IN	306.74	336.55	292.06	296.64	389.46	315.35	346.68	428.05	490.62	490.37
IA	210.50	179.80	196.88	224.44	214.50	236.80	205.94	254.82	338.48	293.31
KS	130.60	114.37	94.32	128.57	96.02	132.29	91.06	122.10	145.94	144.89
LA	272.87	281.16	228.19	375.80	281.52	274.92	280.41	395.72	367.90	311.99
MN	165.06	117.92	129.75	146.93	134.18	149.57	158.32	180.86	264.33	207.08
MS	143.02	326.96	174.46	364.40	252.01	338.34	255.66	317.59	287.84	239.73
MO	146.89	148.89	114.89	161.71	150.87	146.73	97.24	132.01	176.18	150.80
NE	195.25	185.85	162.24	204.14	178.53	203.82	192.43	247.12	304.05	282.43
NC	364.22	326.61	242.99	292.70	276.98	407.96	317.24	301.31	337.87	314.16
OK	119.32	94.03	107.53	116.48	84.07	86.37	62.82	88.24	136.02	67.74
TN	163.92	178.68	144.07	247.64	175.85	248.55	205.48	200.95	211.95	271.37
TX	151.22	201.92	156.03	191.72	173.06	216.21	143.07	211.07	174.19	130.51
WI	205.99	109.46	147.38	170.38	133.12	149.78	183.87	163.30	208.69	181.77

$ per acre in 2005 values

Table 6 Animal Profit in the USA

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
AR	-2.25	-22.33	-35.01	-33.23	-17.79	-15.09	-48.69	-48.46	-65.69	-87.20
GA	14.10	19.55	-40.16	-30.44	-13.02	-51.45	-101.14	-73.89	-70.67	-107.44
IL	-69.46	-83.78	-128.90	-129.70	-181.27	-183.77	-184.36	-139.18	-276.50	-410.69
IN	-35.08	-20.86	-75.69	-50.77	-17.75	-32.58	-60.08	1.50	-46.62	-200.19
IA	335.28	310.08	242.25	364.10	281.87	304.86	286.53	304.37	336.21	98.81
KS	1959.97	1887.45	1779.70	1972.15	1880.70	1910.42	1800.19	1713.97	1644.15	1320.61
LA	29.82	12.31	-17.81	-9.10	0.17	5.91	-24.89	-28.12	-30.55	-37.18
MN	339.91	365.15	218.39	245.67	290.73	257.45	180.82	314.35	279.23	109.26
MS	-20.45	-42.54	-58.24	-63.52	-66.23	-47.49	-98.38	-98.23	-108.58	-115.79
MO	72.24	55.62	37.11	72.33	85.02	84.33	77.47	73.93	55.44	36.91
NE	2503.02	2472.86	2308.46	2747.06	2808.38	2864.69	2828.43	3014.81	2837.76	2338.19
NC	-140.63	-150.36	-260.53	-303.71	-291.77	-279.19	-306.38	-311.68	-341.01	-370.05
OK	274.13	209.19	203.44	250.26	239.35	263.10	254.60	218.56	200.78	169.66
TN	76.42	73.47	36.00	52.46	65.05	57.21	41.59	71.86	50.44	14.47
TX	427.49	410.06	336.74	438.90	444.51	378.13	358.21	376.94	357.03	307.66
WI	1011.65	1161.70	889.74	954.85	1195.38	1097.60	922.65	1316.10	1244.95	807.01

$ per acre in 2005 values

Table 7 Total Revenue in the USA

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
AR	513.16	559.10	463.26	567.52	628.20	553.41	556.33	604.88	694.59	572.32
GA	1107.58	1204.11	1031.65	1145.82	1229.76	1264.00	1200.73	1284.46	1384.83	1180.20
IL	414.25	405.51	342.59	399.25	505.99	408.13	401.31	495.87	647.14	573.11
IN	467.22	491.66	395.69	463.15	570.95	491.53	476.15	577.09	714.91	677.50
IA	540.77	522.78	499.03	516.50	663.27	636.64	554.96	685.73	835.53	762.77
KS	459.90	460.19	389.29	521.19	486.72	511.97	409.05	487.00	540.22	464.13
LA	439.42	464.74	402.96	475.96	489.13	450.39	469.55	549.66	534.49	466.32
MN	467.28	403.88	394.16	420.14	477.55	494.43	466.03	534.53	677.49	555.85
MS	506.53	674.47	521.55	622.44	721.08	719.53	616.44	707.92	720.65	637.02
MO	291.38	292.31	253.93	275.79	338.35	290.83	256.64	277.98	326.63	299.70
NE	586.59	612.64	526.27	670.63	705.60	696.79	650.31	760.93	848.28	770.94
NC	1538.46	1512.83	1264.97	1334.25	1551.08	1595.50	1468.65	1533.97	1662.09	1461.82
OK	358.42	336.83	325.91	356.72	381.98	369.86	340.97	390.80	404.18	317.66
TN	349.52	354.35	320.59	353.10	379.56	387.09	372.04	343.97	396.77	368.41
TX	521.54	601.02	511.08	600.36	630.87	602.50	475.99	626.78	515.45	496.92
WI	623.85	555.09	525.46	551.29	604.73	625.83	572.47	667.67	705.94	605.75

$ per acre in 2005 values

Source: http://www.ers.usda.gov/Data/farmincome/FinfidmuXls.htm

Table 8 Crop revenue in the USA

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
AR	294.59	335.52	280.66	434.78	354.57	341.65	360.26	436.88	483.46	401.15
GA	476.36	469.56	468.55	575.46	425.39	513.88	423.08	498.81	560.33	428.98
IL	336.27	324.46	297.46	328.47	344.70	349.87	315.99	420.15	506.07	487.64
IN	410.75	444.96	388.80	400.44	503.20	427.46	459.74	572.02	656.63	662.99
IA	302.55	270.08	280.76	313.98	307.64	332.96	295.34	371.26	483.14	436.06
KS	178.81	162.92	140.55	178.39	146.61	185.38	137.13	183.14	220.19	208.45
LA	391.90	406.23	355.70	496.29	420.57	400.93	415.69	567.36	544.23	470.16
MN	250.54	191.57	207.21	223.46	217.50	233.61	242.56	285.14	392.08	334.44
MS	247.86	444.17	302.45	488.48	388.36	460.97	388.50	474.00	445.57	390.53
MO	221.89	223.37	183.60	226.72	220.65	222.20	159.15	203.67	257.23	232.62
NE	265.92	258.39	234.98	278.22	253.72	288.57	274.51	351.26	429.84	411.37
NC	511.71	470.27	409.73	451.26	442.03	564.65	480.48	491.88	555.84	504.20
OK	163.47	140.40	148.01	162.43	128.61	129.37	107.14	151.71	219.97	127.18
TN	254.65	264.79	240.04	346.93	275.55	349.48	316.08	327.98	358.96	391.63
TX	223.57	290.94	226.95	267.44	248.56	291.06	205.86	301.03	255.99	210.24
WI	307.94	189.37	227.34	239.53	207.25	232.04	267.80	260.10	325.97	295.06

$ per acre in 2005 values

Source: http://www.ers.usda.gov/Data/farmincome/FinfidmuXls.htm

Table 9 Animal Revenue in the USA

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
AR	112.78	104.35	94.63	100.08	123.22	132.73	105.01	102.25	95.07	81.64
GA	206.12	225.14	177.68	198.00	233.10	206.67	176.03	196.72	189.63	161.51
IL	375.78	395.74	359.94	403.18	374.48	394.18	375.95	462.64	389.15	301.05
IN	330.67	367.07	303.59	336.69	391.98	386.82	356.13	456.35	425.15	316.89
IA	769.08	760.15	718.07	877.63	834.32	905.87	878.26	956.61	1031.90	853.12
KS	2453.13	2395.94	2298.85	2530.57	2425.91	2438.62	2334.06	2265.88	2139.95	1814.20
LA	132.35	125.17	103.46	106.82	119.85	122.46	99.35	100.49	95.41	83.73
MN	657.51	702.51	568.20	602.95	659.37	613.77	527.31	696.05	666.62	516.45
MS	93.04	89.07	82.54	83.82	82.76	108.77	70.56	72.89	59.99	49.98
MO	136.98	123.92	106.67	141.84	155.36	155.06	149.78	149.91	131.24	119.40
NE	3186.33	3197.99	3059.11	3564.62	3662.47	3756.13	3743.17	3944.47	3791.55	3319.90
NC	234.38	241.78	216.59	204.08	235.17	219.59	187.29	203.64	191.30	170.22
OK	338.99	275.06	266.44	322.94	321.04	344.45	337.09	305.23	284.79	257.20
TN	141.21	142.09	116.63	139.53	154.23	139.49	127.28	155.12	132.69	99.37
TX	530.18	519.57	438.30	563.15	573.20	511.33	491.45	523.11	495.43	451.75
WI	1253.27	1422.50	1160.38	1218.83	1494.65	1411.86	1227.91	1621.86	1562.25	1141.38

$ per acre in 2005 values

Source: http://www.ers.usda.gov/Data/farmincome/FinfidmuXls.htm

Table 10 Total Expenses in the USA

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
AR	370.72	390.13	364.31	365.56	387.01	396.57	430.40	454.52	497.45	467.94
GA	729.36	745.54	704.21	721.61	766.52	795.46	883.84	941.58	939.44	846.44
IL	340.05	336.43	310.29	327.14	336.09	345.64	330.92	387.54	452.77	444.86
IN	392.86	398.98	359.69	363.80	382.67	383.62	384.21	461.06	507.08	513.13
IA	443.36	430.62	420.66	436.00	454.26	491.71	456.21	552.84	620.94	606.17
KS	406.03	397.53	371.00	423.35	391.59	405.25	361.81	425.35	422.05	385.16
LA	338.18	355.02	347.46	324.51	341.53	325.76	360.80	423.20	421.23	360.94
MN	398.27	360.01	359.10	345.48	358.28	358.40	354.58	425.38	466.36	446.80
MS	396.36	441.62	433.45	442.86	445.46	461.18	501.14	553.67	558.59	493.51
MO	241.90	239.52	223.65	213.29	211.22	211.25	190.26	216.02	228.82	226.16
NE	505.56	508.25	479.94	521.04	521.11	547.01	553.43	621.48	662.13	621.61
NC	949.77	914.10	1016.95	1042.15	1081.27	1005.90	1007.29	1150.46	1250.88	1086.56
OK	282.51	265.89	238.59	267.72	277.85	269.47	286.38	341.94	348.22	310.71
TN	278.65	269.57	287.93	305.86	308.10	288.68	307.77	330.25	344.72	312.09
TX	390.33	430.72	345.81	403.34	409.12	417.20	371.17	497.46	435.40	446.09
WI	541.87	454.63	441.92	408.32	449.61	484.03	463.94	511.13	570.87	550.35

$ per acre in 2005 values

Source: http://www.ers.usda.gov/Data/farmincome/FinfidmuXls.htm

Table 11 Crop Expenses in the USA

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
AR	86.23	92.79	93.61	86.18	93.09	98.59	115.78	137.80	151.33	132.45
GA	157.73	156.82	147.56	165.87	189.30	209.56	227.47	250.55	245.70	243.64
IL	101.19	102.87	96.65	100.42	107.98	111.19	105.70	131.21	158.86	163.52
IN	104.00	108.40	96.74	103.80	113.74	112.11	113.06	143.97	166.02	172.62
IA	92.05	90.28	83.88	89.54	93.15	96.15	89.40	116.44	144.67	142.75
KS	48.21	48.55	46.24	49.81	50.59	53.09	46.07	61.04	74.25	63.56
LA	119.03	125.06	127.51	120.49	139.05	126.01	135.29	171.63	176.32	158.17
MN	85.48	73.65	77.46	76.53	83.31	84.04	84.24	104.28	127.75	127.36
MS	104.84	117.22	127.99	124.08	136.34	122.63	132.84	156.41	157.73	150.80
MO	75.00	74.48	68.71	65.01	69.78	75.47	61.91	71.66	81.05	81.82
NE	70.67	72.54	72.74	74.08	75.20	84.75	82.08	104.14	125.79	128.95
NC	147.49	143.66	166.74	158.57	165.05	156.68	163.24	190.57	217.97	190.04
OK	44.15	46.37	40.48	45.95	44.54	43.00	44.32	63.47	83.95	59.44
TN	90.73	86.10	95.96	99.29	99.70	100.93	110.60	127.03	147.01	120.26
TX	72.35	89.02	70.92	75.71	75.50	74.85	62.79	89.96	81.80	79.72
WI	101.95	79.90	79.96	69.15	74.13	82.26	83.93	96.80	117.29	113.29

$ per acre in 2005 values

Source: http://www.ers.usda.gov/Data/farmincome/FinfidmuXls.htm

Table 12 Animal Expenses in the USA

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
AR	115.04	126.68	129.64	133.31	141.01	147.82	153.70	150.71	160.76	168.84
GA	192.01	205.59	217.85	228.44	246.12	258.12	277.18	270.60	260.30	268.95
IL	445.24	479.52	488.84	532.88	555.75	577.95	560.31	601.82	665.66	711.74
IN	365.76	387.94	379.28	387.46	409.73	419.40	416.21	454.85	471.77	517.08
IA	433.80	450.07	475.82	513.53	552.46	601.01	591.73	652.23	695.70	754.31
KS	493.16	508.49	519.16	558.42	545.20	528.20	533.87	551.91	495.80	493.59
LA	102.53	112.86	121.26	115.92	119.69	116.55	124.24	128.60	125.95	120.90
MN	317.59	337.36	349.81	357.28	368.63	356.32	346.49	381.70	387.40	407.18
MS	113.49	131.61	140.78	147.34	148.98	156.26	168.95	171.12	168.57	165.77
MO	64.74	68.30	69.56	69.51	70.33	70.73	72.31	75.98	75.80	82.49
NE	683.32	725.13	750.65	817.56	854.08	891.44	914.74	929.66	953.79	981.72
NC	375.01	392.13	477.12	507.80	526.95	498.78	493.67	515.32	532.31	540.27
OK	64.85	65.88	63.00	72.68	81.69	81.35	82.49	86.67	84.01	87.54
TN	64.79	68.62	80.62	87.08	89.18	82.28	85.69	83.26	82.25	84.90
TX	102.68	109.51	101.56	124.25	128.68	133.21	133.24	146.17	138.40	144.09
WI	241.62	260.80	270.64	263.98	299.27	314.26	305.26	305.76	317.31	334.37

$ per acre in 2005 values

Source: http://www.ers.usda.gov/Data/farmincome/FinfidmuXls.htm
http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/Fact_Sheets/beef_cattle.pdf

Table 13 Total Productivity Index in the USA

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
AR	100.00	106.09	111.47	112.61	113.95	112.66	114.94	118.93	118.58	118.20
GA	100.00	105.51	101.44	109.75	108.47	107.72	48.84	109.59	111.92	112.77
IL	100.00	101.30	95.30	99.68	113.24	99.56	105.91	107.58	112.93	110.37
IN	100.00	105.94	91.34	98.92	112.24	106.77	106.95	104.24	106.57	112.18
IA	100.00	97.82	107.55	97.35	110.82	111.38	108.65	110.35	111.35	117.60
KS	100.00	100.60	99.51	105.32	106.25	106.02	103.11	106.19	107.55	121.95
LA	100.00	104.92	106.62	117.53	112.66	114.76	119.01	131.01	116.17	122.73
MN	100.00	96.52	102.25	96.69	101.08	108.34	105.97	103.11	107.74	108.97
MS	100.00	109.09	114.04	125.96	124.74	121.25	118.05	129.38	130.64	128.72
MO	100.00	105.08	95.49	92.87	106.37	96.44	105.05	109.58	109.89	116.48
NE	100.00	105.30	104.16	108.33	112.07	110.85	112.98	114.75	116.61	124.88
NC	100.00	100.80	95.89	97.77	104.63	106.32	105.94	104.40	110.56	114.07
OK	100.00	98.37	99.88	106.20	105.99	106.26	104.41	104.99	107.74	102.10
TN	100.00	106.20	103.67	115.60	115.18	115.67	117.67	97.20	114.60	131.47
TX	100.00	82.08	102.76	99.31	103.66	127.42	111.88	132.61	93.86	109.40
WI	100.00	100.06	98.60	99.13	99.33	103.38	104.00	102.03	99.51	105.25

Year 2000 equals 100

Source: http://www.ers.usda.gov/Data/farmincome/FinfidmuXls.htm
http://usda.mannlib.cornell.edu/MannUsda/viewTaxonomy.do?taxonomyID=29
http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1105
http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1047

Table 14 Crop Productivity Index in the USA

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
AR	100.00	111.49	116.18	125.46	132.30	123.95	125.62	129.59	124.75	123.97
GA	100.00	120.28	97.22	125.79	111.18	123.88	113.15	121.31	126.12	133.47
IL	100.00	101.52	93.15	97.95	116.42	99.52	108.69	109.20	114.96	111.52
IN	100.00	106.26	85.52	92.00	112.67	105.42	107.63	102.21	105.08	111.80
IA	100.00	101.13	112.58	94.24	120.18	120.02	115.37	118.72	114.70	122.75
KS	100.00	111.99	93.69	116.63	126.14	123.56	102.42	111.72	118.70	143.25
LA	100.00	106.94	107.29	121.30	110.85	115.27	119.04	136.57	114.65	124.67
MN	100.00	90.08	103.54	91.70	97.80	111.28	107.91	101.24	106.16	110.46
MS	100.00	122.85	130.07	149.07	153.05	141.10	122.24	153.63	148.08	145.20
MO	100.00	103.85	91.47	89.53	122.49	100.51	106.92	105.65	107.46	116.85
NE	100.00	116.23	100.30	113.05	125.99	124.57	122.02	127.60	126.75	140.43
NC	100.00	102.47	78.76	88.51	104.42	99.36	98.78	88.67	97.37	105.20
OK	100.00	98.78	95.20	114.93	114.20	105.16	76.01	100.06	111.06	90.11
TN	100.00	116.78	107.19	130.16	134.19	131.44	136.15	87.03	120.10	146.91
TX	100.00	105.92	112.02	104.64	131.43	139.87	132.77	151.21	120.55	116.90
WI	100.00	93.16	98.63	90.46	96.73	101.92	105.97	99.75	97.35	106.62

Year 2000 equals 100

Source: http://www.ers.usda.gov/Data/farmincome/FinfidmuXls.htm
http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1047

Table 15 Animal Productivity Index

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
AR	100.000	103.667	108.755	102.186	102.662	105.885	106.837	109.468	112.239	112.649
GA	100.000	101.133	102.738	102.724	107.678	103.044	31.093	105.668	106.566	105.756
IL	100.000	100.672	103.771	106.119	101.994	99.684	95.070	99.213	99.824	102.180
IN	100.000	105.241	107.416	114.989	111.180	109.436	105.203	110.276	111.740	113.669
IA	100.000	95.035	100.990	101.148	101.333	103.716	101.697	99.228	106.039	109.096
KS	100.000	96.358	102.029	100.636	98.632	98.884	103.390	103.036	99.866	105.167
LA	100.000	102.130	105.488	109.690	115.299	114.076	118.971	119.489	119.595	117.900
MN	100.000	101.080	100.808	102.359	103.252	105.529	103.379	105.239	110.459	105.508
MS	100.000	103.951	106.629	107.960	111.311	112.693	115.939	113.999	118.604	118.598
MO	100.000	106.056	99.328	96.227	92.312	93.119	103.530	113.906	113.355	115.930
NE	100.000	99.862	106.479	105.579	104.816	103.984	107.852	104.978	106.520	107.784
NC	100.000	100.141	103.169	101.916	104.701	108.245	108.347	110.007	116.031	118.174
OK	100.000	98.353	100.990	104.619	104.351	106.692	108.968	106.272	106.451	104.820
TN	100.000	99.432	100.793	100.574	102.441	104.383	103.877	104.713	109.589	113.079
TX	100.000	77.130	100.268	97.993	96.310	123.626	105.118	125.436	81.744	107.128
WI	100.000	101.615	98.594	101.956	99.989	103.765	103.239	102.745	100.395	104.579

Year 2000 equals 100

Source: http://www.ers.usda.gov/Data/farmincome/FinfidmuXls.htm
http://usda.mannlib.cornell.edu/MannUsda/viewTaxonomy.do?taxonomyID=29
http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1105

Table 16 Cash Rent for cropland in the USA

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
AR	77.84	73.91	78.16	75.45	77.50	76.00	73.60	69.61	73.21	75.26
GA	56.40	60.67	59.71	59.51	59.94	58.00	58.10	56.44	59.85	69.79
IL	131.98	131.27	134.62	130.71	130.21	129.00	127.83	132.64	150.09	148.70
IN	112.81	110.31	109.65	109.46	110.57	109.00	107.49	112.89	124.31	126.80
IA	129.73	129.06	130.27	129.65	130.21	131.00	128.80	141.11	156.54	159.65
KS	41.17	43.02	42.34	41.45	42.37	42.00	42.61	42.33	43.74	43.79
LA	62.27	68.39	67.31	65.89	68.20	66.00	69.72	64.91	67.22	67.05
MN	87.88	88.80	87.83	87.14	86.29	86.50	85.22	88.43	100.37	103.09
MS	69.94	68.39	65.14	66.95	68.20	69.00	65.85	67.26	74.13	75.26
MO	67.68	71.70	70.57	74.39	78.54	79.00	76.50	74.32	73.67	82.10
NE	99.27	97.07	97.71	97.77	98.17	97.00	97.81	96.89	111.42	116.77
NC	50.76	52.95	55.37	54.20	54.77	53.00	50.36	51.27	52.95	55.65
OK	29.33	29.78	29.31	29.22	31.00	29.00	27.12	25.40	25.78	25.54
TN	67.68	65.63	65.68	65.89	69.24	67.00	65.85	63.03	63.08	66.59
TX	30.46	29.78	29.31	29.01	30.79	29.70	27.12	27.28	29.01	31.47
WI	73.32	72.80	71.65	72.26	72.34	70.00	68.76	67.73	78.27	79.37

$ per acre in 2005 values

Source: http://www.nass.usda.gov/Publications/Ag_Statistics/2010/Chapter09.pdf
http://www.nass.usda.gov/Publications/Ag_Statistics/

Table 17 Cash Rent for Pastureland in the USA

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
AR	15.57	17.10	17.59	17.00	17.15	17.00	16.95	18.81	19.80	15.96
GA	24.82	25.37	24.97	24.44	24.80	22.00	24.21	23.52	24.86	22.81
IL	37.23	36.40	32.57	34.54	35.14	34.50	32.93	29.16	34.07	31.93
IN	27.64	29.23	29.31	28.69	29.97	30.50	30.02	29.16	29.47	28.28
IA	32.71	33.09	32.24	32.94	33.59	36.00	36.80	36.69	38.67	39.23
KS	14.44	13.90	13.68	13.39	13.64	13.40	13.27	13.64	14.27	14.14
LA	15.79	17.65	17.37	15.94	16.02	16.50	18.40	21.64	24.86	14.60
MN	19.74	20.96	20.63	20.19	20.15	20.50	18.40	17.87	19.34	20.53
MS	15.79	17.65	19.54	17.00	17.05	16.50	15.49	16.93	17.04	14.60
MO	22.56	24.82	25.62	24.97	26.87	27.00	25.18	24.46	23.94	22.81
NE	12.75	12.46	11.62	12.22	12.40	12.00	12.11	13.17	14.27	14.60
NC	23.69	24.27	23.34	23.38	23.77	25.00	24.21	25.40	26.70	21.89
OK	8.80	9.16	9.23	9.03	9.30	9.00	8.23	8.94	9.67	9.58
TN	20.31	19.86	17.91	18.60	19.63	18.00	19.37	18.81	20.26	18.25
TX	6.77	7.94	7.82	8.29	8.06	8.30	7.84	5.83	5.99	5.66
WI	42.87	39.71	41.25	38.26	38.24	38.00	36.80	35.75	33.15	32.84

$ per acre in 2005 values

Source: http://www.nass.usda.gov/Publications/Ag_Statistics/2010/Chapter09.pdf
http://www.nass.usda.gov/Publications/Ag_Statistics/

Table 18 Total Output Price Index in the USA

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
AR	100.00	105.28	96.27	119.02	126.31	125.85	126.48	160.65	183.50	173.57
GA	100.00	108.10	91.01	103.50	120.97	119.45	106.07	130.28	134.57	131.01
IL	100.00	103.81	116.65	132.73	117.73	117.06	147.08	208.23	197.46	186.21
IN	100.00	104.76	114.28	128.69	118.96	117.99	141.19	200.22	189.87	179.51
IA	100.00	104.28	107.68	120.50	116.93	119.09	135.33	177.55	171.10	161.14
KS	100.00	103.78	103.16	107.84	116.45	126.67	134.38	156.98	156.91	141.25
LA	100.00	102.61	102.13	120.21	120.11	120.41	126.13	160.69	183.29	168.73
MN	100.00	107.27	108.83	120.45	119.04	120.02	134.72	180.34	178.32	163.44
MS	100.00	105.95	96.12	116.61	124.43	123.57	115.53	152.48	165.00	159.61
MO	100.00	104.39	104.71	118.97	118.51	122.21	131.13	169.65	169.97	161.89
NE	100.00	103.49	103.52	112.14	115.11	123.87	136.07	161.53	158.39	150.32
NC	100.00	106.08	92.22	103.40	119.16	119.54	111.20	131.11	136.17	129.00
OK	100.00	105.66	97.12	101.61	118.13	126.17	124.73	136.71	146.48	121.58
TN	100.00	105.75	101.52	115.61	118.72	118.90	121.27	145.91	156.94	152.17
TX	100.00	103.19	95.12	102.50	114.73	122.53	121.36	133.82	134.61	120.30
WI	100.00	116.34	104.10	107.36	123.76	122.22	122.37	163.66	160.58	132.15

Year 2000 equals 100

Source: http://quickstats.nass.usda.gov/
http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1003
http://usda.mannlib.cornell.edu/MannUsda/viewTaxonomy.do?taxonomyID=29
http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1105
http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1047

Table 19 Crop Output Price Index in the USA

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
AR	100.00	85.45	105.86	140.41	121.58	120.07	145.97	198.49	234.19	218.94
GA	100.00	83.95	90.02	107.19	89.53	86.25	92.58	130.79	134.64	131.28
IL	100.00	102.80	124.03	143.26	117.59	115.38	155.35	225.26	209.97	198.32
IN	100.00	102.64	123.63	143.68	118.19	116.11	152.89	224.52	208.96	199.32
IA	100.00	102.87	123.68	142.64	116.71	115.03	154.81	223.63	207.79	198.38
KS	100.00	106.16	128.04	132.12	119.21	121.43	155.43	227.88	226.74	192.34
LA	100.00	95.08	107.94	129.38	115.18	113.94	134.32	176.48	207.20	187.07
MN	100.00	103.61	124.09	142.09	117.51	117.07	153.43	221.21	209.86	196.25
MS	100.00	81.39	107.14	135.43	111.38	110.19	126.78	190.05	209.82	204.03
MO	100.00	99.77	119.90	140.62	116.61	116.75	147.22	214.71	206.77	199.19
NE	100.00	104.87	123.46	137.77	115.28	114.60	154.53	222.76	209.66	195.36
NC	100.00	94.18	105.35	120.34	105.22	101.19	116.83	155.89	163.54	152.16
OK	100.00	104.42	122.74	120.47	117.18	118.33	143.73	213.49	231.38	178.11
TN	100.00	96.96	112.25	130.90	111.41	105.91	127.26	173.45	192.89	182.31
TX	100.00	91.86	103.52	117.57	100.97	101.40	116.69	164.57	173.69	163.57
WI	100.00	111.57	125.29	129.31	111.13	116.10	154.62	214.08	206.94	191.08

Year 2000 equals 100

Source: http://quickstats.nass.usda.gov/

http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1003

http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1047

Table 20 Animal Output Price Index in the USA

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
AR	100.00	104.54	93.30	98.37	115.71	129.34	126.46	117.45	108.73	101.12
GA	100.00	109.55	95.03	99.23	120.26	127.01	118.68	133.83	126.61	102.30
IL	100.00	108.95	94.48	98.98	120.34	127.37	120.45	128.16	122.48	102.10
IN	100.00	114.60	96.09	100.04	125.30	124.84	113.56	142.99	136.58	103.17
IA	100.00	106.41	93.80	98.62	118.00	128.34	123.75	124.22	115.07	101.59
KS	100.00	102.80	92.95	98.21	115.31	129.43	126.83	116.95	108.69	101.16
LA	100.00	108.86	94.46	98.92	118.70	128.18	122.72	125.02	116.61	101.51
MN	100.00	113.18	95.71	99.69	123.46	125.77	115.48	139.06	131.68	102.78
MS	100.00	107.51	94.04	98.73	118.16	128.58	123.02	124.99	118.07	101.63
MO	100.00	106.49	93.93	98.59	117.29	128.57	124.54	121.87	114.04	101.42
NE	100.00	102.55	92.85	98.15	114.84	129.63	127.38	115.51	106.97	101.04
NC	100.00	110.84	94.95	99.31	120.65	126.91	118.94	133.36	126.83	102.23
OK	100.00	103.87	93.16	98.30	115.73	129.30	126.46	117.93	109.27	101.17
TN	100.00	108.60	94.53	98.86	118.56	127.94	122.57	124.35	117.09	101.73
TX	100.00	103.97	93.27	98.34	116.12	128.95	125.21	120.89	113.44	101.44
WI	100.00	117.83	97.17	100.58	127.25	123.97	109.86	148.56	142.25	103.67

Year 2000 equals 100

Source: http://quickstats.nass.usda.gov/

http://usda.mannlib.cornell.edu/MannUsda/viewTaxonomy.do?taxonomyID=29

http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1105

http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1003

Table 21 Input Price Index in the USA

Sector	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Farm	107	113	113	118	129	132	137	152	180	180
Crop	121	125	126	131	137	146	155	166	193	188
Animal	110	111	102	109	128	138	134	131	124	115

Year 1992 equals 100
Source: http://quickstats.nass.usda.gov/
http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1003

Table 22 Price of Agricultural Land in Slovakia

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
DS	3446.90	3175.86	5806.41	4510.19	6182.14	8383.19	7819.30	12963.87	22784.18	13755.74
TO	2396.92	2701.09	1019.09	4068.81	6528.38	1673.11	1812.35	2583.05	751.12	5117.41
LM	536.06	3798.44	2417.02	6428.38	14773.55	10106.89	9539.71	33165.71	35595.99	11343.54
RS	948.34	258.76	1765.84	2844.01	2050.36	985.04	874.13	864.88	1172.65	1100.95
SK	670.24	2460.61	910.60	2504.17	783.92	2333.34	3543.93	612.98	3679.21	839.31
MI	1206.38	2350.29	1482.64	1632.53	3610.99	2198.69	3645.01	15582.51	7187.75	11276.80

As of May 20, Euro per hectare in 2005 values
Source: Buday S., 2010

Table 23 Price of Arable Land in Slovakia

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
DS	3506.65	7555.21	7118.69	4499.88	6326.32	8790.21	8029.63	13189.72	23727.74	13822.85
TO	2468.39	3318.77	846.80	4122.90	6568.91	1589.74	1780.41	2537.30	7576.76	5309.04
LM	798.63	8978.42	12511.66	7701.58	16820.67	10435.10	12908.65	36461.04	39634.63	18836.69
RS	1298.49	334.24	2935.47	3648.78	2498.21	1140.43	970.70	892.68	1170.83	1041.13
SK	969.97	2899.14	1068.66	2743.29	6567.82	3622.26	3602.39	470.43	5907.37	4284.18
MI	1407.50	2376.57	1392.07	3733.39	4122.35	5725.95	6346.92	18768.38	8725.44	18138.99

As of May 20, Euro per hectare in 2005 values
Source: Buday S., 2010

Table 24 Price of Grassland in Slovakia

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
DS	2030.75	459.38	14685.86	6217.85	3446.96	3182.93	7096.03	4593.47	14476.57	2886.63
TO	872.95	1476.86	1763.98	2651.50	6177.92	2061.95	2130.56	3869.61	6872.93	2711.83
LM	432.42	2771.66	1397.47	3221.14	13326.40	9567.41	5105.34	23800.25	27683.82	5620.86
RS	520.72	130.99	1328.97	1110.05	1441.11	838.38	690.87	750.43	1188.87	1213.66
SK	470.69	1900.86	813.76	2211.13	491.44	1188.47	1003.55	1801.17	2340.38	344.66
MI	679.16	2975.65	1476.04	1630.71	907.00	692.68	921.50	4117.76	3032.03	1186.30

As of May 20, Euro per hectare in 2005 values
Source: Buday S., 2010

Table 25 Total Profit in Slovakia

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
DS	-86.36	-34.96	-17.16	-103.46	44.64	6.79	50.37	-44.59	54.77	-144.95
TO	-36.04	24.34	22.99	-51.46	41.73	37.81	-3.56	56.99	65.25	-67.69
LM	32.97	-10.44	6.32	-42.47	9.06	6.94	19.08	35.48	6.73	-30.99
RS	-32.85	-54.86	44.65	-32.46	40.71	35.60	16.53	58.92	63.36	-10.23
SK	-29.27	7.61	6.16	-12.26	9.35	8.74	26.12	44.48	29.06	614.11
MI	-16.35	-10.02	-58.53	-18.05	45.17	-5.44	-1.56	42.59	3.20	-44.01

Euro per hectare in 2005 values
Source: http://px-web.statistics.sk/PXWebSlovak/

Table 26 Crop Profit in Slovakia

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
DS	255.24	372.47	384.96	213.41	228.12	14.44	-167.42	-261.69	5.14	-379.22
TO	184.17	330.71	465.47	364.32	70.64	-145.43	73.27	138.73	380.85	-294.18
LM	1482.75	1005.52	938.51	598.68	487.51	370.74	294.82	103.82	128.32	-120.28
RS	360.37	531.93	507.70	234.22	601.14	259.96	-82.02	18.63	312.61	-150.78
SK	188.61	259.98	326.85	256.24	60.83	-90.62	-156.79	23.95	-110.52	-168.13
MI	0.15	213.81	356.92	208.55	259.81	-33.03	-164.60	138.89	101.08	-159.80

Euro per hectare in 2005 values

Table 27 Animal Profit in Slovakia

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
DS	-2048.41	-2399.44	-1541.13	-1978.40	-850.64	-1489.21	-664.14	-795.10	-161.98	-1185.48
TO	-1204.32	-1386.09	-1654.35	-763.14	-472.03	-760.36	-788.74	-787.58	-721.71	-777.23
LM	31.11	28.97	73.31	20.67	45.38	43.22	83.64	79.32	70.26	24.35
RS	13.58	-15.05	36.95	16.93	9.26	21.71	20.70	28.86	25.98	10.70
SK	-7.42	8.00	14.18	2.00	7.75	9.81	16.99	13.58	11.97	-27.05
MI	-44.25	-55.72	-3.46	-10.25	5.04	-9.84	11.88	-1.23	-27.14	-26.33

Euro per hectare in 2005 values

Table 28 Total Revenue in Slovakia

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
DS	2079.31	1997.74	2004.19	2178.89	2200.30	2027.17	2283.13	1944.20	1957.45	1545.28
TO	2307.62	2441.40	2220.27	2237.38	2443.65	2214.34	1726.68	1590.91	1534.60	1720.18
LM	1210.01	1140.63	999.46	1008.95	944.63	726.27	808.11	855.46	864.43	615.26
RS	921.96	1006.57	1188.29	1181.16	1022.78	987.46	1157.32	1085.51	879.50	770.36
SK	348.83	370.40	320.15	308.40	338.96	371.22	398.19	370.47	346.32	903.77
MI	693.66	886.03	857.76	675.29	714.15	810.19	930.92	622.38	631.97	625.03

Euro per hectare in 2005 values

Source: http://px-web.statistics.sk/PXWebSlovak/

Table 29 Crop Revenue in Slovakia

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
DS	975.70	1077.10	1013.62	1084.86	1104.30	926.06	793.86	636.19	929.53	450.09
TO	1137.62	1357.91	1347.50	1245.72	1287.44	1022.25	964.27	991.32	1206.93	729.86
LM	2124.86	1779.78	1685.08	1532.25	1224.59	959.89	856.07	978.50	1095.55	643.00
RS	1022.86	1118.40	1055.41	1001.16	1176.84	822.98	690.67	771.77	1020.31	536.21
SK	442.46	554.72	612.75	631.02	396.15	274.78	225.30	421.93	345.36	252.60
MI	470.53	687.27	796.56	687.22	698.74	504.38	443.41	579.89	607.73	398.12

Euro per hectare in 2005 values

Source: http://px-web.statistics.sk/PXWebSlovak/

Table 29 Animal Revenue in Slovakia

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
DS	12914.47	11866.82	11745.56	11320.69	10178.48	9562.49	8218.21	7286.28	6850.21	4719.81
TO	6065.29	6287.54	6733.57	6265.82	5692.68	5283.78	4913.11	4704.25	4628.28	3017.27
LM	501.09	492.51	499.78	457.83	362.45	340.48	301.78	281.27	265.24	168.17
RS	326.85	309.22	303.33	287.26	246.02	216.41	172.46	160.58	152.91	102.27
SK	157.64	134.42	116.12	129.70	95.93	82.35	68.66	68.43	61.13	55.25
MI	384.48	347.44	314.05	336.90	205.42	203.06	181.92	171.35	150.47	117.63

Euro per hectare in 2005 values

Source: http://www.agroporadenstvo.sk/zv/hd/chovhd10.htm?start
http://px-web.statistics.sk/PXWebSlovak/

Table 30 Total Expenses in Slovakia

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
DS	2165.67	2032.70	2021.35	2282.38	2155.68	2020.39	2232.77	1988.79	1902.68	1690.22
TO	2343.67	2417.06	2197.28	2288.84	2401.92	2176.52	1730.25	1533.92	1469.36	1787.87
LM	1177.05	1151.07	993.13	1051.43	935.56	719.36	789.03	819.98	857.69	646.25
RS	954.32	1061.43	1143.64	1213.62	982.07	951.89	1140.78	1026.59	816.14	780.59
SK	378.06	362.75	313.99	320.65	329.61	362.50	372.08	325.99	317.26	289.66
MI	709.62	896.08	916.32	693.34	669.01	815.63	932.48	579.79	628.77	669.04

Euro per hectare in 2005 values

Source: http://px-web.statistics.sk/PXWebSlovak/

Table 31 Crop Expenses in Slovakia

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
DS	720.46	704.63	628.66	871.45	876.18	911.62	961.28	897.89	924.39	829.30
TO	953.45	1027.19	882.03	881.40	1216.80	1167.68	891.00	852.60	826.08	1024.04
LM	642.11	774.26	746.57	933.57	737.08	589.15	561.24	874.67	967.22	763.28
RS	662.49	586.47	547.70	766.94	575.69	563.02	772.69	753.13	707.71	686.99
SK	253.85	294.74	285.90	374.78	335.32	365.40	382.10	397.98	455.88	420.73
MI	470.38	473.47	439.65	478.67	438.93	537.41	608.01	441.01	506.65	557.92

Euro per hectare in 2005 values

Source: http://px-web.statistics.sk/PXWebSlovak/

Table 32 Animal Expenses in Slovakia

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
DS	14962.88	14266.25	13286.69	13299.09	11029.13	11051.70	8882.36	8081.39	7012.19	5905.28
TO	7269.61	7673.64	8387.92	7028.96	6164.71	6044.14	5701.85	5491.83	5350.00	3794.50
LM	469.98	463.54	426.47	437.16	317.07	297.26	218.14	201.95	194.98	143.82
RS	313.26	324.27	266.38	270.33	236.76	194.70	151.76	131.72	126.92	91.57
SK	165.07	126.42	101.94	127.69	88.18	72.54	51.68	54.85	49.17	82.30
MI	428.73	403.17	317.52	347.15	200.38	212.90	170.03	172.58	177.61	143.96

Euro per hectare in 2005 values

Source: http://www.agroporadenstvo.sk/zv/hd/chovhd10.htm?start
http://px-web.statistics.sk/PXWebSlovak/

Table 33 Total Productivity Index in Slovakia

Total Productivity Index in Slovakia

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
DS	100.00	122.77	124.20	116.54	135.17	136.20	129.83	111.14	156.33	136.03
TO	100.00	131.26	130.65	115.43	154.78	142.17	138.25	133.49	156.84	147.17
LM	100.00	96.77	111.93	110.70	116.71	113.44	122.86	130.64	139.36	131.13
RS	100.00	137.82	130.97	120.35	173.71	169.07	144.90	137.90	203.88	173.90
SK	100.00	134.98	149.72	126.67	151.89	155.48	154.69	220.98	179.01	195.71
MI	100.00	117.02	126.26	115.12	138.67	127.74	130.21	143.85	150.29	138.26

Year 2000 equals 100

Source: http://px-web.statistics.sk/PXWebSlovak/
http://www.vuepp.sk/regionalna_alokacia.pdf
http://portal.statistics.sk/files/Sekcie/sek_500/polnohospodarstvo/publikacie-stiahnutie/stavy-zvierat/supis-zvierat-2008.pdf
http://portal.statistics.sk/files/Sekcie/sek_500/polnohospodarstvo/publikacie-stiahnutie/stavy-zvierat/supis-zvierat-2009.pdf

Table 34 Crop Productivity Index in Slovakia

Crop Productivity Index in Slovakia

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
DS	100.00	130.24	130.20	119.60	144.56	144.87	132.97	103.67	165.26	141.97
TO	100.00	138.77	136.43	116.17	166.00	149.66	142.80	134.70	163.28	152.71
LM	100.00	88.93	111.39	107.59	118.58	103.52	112.02	124.63	140.66	127.49
RS	100.00	147.99	136.59	123.14	187.59	183.44	150.71	139.82	215.06	184.01
SK	100.00	136.54	151.54	127.53	153.51	157.26	156.24	224.70	180.57	199.40
MI	100.00	142.17	164.95	125.55	188.46	146.98	144.45	164.37	185.99	167.86

Year 2000 equals 100

Source: http://px-web.statistics.sk/PXWebSlovak/
http://www.vuepp.sk/regionalna_alokacia.pdf

Table 35 Animal Productivity Index in Slovakia

Animal Productivity Index in Slovakia

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
DS	100.00	106.73	112.81	111.49	112.67	118.15	124.57	128.61	127.98	124.91
TO	100.00	107.37	114.39	114.44	117.82	121.05	126.59	130.98	130.15	127.95
LM	100.00	106.49	112.86	114.95	114.72	123.64	134.13	138.47	137.69	136.42
RS	100.00	109.08	116.86	116.92	114.82	120.99	124.92	131.72	128.72	125.21
SK	100.00	107.06	113.87	114.23	110.02	118.83	119.85	121.58	116.75	110.17
MI	100.00	105.22	106.70	112.48	115.91	124.39	129.78	133.94	131.57	124.84

Year 2000 equals 100

Source: http://px-web.statistics.sk/PXWebSlovak/
http://www.vuepp.sk/regionalna_alokacia.pdf
http://portal.statistics.sk/files/Sekcie/sek_500/polnohospodarstvo/publikacie-stiahnutie/stavy-zvierat/supis-zvierat-2008.pdf
http://portal.statistics.sk/files/Sekcie/sek_500/polnohospodarstvo/publikacie-stiahnutie/stavy-zvierat/supis-zvierat-2009.pdf

Appendix B

Examples of Tests in the Case of USA Crop Model

Price of cropland land = f (profit, productivity index, interest rate)

Table 1 White Test of Heteroskedasticity

Test of First and Second Moments Specification		
DF	Chi-Square	Pr>ChiSq
70	68.71	0.5213

Table 2 Durbin Watson Test for Autocorrelation

Durbin-Watson Stat.	.7378838
Rho = cor[e,e(-1)]	.6310581

Table 3 Test for Multicollinearity

Collinearity Diagnostics (intercept adjusted)

			Proportion of Variation						
Number	**Eigenvalue**	**Condit. Indx.**	**lnprofit**	**lnprod**	**lninterest**	**GA**	**IL**	**IN**	**IA**
1	2.1069	1.0000	0.0283	0.0345	0.0159	0.0070	0.0001	0.0037	0.0005
2	1.6259	1.1384	0.0107	0.0680	0.0123	0.0005	0.0070	0.0283	0.0001
3	1.0667	1.4054	0.0000	0.0000	0.0000	0.0041	0.0027	0.0033	0.4473
4	1.0667	1.4054	0.0000	0.0000	0.0000	0.0043	0.4099	0.0113	0.0000
5	1.0667	1.4054	0.0000	0.0000	0.0000	0.0056	0.0000	0.0004	0.0000
6	1.0667	1.4054	0.0000	0.0000	0.0000	0.0062	0.0000	0.0001	0.0000
7	1.0667	1.4054	0.0000	0.0000	0.0000	0.0002	0.0000	0.0023	0.0000
8	1.0667	1.4054	0.0000	0.0000	0.0000	0.3937	0.0000	0.0128	0.0000
9	1.0667	1.4054	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006	0.0000
10	1.0667	1.4054	0.0000	0.0000	0.0000	0.0000	0.0000	0.0249	0.0000
11	1.0667	1.4054	0.0000	0.0000	0.0000	0.0000	0.0000	0.0095	0.0000
12	1.0667	1.4054	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0000
13	1.0667	1.4054	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0000
14	1.0667	1.4054	0.0000	0.0000	0.0000	0.0000	0.0000	0.1985	0.0000
15	1.0109	1.4437	0.0000	0.0004	0.6642	0.0037	0.0005	0.0004	0.0002
16	0.3046	2.6301	0.0103	0.5718	0.2542	0.0490	0.0004	0.0005	0.0088
17	0.0975	4.6493	0.7059	0.3233	0.0074	0.2449	0.1896	0.5531	0.0917
18	0.0542	6.2356	0.2448	0.0020	0.0460	0.2807	0.3899	0.1482	0.4515

Collinearity Diagnostics (intercept adjusted)

	Proportion of Variation								
Number	**KS**	**LA**	**MN**	**MS**	**MO**	**NE**	**NC**	**OK**	**TN**
1	0.0059	0.0077	0.0053	0.0161	0.0067	0.0007	0.0004	0.0148	0.0003
2	0.0113	0.0014	0.0007	0.0256	0.0001	0.0046	0.0422	0.0027	0.0060
3	0.0005	0.0041	0.0010	0.0044	0.0008	0.0026	0.0026	0.0002	0.0024
4	0.0000	0.0049	0.0027	0.0001	0.0013	0.0010	0.0133	0.0002	0.0007
5	0.0028	0.0051	0.0005	0.0194	0.0008	0.4202	0.0000	0.0004	0.0068
6	0.0047	0.0055	0.0008	0.0245	0.0014	0.0000	0.0002	0.0011	0.4015
7	0.0055	0.0002	0.3311	0.0018	0.0098	0.0000	0.0060	0.0114	0.0000
8	0.0001	0.0208	0.0000	0.0313	0.0001	0.0000	0.0065	0.0010	0.0000
9	0.0133	0.0001	0.0000	0.0007	0.2921	0.0000	0.0030	0.0216	0.0000
10	0.0000	0.3601	0.0000	0.0473	0.0000	0.0000	0.0140	0.0021	0.0000
11	0.0121	0.0000	0.0000	0.0083	0.0000	0.0000	0.0228	0.0289	0.0000
12	0.0187	0.0000	0.0000	0.0935	0.0000	0.0000	0.0003	0.0047	0.0000
13	0.1723	0.0000	0.0000	0.0290	0.0000	0.0000	0.0005	0.0925	0.0000
14	0.0000	0.0000	0.0000	0.0114	0.0000	0.0000	0.1581	0.0021	0.0000
15	0.0002	0.0034	0.0045	0.0296	0.0034	0.0028	0.0046	0.0054	0.0024
16	0.0000	0.0448	0.0209	0.3009	0.0142	0.0419	0.0262	0.0278	0.0380
17	0.0803	0.2892	0.0032	0.0371	0.0038	0.0174	0.5111	0.0874	0.0066
18	0.6724	0.2528	0.6294	0.3190	0.6656	0.5089	0.1882	0.6959	0.5353

Table 4 Hypothesis Tests that all State Intercepts are equal in the USA Crop Model

	Likelihood Ratio test			F Tests			
	Chi-squared	d.f.	Prob.	F	num.	denom.	P value
(4)vs(3)	292.868	15	0.0000	55.36	15	125	0.0000

Likelihood Ratio and F tests are performed where the model is restricted to the three continuous independent variable plus intercept which result in χ^2=292.89, p=0.0000; F=55.36, p=0.0000;

Examples of Tests in the Case of SK Crop Model

Price of arable land = f (profit, productivity index, interest rate)

Table 5 White Test of Heteroskedasticity

Test of First and Second Moments Specification		
DF	Chi-Square	Pr>ChiSq
29	37.79	0.2114

Table 6 Autocorrelation

Durbin-Watson Stat.	2.3699613
Rho = cor[e,e(-1)]	-.1849807

Table 7 Test for Multicollinearity

Collinearity Diagnostics (intercept adjusted)

			Proportion of Variation							
Number	**Eigenvalue**	**Condit.Indx.**	**lnprofit**	**lnprod**	**lninterest**	**TO**	**LM**	**RS**	**SK**	**MI**
1	1.9433	1.0000	0.0535	0.0759	0.0333	0.0001	0.0516	0.0056	0.0035	0.0234
2	1.3623	1.1943	0.1066	0.0192	0.0384	0.0013	0.0016	0.1357	0.0160	0.1020
3	1.2212	1.2615	0.0002	0.0001	0.0298	0.2967	0.0000	0.0754	0.0381	0.0077
4	1.1993	1.2730	0.0017	0.0013	0.0793	0.0436	0.0825	0.0037	0.1449	0.0759
5	1.1330	1.3097	0.0000	0.0072	0.0887	0.0164	0.0380	0.0700	0.2088	0.0472
6	0.7504	1.6093	0.6605	0.0466	0.0075	0.0007	0.0046	0.0413	0.0135	0.1345
7	0.2158	3.0011	0.0699	0.7523	0.5873	0.0511	0.0608	0.1975	0.2058	0.2951
8	0.1747	3.3351	0.1076	0.0974	0.1357	0.5901	0.7609	0.4709	0.3695	0.3143

Table 8 Hypothesis Tests that all the State Intercepts are equal in the SK Crop Model

Likelihood Ratio test			F test			
Chi-squared	d.f	Prob.	F	num	denom	P value
42.631	5	0.0000	10.82	5	45	0.0000

Likelihood Ratio and F tests are performed where the model is restricted to the three continuous independent variables plus intercept which results in χ^2=42.631, p=0.0000; F=10.82, p=0.0000;

Table 9 Summary Statistics for Different Proxies of Profitability in USA Models

Variable	Mean	Median	SD	Min	Max
Total					
Output Price Index	113.18	114.14	13.53	92.85	148.56
Input Price Index	129.66	120.79	18.41	92.22	163.66
Crop					
Cash Rent ($/Ac)	226	185	76	63	408
Output Price Index	144.12	123.10	38.77	91.86	231.38
Input Price Index	151.89	146.00	24.47	125.00	193.00
Animal					
Cash Rent ($/Ac)	21	16	10	6	41
Output Price Index	113.18	114.14	13.53	92.85	148.56
Input Price Index	120.78	124.00	12.32	102.00	138.00

Output Price Index – the value is equal to 100 in the year 2000
Input Price Index- the value is equal to 100 in the year 1992

Models with Different Proxy for Profitability

Price of cropland = f (cash rent, productivity index, interest rate)

Table 10 USA Crop Model

Ordinary least squares regression

Standard deviation	0.4894
Number of observations	144
Degrees of freedom	125
Residuals Sum of squares	2.6539
Standard error	0.1457
R-squared	0.9224
Adjusted R-squared	0.9111
Model test F [18, 125] (prob)	82.60(.0000)

Variable	Coefficient	Standard Error	t-ratio	P[|T|>t]	Mean of X
LAGRENT	0.0154	0.0740	0.2070	0.8360	5.3248
LAGPROD	0.4526	0.1462	3.0960	0.0024	4.6987
LAGINTER	-0.4114	0.1003	-4.1000	0.0001	1.4867
AR	5.6270	0.7435	7.5680	0.0000	0.0625
GA	6.3380	0.7402	8.5630	0.0000	0.0625
IL	6.5160	0.7256	8.9800	0.0000	0.0625
IN	6.4536	0.7301	8.8400	0.0000	0.0625
IA	6.3365	0.7308	8.6700	0.0000	0.0625
KS	5.1000	0.7214	7.0700	0.0000	0.0625
LA	5.6502	0.7402	7.6330	0.0000	0.0625
MN	6.0030	0.7141	8.4060	0.0000	0.0625
MS	5.5415	0.7564	7.3260	0.0000	0.0625
MO	5.9782	0.7145	8.3670	0.0000	0.0625
NE	5.6842	0.7359	7.7240	0.0000	0.0625
NC	6.5477	0.7205	9.0880	0.0000	0.0625
OK	5.1640	0.7076	7.2980	0.0000	0.0625
TN	6.2720	0.7351	8.5330	0.0000	0.0625
TX	5.3641	0.7376	7.2730	0.0000	0.0625
WI	6.3326	0.7113	8.9030	0.0000	0.0625

Price of pastureland = f (cash rent, productivity index, interest rate)

Table 11 USA Animal Model

Ordinary least squares regression

Standard deviation	0.7145
Number of observations	144
Degrees of freedom	125
Residuals Sum of squares	7.0083
Standard error	0.2367
R-squared	0.9040
Adjusted R-squared	0.8901
Model test F [18, 125] (prob)	65.40(.0000)

Variable	Coefficient	Standard Error	t-ratio	P[|T|>t]	Mean of X
LAGRENT	-0.2971	0.2880	-1.0320	0.3042	2.9724
LAGPROD	0.5481	0.3409	1.6080	0.1104	4.6139
LAGINTER	-0.8001	0.1477	-5.4190	0.0000	1.4867
AR	6.8765	1.8858	3.6460	0.0004	0.0625
GA	7.9898	1.9555	4.0860	0.0001	0.0625
IL	7.0408	2.0195	3.4860	0.0007	0.0625
IN	7.1817	2.0039	3.5840	0.0005	0.0625
IA	6.7954	2.0021	3.3940	0.0009	0.0625
KS	5.7029	1.8569	3.0710	0.0026	0.0625
LA	6.8783	1.9067	3.6070	0.0004	0.0625
MN	6.3468	1.9149	3.3140	0.0012	0.0625
MS	6.9043	1.8551	3.7220	0.0003	0.0625
MO	6.8033	1.9480	3.4920	0.0007	0.0625
NE	5.1646	1.8589	2.7780	0.0063	0.0625
NC	7.8144	1.9569	3.9930	0.0001	0.0625
OK	5.7731	1.7991	3.2090	0.0017	0.0625
TN	7.5132	1.9126	3.9280	0.0001	0.0625
TX	6.0330	1.7643	3.4200	0.0008	0.0625
WI	7.1005	2.0289	3.5000	0.0006	0.0625

Price of agricultural land = f (output price index, input price index, productivity index, interest rate)

Table 12 USA Total Model

Ordinary least squares regression

Standard deviation	0.5165
Number of observations	144
Degrees of freedom	124
Residuals Sum of squares	1.0763
Standard error	0.0932
R-squared	0.9717
Adjusted R-squared	0.9674
Model test F [18, 125] (pro	224.83(.0000)

Variable	Coefficient	Standard Error	t-ratio	P[|T|>t]	Mean of X
LAGOUT	0.4126	0.0921	4.4810	0.0000	4.7204
LAGINP	0.5931	0.0672	8.8200	0.0000	4.8014
LAGPROD	-0.1866	0.0987	-1.8910	0.0609	4.6612
LAGINTER	-0.1417	0.0692	-2.0490	0.0426	1.4867
AR	3.7286	0.5400	6.9050	0.0000	0.0625
GA	4.2446	0.5312	7.9910	0.0000	0.0625
IL	4.2380	0.5359	7.9080	0.0000	0.0625
IN	4.2161	0.5365	7.8590	0.0000	0.0625
IA	4.0695	0.5367	7.5830	0.0000	0.0625
KS	2.9385	0.5345	5.4970	0.0000	0.0625
LA	3.6743	0.5413	6.7870	0.0000	0.0625
MN	3.7861	0.5353	7.0730	0.0000	0.0625
MS	3.6622	0.5445	6.7260	0.0000	0.0625
MO	3.6876	0.5340	6.9060	0.0000	0.0625
NE	3.1036	0.5380	5.7680	0.0000	0.0625
NC	4.4642	0.5347	8.3500	0.0000	0.0625
OK	3.0255	0.5343	5.6620	0.0000	0.0625
TN	4.1890	0.5386	7.7770	0.0000	0.0625
TX	3.1899	0.5352	5.9600	0.0000	0.0625
WI	4.1152	0.5345	7.6990	0.0000	0.0625

Price of cropland = f (output price index, input price index, productivity index, interest rate)

Table 13 USA Crop Model

Ordinary least squares regression

Standard deviation	0.4891
Number of observations	144
Degrees of freedom	124
Residuals Sum of squares	0.7960
Standard error	0.0812
R-squared	0.9767
Adjusted R-squared	0.9731
Model test F [18, 125] (pro	274.04(.0000)

Variable	Coefficient	Standard Error	t-ratio	P[|T|>t]	Mean of X
LAGOUT	0.0041	0.0541	0.0760	0.9399	4.8617
LAGINP	0.9862	0.1041	9.4710	0.0000	4.9619
LAGPROD	0.1679	0.0781	2.1490	0.0336	4.6987
LAGINTER	0.1316	0.0628	2.0950	0.0382	1.4867
AR	1.3565	0.4781	2.8370	0.0053	0.0625
GA	2.0567	0.4786	4.2970	0.0000	0.0625
IL	2.2029	0.4707	4.6800	0.0000	0.0625
IN	2.1385	0.4694	4.5560	0.0000	0.0625
IA	2.0384	0.4734	4.3060	0.0000	0.0625
KS	0.7936	0.4736	1.6760	0.0963	0.0625
LA	1.3667	0.4758	2.8720	0.0048	0.0625
MN	1.6735	0.4691	3.5680	0.0005	0.0625
MS	1.3022	0.4839	2.6910	0.0081	0.0625
MO	1.6523	0.4701	3.5140	0.0006	0.0625
NE	1.4010	0.4762	2.9420	0.0039	0.0625
NC	2.2128	0.4681	4.7270	0.0000	0.0625
OK	0.8278	0.4693	1.7640	0.0802	0.0625
TN	1.9884	0.4772	4.1670	0.0001	0.0625
TX	1.0891	0.4795	2.2710	0.0248	0.0625
WI	1.9958	0.4679	4.2650	0.0000	0.0625

Price of pastureland = f (output price index, input price index, productivity index, interest rate)

Table 14 USA Animal Model

Ordinary least squares regression

Standard deviation	0.7145
Number of observations	144
Degrees of freedom	124
Residuals Sum of squares	2.4492
Standard error	0.1405
R-squared	0.9664
Adjusted R-squared	0.9613
Model test F [18, 125] (prob)	188.04(.0000)

Variable	Coefficient	Standard Error	t-ratio	P[|T|>t]	Mean of X
LAGOUT	0.9092	0.1249	7.2790	0.0000	4.7204
LAGINP	-1.1467	0.1435	-7.9900	0.0000	4.7937
LAGPROD	0.0035	0.2046	0.0170	0.9862	4.6139
LAGINTER	-0.7533	0.1002	-7.5160	0.0000	1.4867
AR	9.6789	1.5488	6.2490	0.0000	0.0625
GA	10.6887	1.5581	6.8600	0.0000	0.0625
IL	9.6593	1.5604	6.1900	0.0000	0.0625
IN	9.8368	1.5671	6.2770	0.0000	0.0625
IA	9.3798	1.5499	6.0520	0.0000	0.0625
KS	8.5923	1.5519	5.5360	0.0000	0.0625
LA	9.6797	1.5570	6.2170	0.0000	0.0625
MN	9.0854	1.5563	5.8380	0.0000	0.0625
MS	9.6489	1.5387	6.2710	0.0000	0.0625
MO	9.4923	1.5509	6.1210	0.0000	0.0625
NE	8.1118	1.5584	5.2050	0.0000	0.0625
NC	10.5124	1.5586	6.7450	0.0000	0.0625
OK	8.7886	1.5532	5.6580	0.0000	0.0625
TN	10.2902	1.5552	6.6170	0.0000	0.0625
TX	9.0902	1.5505	5.8630	0.0000	0.0625
WI	9.6280	1.5583	6.1780	0.0000	0.0625