

**Czech University of Life Sciences Prague**

**Faculty of Economics and Management**

**Department of Economics (FEM)**



**Diploma Thesis**

**Price Elasticities for Chosen Agriculture Products in the  
Czech Republic**

**Tatiana Shcherbinina**

© 2019 CULS Prague

## DIPLOMA THESIS ASSIGNMENT

Bc. Tatiana Shcherbinina

Economics and Management

Thesis title

**Price Elasticities for Chosen Agriculture Products in the Czech Republic**

---

### Objectives of thesis

The goal of the Diploma Thesis is to determine the demand price elasticity for the selected agricultural products in the Czech Republic. Tasks of the Diploma Thesis are:

- a) To generalize the theoretical experience of researchers in the field of price elasticity.
- b) To carry out the research of the demand price elasticity for the chosen agricultural products in the Czech Republic.
- c) To predict the future changes in the demand price elasticity for agricultural products in the Czech Republic.

### Methodology

The first method is the econometric modeling methods (linear and logarithmic regressions) should be used. By using these methods calculations in the price elasticity can be done and predicted for the future period.

The second method is the SWOT analysis. The SWOT analysis sums up the research findings in case of internal and external factors which influence on agriculture development. Also it creates the ground for providing recommendations for the strategical development of the agricultural market.

## **The proposed extent of the thesis**

60 – 80 pages

## **Keywords**

Elasticity, elastic, inelastic, price, agriculture, products, government, effect, consequences, consumers.

---

## **Recommended information sources**

Czech Ministry of Agriculture (2011): Action plan for Organic Farming 2011 – 2015, Adopted by the Government of the Czech Republic in 2010. MZe ČR, Pp.32

DEATON A., MUELLBAUER J. Economics and Consumer Behaviour. Cambridge: Cambridge University Press

DEBERTIN L. DAVID. Agricultural Production Economics. The 2nd edition, University of Kentucky, 2012 (ISBN-13: 978-1469960647)

Eurostat [online]: <https://ec.europa.eu/eurostat/>

FAOSTAT [online]: <http://www.fao.org/sustainable-development-goals/en/>

STORY JOHN. Price Elasticity of Demand and Marketing: Mastering elasticity to market strategically. Independent Publishing Platform, 2016

---

## **Expected date of thesis defence**

2018/19 SS – FEM

## **The Diploma Thesis Supervisor**

Ing. Tomáš Maier, Ph.D.

## **Supervising department**

Department of Economics

Electronic approval: 26. 3. 2019

**prof. Ing. Miroslav Svatoš, CSc.**

Head of department

Electronic approval: 26. 3. 2019

**Ing. Martin Pelikán, Ph.D.**

Dean

Prague on 26. 03. 2019

### **Declaration**

I declare that I have worked on my diploma thesis titled "Price elasticities for chosen agricultural products in the Czech Republic" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the diploma thesis, I declare that the thesis does not break copyrights of any their person.

In Prague on 31<sup>st</sup> March 2019

---

Tatiana Shcherbinina

### **Acknowledgement**

I would like to thank Ing. Tomáš Maier, Ph.D. for valuable pieces of advice and support throughout my work on this diploma thesis. Also I am really pleased to be a part of the Czech University of Life Sciences community.

# **Price Elasticities for Chosen Agriculture Products in the Czech Republic**

## **Abstract**

The research is focused on the analysis of price elasticity for the chosen products (wheat, barley, milk and eggs) in the Czech Republic. The aim of the Diploma Thesis is to determine the demand price elasticities for the selected agricultural products in the Czech Republic and forecast their changes in the future. The study is based on use of secondary sources of data collecting: Czech Statistical Office, FAOSTAT and Eurostat. The first part examines the theoretical experience in case of price formation, consumers' behavior and elasticity calculations. The analytical part is focused on the analysis of current agricultural situation in the Czech Republic and its difference in comparison with the Russian agrarian market. The practical part includes calculations in log-linear demand models and elasticities for the chosen products. SWOT analysis is used to provide suitable recommendations for the development of Czech agricultural market.

**Keywords:** elasticity, price, agriculture, products, government, effect, consumers

# Cenová elasticita pro vybrané zemědělské produkty v České republice

## Abstrakt

Výzkum je zaměřen na analýzu cenové elasticity pro vybrané produkty (pšenice, ječmen, mléko a vejce) v České republice. Cílem diplomové práce je stanovit pružnost poptávkových cen vybraných zemědělských produktů v České republice a předpovědět jejich změny v budoucnosti. Studie je založena na využití sekundárních zdrojů sběru dat: Českého statistického úřadu, FAOSTAT a Eurostatu. První část zkoumá teoretické zkušenosti v případě tvorby cen, chování spotřebitelů a výpočtu pružnosti. Analytická část je zaměřena na analýzu současné zemědělské situace v České republice a její rozdíl ve srovnání s ruským agrárním trhem. Praktická část obsahuje výpočty v lineárních a logaritmicko poptávkových modelech a pružnosti pro vybrané produkty. SWOT analýza slouží k poskytnutí vhodných doporučení pro rozvoj českého zemědělského trhu.

**Klíčová slova:** pružnost, cena, zemědělství, produkty, vláda, vliv, spotřebitelé

## Table of content

<b>1</b>	<b>Introduction</b> .....	<b>9</b>
<b>2</b>	<b>Objectives of the Diploma Thesis and research questions</b> .....	<b>10</b>
<b>3</b>	<b>Methodology</b> .....	<b>10</b>
<b>4</b>	<b>Literature overview</b> .....	<b>12</b>
	4.1 Theoretical foundations of market pricing .....	13
	4.2 Theory of demand elasticity in the field of the econometric modeling .....	15
	4.3 The concepts and formation of price elasticity .....	22
	4.4 The demand price elasticity application in the econometric modeling and forecasting .....	25
<b>5</b>	<b>Analytical Part</b> .....	<b>27</b>
	5.1 Analysis of the demand elasticity in the market of agricultural products .....	27
	5.2 The analysis of the agriculture market in Russia .....	35
	5.3 The analysis of the agriculture market in the Czech Republic .....	38
<b>6</b>	<b>Suggestions for the Solution of the Problem</b> .....	<b>48</b>
	6.1 Econometric Modeling .....	48
	6.1.1 Panel Data Set of demand of the agriculture elasticity and its choice for the agricultural market .....	48
	6.1.2 Algorithms of the Econometric Modeling Process of the demand elasticity.....	57
	6.2 Forecasting of demand elasticity.....	61
	6.2.1 Forecasting of the demand elasticity in the sphere of the agricultural products .....	61
<b>7</b>	<b>Results and Discussion</b> .....	<b>65</b>
<b>8</b>	<b>Conclusion</b> .....	<b>67</b>
<b>9</b>	<b>List of the literature</b> .....	<b>69</b>
<b>10</b>	<b>List of Figures</b> .....	<b>71</b>
<b>11</b>	<b>List of Graphs</b> .....	<b>72</b>
<b>12</b>	<b>List of Tables</b> .....	<b>73</b>



# 1 Introduction

Living in the contemporary world consumers and traders have the situation of changes in price for the specific production. Relying on that fact, both of groups will react different because of their possibilities. Concentrating attention on the market environment analysis that surrounds agricultural enterprises it is extremely important to know such a characteristic feature of agriculture as the demand price for agricultural products.

Price elasticity is a quantitative reflection of consumers' reaction to changes in the price of goods. The mentioned reaction follows from the action of the law of demand according to which consumers reduce the purchase of goods with rising prices for them, and vice versa, they will get more with lower prices. However, this action of the law is manifested far from equally for different goods for example there is a different degree of consumer sensitivity to price changes for a particular product.

The topic of this Diploma Thesis which is called "**Price Elasticities for Agriculture Products in the Czech Republic**" plays the important role in the field of the agriculture development. It is well-known that agriculture is a relatively large area of the society economic activity. It works closely with other sectors of the national economy. In the modern economy this relationship is based on a market mechanism, the freedom of entrepreneurship, the dominance of private property, the maximization of profits which are the most important features of the modern economy.

**The practical importance** is based on two fields of the future results applications. **Firstly**, problems of the agricultural sector in a market economy form the following specific factors: the features of the production structure, the influence of natural conditions, the elasticity of demand for food products, a decrease in the share of consumer spending on food in the event of income growth. Relying on such factors, economists can improve the future situation by analyzing factors. **Secondly**, obtaining the results in the current price elasticity it is possible to predict the future price for the specific product and introduce the well-made policy for stimulating its consumption.

## 2 Objectives of the Diploma Thesis and research questions

The goal of the Diploma Thesis is to determine the demand price elasticity for selected agricultural products in the Czech Republic. In accordance with the goal prices for all chosen products should be implemented in the duration of 25 years.

According to the mentioned goal here are some tasks which should be examined during the Diploma Thesis:

- a) To generalize the theoretical experience of researchers in the field of price elasticity.
- b) To carry out the research of the demand price elasticity for the chosen agricultural products in the Czech Republic.
- c) To predict the future changes in the demand price elasticity for agricultural products in the Czech Republic.

Concentrating attention on the research questions, they are shown in the Table 1.

Table 1 – The main research questions

No	The research question
1	What are the most practical and economic methods for determining the price elasticity?
2	Do all types of agricultural products have the similar price elasticity or we have the special goods? How does the price elasticity change in case of long period?
3	What approaches (operational or agronomic) can be developed to increase efficiency in Czech agriculture?
4	What type and specific combinations of improved technologies, farming practices, institutions and policies will result in the maintenance of elasticity?
5	What are the best farmers' tools in agriculture to improve elasticity for wheat, barley, milk and eggs?
6	How do the outside factors influence on the elasticity of wheat, milk, barley and eggs?
7	If the Czech government spends more investments on agriculture, will it help to stabilize the price elasticity?

The source of the Table 1: Author.

All of the mentioned questions which are presented in the Table 1 are important for this research. They will show the current and the future state of the Czech agrarian market: possible profits and disadvantages. Finally, the research questions should determine the best compromise requires an improved understanding of how to use new technologies and agrarian schemes to ensure sustainable food production.

Moreover, in the end of the research explanations the explanation of the elasticity of specific types of products should be given. Also, during the analytical part some contemporary concepts of the price formation for products should be uncovered and examined.

Carrying out the master work some sources which include classical literature on economic theory, current trends in the practice of economic theory and our own reflections were used. Therefore, the official statistics of the Czech Republic was applied in this work.

### 3 Methodology

Relying on the master's work theme it is better to analyze the theory of elasticity, its laws, formation and conditions. In case of price elasticity there is the description: elasticity is the reaction of an economic indicator which shows the change in a factor or group of factors (Debertin L. David, p.33). To understand its changes and ways of calculation some methods will be used during this work.

In case of obtaining proper results in the research the correct selection of methods plays the significant role. Relying on the fact that the Diploma Thesis analyzes the changes in the demand price elasticity, **the econometric modeling method** (linear and logarithmic regressions) should be used. Using the linear and logarithmic regression models it is possible to analyze the features of economic variables and the relationships between them, study the structure of causal relationships between variable and reveal the future trend for changes in elasticity for the chosen products.

The second method is the **SWOT analysis**. It helps to analyze the Czech agrarian market from different angles. It shows internal and external factors which influence on agriculture from two sides: positive and negative.

In accordance with the mentioned before here are three main methods which were used in the Diploma Thesis:

1. Econometric modeling (linear regression).
2. SWOT analysis.

Dealing with the key words there are the most important of them: *price elasticity, elasticity, elastic, inelastic, goods, price, agriculture, products, government, effect, consequences, reason and consumer.*

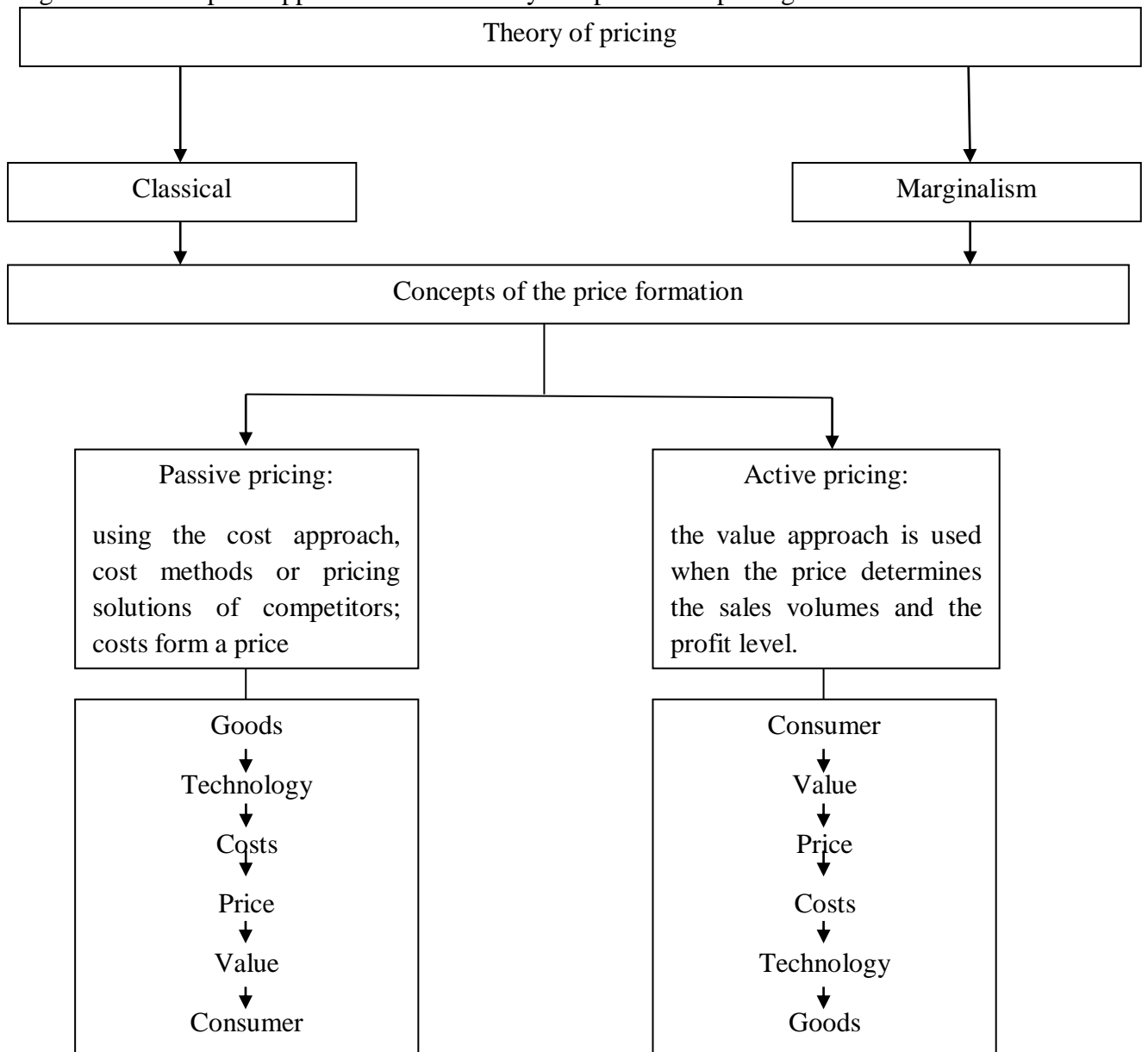
## 4 Literature overview

### 4.1 Theoretical foundations of market pricing

Pricing is the science that studies the processes of formation, patterns of movement and the use of prices. The subject of science is the theory of prices and the practice of their establishment.

The development of the theoretical foundations of pricing has contributed to the emergence of passive and active conceptual approaches to practical pricing, involving the use of appropriate methods: costly and based on the value of the goods to the consumer. The process of the pricing establishment can be shown in the Figure 1.

Figure 1 – Conceptual approaches in the theory and practice of pricing



The source for the Figure 1 is (The modern economic theory).

The seller's pricing activities largely depend on the market type where it operates. The modern market is a complex system that includes organizational, economic ties and has a set of economic instruments with is the way how these links are realized.

The market structure is the main characteristics which includes the number and size of market organizations, the degree of goods homogeneity (similarities or differences), ease or difficulty of entering and exiting the market, having a competitive environment, availability of market information. Nowadays, the market economy can be classified according to the following criteria which are represented in the Table 2.

Table 2 – Market classification in accordance with specific characteristics

Classification in accordance with:	The market type:
Economical purpose	<ul style="list-style-type: none"> <li>✓ Goods and services.</li> <li>✓ Raw materials.</li> <li>✓ Labor.</li> <li>✓ Securities.</li> <li>✓ Money (capital, currency).</li> <li>✓ Scientific and technical developments.</li> </ul>
The degree of the competition limits	<ul style="list-style-type: none"> <li>✓ Free competition;</li> <li>✓ Monopolistic competition.</li> <li>✓ Oligopolistic competition.</li> <li>✓ Pure monopoly.</li> </ul>
The type of the market participants	<ul style="list-style-type: none"> <li>✓ Wholesale.</li> <li>✓ Retail.</li> </ul>
Industries	<ul style="list-style-type: none"> <li>✓ Agriculture( grains, milk).</li> <li>✓ Cars.</li> <li>✓ Metal.</li> <li>✓ Natural resources.</li> </ul>
The way of leading the law	<ul style="list-style-type: none"> <li>✓ Legal.</li> <li>✓ Illegal (the black market).</li> </ul>
Geographical position	<ul style="list-style-type: none"> <li>✓ Local (regional).</li> <li>✓ National.</li> <li>✓ World-wide.</li> </ul>

The source for the Table 2 is (The modern economic theory).

In accordance with the Table 2 there are a lot of conditions for pricing forming which play the great role for consumers' behavior in case of purchasing which defines the demand elasticity.

## **4.2 Theory of demand elasticity in the field of the econometric modeling**

In economic theory the concept of elasticity is important for specific calculations of the behavior of economic indicators. Elasticity is the reaction of an economic indicator which shows the change in a factor or group of factors. It can be defined by relying on the theory.

“The term elasticity is used by economists when discussing relationships between two variables. Elasticity is a number that represents the ratio of two percentages. Any elasticity is a pure number in that it has no units.” (Debertin L. David, p.33).

The elasticity of demand introduces how much one economic variable (in percentage) changes when the changes by one percent. There are three types of elasticity: price elasticity, income elasticity, and cross-elasticity. In this Diploma Thesis price elasticity is analyzed.

The reaction of supply and demand in response to price changes is reflected by the laws of supply and demand. Whereas, these laws propose the idea of the change in volumes of supply and demand only at a qualitative level. However, in most cases economists need more detailed information in case of the sellers or buyers' reaction to a change in a factor. In response to a change in factors demand or supply may demonstrate varying degrees of response to this change. In order to get more information about the change in any value, in economics, elasticity indicators are used.

In other words, an indicator (coefficient) of elasticity is needed to measure the sensitivity of a change in demand or supply, or any other function.

Concentrating attention on the theory it should be mentioned that the concept of elasticity was introduced by Alfred Marshall.

In accordance with the economic theory, it can be defined three groups of elasticities. Relying on types of the product, it should be proposed the group of the elasticity. Concentrating attention on group, the short description of them could be done.

The price demand for the first group is relatively elastic, when small changes in price cause significant changes in their sales. The second group includes goods with proportional (single) elasticity, when sales change in proportion to changes in price. The third group is goods for which even significant price changes cause small changes in the volume of sales. The demand for these products is called relatively inelastic.

Agricultural products belong to the third group of goods with relatively inelastic demand.

If demand is elastic, in this case it is the following conditional: if the price of a product decreases, the cash proceeds from the sale of its increase (therefore a high rate of sales growth is compared with a low rate of price reduction which allows compensating for losses from such decrease). At the same time, prices which are increasing with elastic demand for a product will lead to opposite effects - the total cash income will decrease, since its growth from a price increase does not compensate for losses from a decrease in sales.

Concentrating attention on the point of demand elasticity the cash income from a decrease or increase in price does not change since the loss of revenue (as a result of a decrease in sales due to price) increases and it will be offset by additional income from such growth. Conversely, when the price is reduced the loss of revenue for this reason is equally compensated by the increase in sales.

Dealing with relatively inelastic demand for goods a decrease in their prices always leads to a decrease in cash proceeds from their sale. Indeed, obtaining a demand, a significant reduction in price will result in slight sales increase. The additional cash income received due to the greater sale compensates for the losses arising from the price reduction. However, if it rises on goods with relatively inelastic demand, the cash revenue will increase due to this, since the additional income which was generated from the price increase will be greater than the loss from a decrease in sales.

The relative inelasticity of demand for agricultural products is the result of several factors that determine the degree of the consumer's sensitivity to changes in goods prices.

In accordance with the mentioned above we can show three types of the demand elasticity by using the Table 3.

Table 3 – Types of demand elasticity

The type of elasticity	Description
The elastic demand	If $E_a > 1 \rightarrow$ the 1% change leads to a greater percentage change in demand
The Inelastic demand	If $E_a < 1 \rightarrow$ the 1% change of the price causes less than 1% in the demand change. This means that demand is growing slower than the price is falling
The demand with a single elasticity	If $E_a = 1 \rightarrow$ the 1% change in price leads to a 1% change in demand. The rates of change in demand and prices are the same

The source for the Figure 1 is (The modern economic theory).



The main factor is the substitution factor, with a rise in prices for one commodity, a consumer can satisfy the same need by buying another commodity (the price for which has not changed or decreased).

Although the substitution for food products is very limited due to the biological properties of the human ability. In this case it should be mentioned that the general pattern is manifested - the less substitutes for this product, the demand is less elastic for it and vice versa. Therefore, it becomes clear that the demand for grain and bread is not very elastic due to the fact that these products are almost impossible to replace with others. Moreover, with a significant increase in the price of bread the volume of its sales will change little, which is a reflection of the price inelasticity of demand for this product.

Demand price for many products depends on price versus consumer's income. Although it depends on the quality and price of available substitutes. The majority of food consumers buy regardless of rising or falling prices. The average ratio of agricultural products price elasticity in industrial countries is 0.20–0.25. To increase sales by 10%, farmers should reduce prices 40-50%. People who are solving the problem have the perception that they use extra income for the purchase of other goods and services (Investments in agriculture as perspectives or uncertainty and risks).

The degree of sensitivity of the proposal to the price signal is called the offer elasticity which is determined by the time factor. To expand production to the producer during the certain period of time is required to acquire and distribute available resources in an organization to produce a product, which increased the price. In the instant period time, the offer will be completely inelastic: whatever the price hike, increase the offer is impossible. If prices have fallen, then the reaction commodity producer will depend on the product type. A product which production can be saved for example, grain, you can postpone and do not sell it before the price increase (Story John, p.58).

In the short term offer may be increased within one production cycle through the use of intensive technology and increasing variables production costs that will pay off price increase.

In the long run, the manufacturer manages to expand in response to price increases production, and theoretical conclusions about the return prices due to the expansion of supply to the equilibrium level are not confirmed. Mass production expansion in the industry increases the demand for resources, their prices are rising and, accordingly, the cost increases agricultural products (The modern economic theory).

For the whole history of agrarian development parity prices - the ratio of prices, showing how much non-agricultural goods and services may purchase a manufacturer for a unit of its product, - is not in his favor. With the passage time it tends to decrease.

In the theory of price dynamics, there are two aspects which are stood out:

- The first one is related to the analysis of transient processes in pricing.
- The second aspect is related with the study of the direction of price shifts over long periods of time. In this case, the discreteness of pricing doesn't matter and the price can be perceived as a continuous function in time, for which is characterized by the presence of oscillatory (wavy) trends.

In accordance with the economic theory there are two determinants which can influence on consumers' behavior:

- Price.
- Non-price (Deaton A, p.12).

Relying on the **non- price determinants** here are some of them:

- **Tastes and preferences of consumers.** For example, active advertising of grain or dairy products can lead to an increase in demand for yoghurt, cheese, cereals and other natural products, increasing the value of demand at the same prices (the demand curve to the right position) (The modern economic theory).
- **Consumers' incomes.** For the overwhelming group of normal quality goods, income growth causes an increase in demand at the same price levels. In this case it corresponds the demand curve to the right. However, for relatively worse products with a relatively lower quality, income growth encourages the consumer to replace the relatively worse product with a better one and thereby reduces demand. As a result, the demand curve shifts to the left (The modern economic theory).
- **The number of consumers.** As more market has potential buyers, a higher markets demand for the product (The modern economic theory).
- **Prices for "other" products.** This factor is non-price, because assumes that the price of the goods in question is unchanged. The price of any other commodity besides that which we analyze acts as a non-price, or exogenous factor (The modern economic theory).
- **Economic expectations of consumers.** Expectations may relate to changes in prices, cash income, the macroeconomic situation in the country, etc. Thus, expectations of rising prices (the so-called inflationary expectations) can cause an increase in demand for goods which are placed in the present period of time, which will graphically mean a shift in the demand curve to the right, and expectations of a reduction in cash income (The modern economic theory).

In accordance with the mentioned above, there are three groups of "other" products:

- Neutral, in other words, it has an extremely low, close to zero effect on the market for the main product, for example, tea (The modern economic theory).

- Substitutes that satisfy similar needs, and therefore are competitors for the main product, such as tea and coffee (The modern economic theory).
- Supplementary, which consumption is due to the consumption of the main product, such as tea and sugar (The modern economic theory).

In conclusion it can be shown the Table 3 with common trends in the sphere in agriculture. I would like to show the type of elasticity and factors which are the main performers in the agrarian elasticity.

The study of non-price factors allows us to formulate the law of demand.

The effect of the law of demand can be explained by the action of two interrelated effects: the income effect and the substitution effect. The essence of these effects is as follows:

- On the one hand, the rise in prices reduces the real income of the consumer with a constant amount of his cash income, reduces his purchasing power, which leads to a relative reduction in the amount of demand for the risen goods (income effect) (Deaton A, p.12).
- On the other hand, the same price increase makes more attractive for the consumer other goods, prompts it to replace the more expensive product with a cheaper analogue, which again leads to a reduction in the demand for it (substitution effect) (Deaton A, p.12).

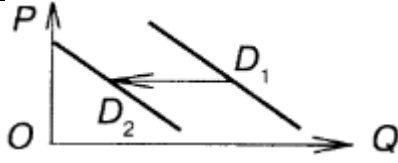
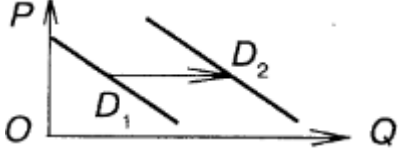
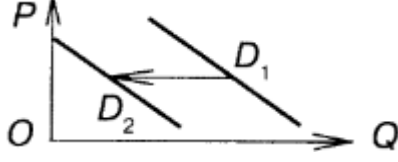
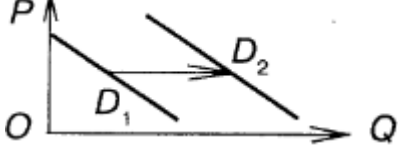
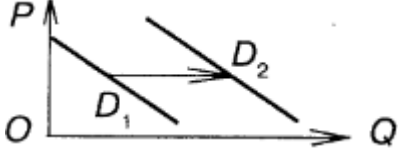
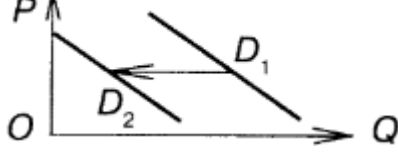
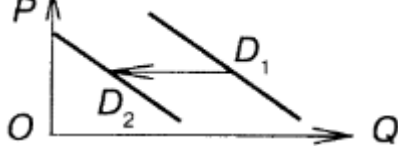
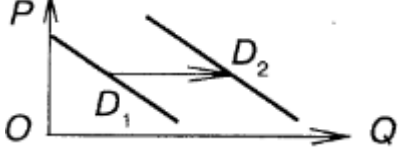
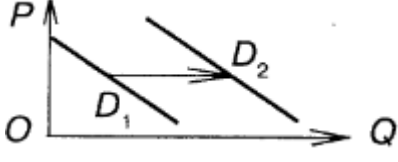
In accordance with the mentioned above it should be better to explain and illustrate the movement of the demand curve.

Demand curve shift reflects:

- The reaction of buyers to changes in price factors.
- Changes in household income.
- Changes in population structure.
- Price changes for other goods, especially for substitute products.
- Government economic policy.
- Changes in consumer preferences.

Relying on the theory the shift of the demand curve can be illustrated by using figures. All movements and their explanations are shown in the Table 4.

Table 4 – The shift of the Demand curve

Factors	Changes in Demand	Shift of the demand curve	Explanation
Change in prices for substitutes	Price increase for substitutes		Shift to the left
	Price decrease for substitutes		Shift to the right
Price changes for complementary goods	Price increase for complementary goods		Shift to the left
	Price decrease for complementary goods		Shift to the right
Consumers' income	Increase in consumers' income		Shift to the right
	Decrease in consumers' income		Shift to the left
Advertising	The company increases advertising costs		Shift to the left
Seasonal changes	During the specific seasons, some things happen that increase costs		Shift to the right
Consumers' expectations	Consumers prejudice about increase in goods price		Shift to the right

The source for the Table construction is (Story John, p. 54).

Changes in the global economy can be caused by a variety of factors. Consider as an example the simplest case of increase in the rate of economic growth in one country relative to

another. Consumers and entrepreneurs of the country whose growth rates are higher will buy more imported goods from the country whose growth rates are lagging due to their lower relative price, thereby increasing the aggregate demand in the country in lagging growth rates. All of these changes will lead to the movement of the aggregate demand curve to the right or left.

In accordance with the mentioned above there are some factors which play the important role in the way of forming elasticity. These factors are shown in the table 5.

Table 5 – The main factors for the elasticity

The type of the elasticity	Factors
Elastic	<ol style="list-style-type: none"> <li>1) The availability of substitute products in the market</li> <li>2) Time factor</li> <li>3) The share of expenditures for the goods in the consumer budget</li> <li>4) The degree of saturation of the market with the goods</li> <li>5) A variety of possibilities for using this product</li> <li>6) The importance of the goods for the consumer (if the product is necessary in everyday life, then the demand for it will be inelastic to price changes). Goods that are not so important to the consumer and which acquisition can be delayed is characterized by greater elasticity)</li> </ol>
Inelastic	<ol style="list-style-type: none"> <li>1) The consumer attaches great importance to the characteristics of the goods</li> <li>2) The consumer wants to have the unique goods and this person is willing to pay for it</li> <li>3) The consumer has significant savings from using a particular product or service</li> <li>4) The price of the goods is small in comparison with the budget of the consumer</li> <li>5) The consumer is poorly informed and does not make the best purchases</li> </ol>

The source for the Figure 1 is (The modern economic theory).

Relying on the Table 5, there are some causes of the elasticity type. But there are some exceptions when the elasticity law does not work (The modern economic theory).

- Giffen's paradox. The rise in prices for the main group of essential goods leads to the refusal of more expensive and high-quality goods, and to an increase in the volume of demand for this main product.. The increase in prices for the specific product happens due to the fact

that the real incomes of segments of the population fall, and they are forced to reduce the purchase of more expensive goods, increasing the consumption of the first-need goods in order to survive and not starve to death (The modern economic theory).

- When the price is an indicator of quality. In this case, the consumer can assume that the high price of the goods indicates its high quality (The modern economic theory).
- The effect of Veblen . It is associated with the prestigious demand, focused on the purchase of goods, testifying the buyer's opinion of its high status or belonging to the "beneficiary goods" (The modern economic theory).
- The effect of the expected price movements. If the price of goods decreases and consumers expect this trend to continue, then the size of demand may decrease in the specific period of time and vice versa (The modern economic theory).
- For rare and expensive goods that are a way of investing money (The modern economic theory).

### **4.3 The concepts and formation of price elasticity**

In a market economy, the success of any enterprise or entrepreneur depends largely on how correctly they will set prices for their goods and services. But it is not easy to follow this idea because a complex of political, economic, psychological and social factors has a significant effect on prices. Today, the price can be determined by the number of costs for the production of goods, but in the future its level may depend on the psychology of consumer behavior (Deaton A, p.12).

Price is one of the criteria that determines consumer perception. It influences on the decision to purchase goods, has an impact on the profit of a commercial enterprise and it is in close cooperation with market factors. Price in the market conditions acts as an effective means in the competitive struggle for buyers, predetermines the volumes of production and goods sales, affects the behavior of buyers and their solvency.

Prices at all times are an integral part of market relations. Free prices are the main regulator of the proportions of social reproduction, economic relations. Prices are also an important object of state regulation, thanks to which the state implements its policy in market conditions.

Relying on the economy theory the price has the following features:

- **Measuring.** The price shows the amount of money paid and received per unit of product or service (The modern economic theory).
- **Measure.** Using this price function, you can compare products, differentiate them into expensive and cheap ones, compare the values of different products (The modern economic theory).

- **Accounting.** The world of goods with the help of prices is translated from the natural-material to the value form. At the macro and micro levels all indicators are calculated in the value form. The price becomes an auxiliary instrument of accounting. It also acts as a tool for calculating relative indicators: product profitability, capital productivity, etc. In this regard, the price participates in the formation of the main financial and economic indicators of an enterprise, measured in monetary terms, and is used to analyze, forecast and plan the main production and exchange indicator processes. Price is also an indicator of market conditions, reflects the main processes occurring on it (The modern economic theory).
- **Regulatory.** Price is a tool for regulating economic processes: it balances supply and demand, linking them with the monetary and payment ability of the producer and the consumer. It plays a regulatory role in the allocation of resources, as the prices of resources orient entrepreneurs to the use of cheap resources and savings expensive. The state sometimes uses this function of price for its own purposes through taxes, subsidies and price fixing for certain types of goods or services (The modern economic theory).
- **Social.** Price is a factor in the standard of living of the population, affecting the volume and structure of consumption, the level of real incomes of various social groups, it is the main component of inflationary processes. The subsistence minimum and the family's consumer budget depends on the level and price dynamics; therefore, the social reaction to price fluctuations is very acute (The modern economic theory).
- **Stimulating.** Market pricing creates opportunities for alternative choices when making business decisions. Thus, the incentive effect of price lies in the fact that its level induces the use of the most economical production methods and the most complete use of resources, on the one hand, and rational consumer behavior (demand), on the other. The price is a tool for the formation of profit, a taxation factor where is prices are used for rental apartments. In addition to price, the system of economic incentives includes, as is known, economic levers based on price: profit, profitability, taxes. In modern market conditions, price becomes the main instrument of competition, and competition is the main driving force of production (The modern economic theory).
- **Distribution.** The distribution and redistribution of income occurs through the price level, their structure and ratio. Different price levels can be established for different consumers, higher or lower prices can be achieved by including or not including taxes (excise). Redistributive pricing is not a phenomenon that is characteristic only of government regulation. Monopoly also carries out redistributive pricing by appropriating other people's profits, like oligopoly as a cartel, when manufacturers agree on a monopoly price level (The modern economic theory).

The degree of consumer sensitivity to price change is measured using the coefficient of price elasticity of demand, which is the ratio of the percentage change in the quantity of products requested to the percentage change in price that caused this change in demand (The modern economic theory).

Relying on the economic theory, there are some formulas for calculating elasticity:

First of all it is worth for defining the demand which can be represented by the formula 1:

$$D = f(Q, P), \quad (1)$$

Where:

$D$  is the quantity of demand;

$P$  is the size of average market price;

$Q$  is the quantity of product market volume.

We will have the following formula for the elasticity:

$$E_p^D = Q'_p * \frac{\Delta P}{\Delta Q}, \quad (2)$$

Where:

$E_p^D$  is the elasticity;

$\Delta P$  is changes in the price;

$Q'_p$  is the derivative of the demand function for the price;

$\Delta Q$  is changes in the quantity.

Based on the price elasticity of demand, it is possible to determine the dynamics of the producer's total revenue as the price changes. For example, how will the manufacturer's revenue change when the price increases, if the demand for this product is elastic. The reasoning in this case may be as follows: high elasticity of demand means that the price changes, the value of the demand volume changes more rapidly than the price, that means if the price rises, the demand volume falls more rapidly than its growth. Consequently, the total revenue of the manufacturer will be reduced.

The seller is interested to raise the price if the demand is inflexible, and to lower if the demand is elastic. Understanding the magnitude of the elasticity coefficient one can determine the required size of the price change (in order to increase the seller's income or achieve cost savings for the consumer).

The coefficient of direct elasticity can also be used to determine the required change in the volume of demand at the expected level of price change, provided that the mass of profits earned by the enterprise remains unchanged. In this case, it has the view which is represented in the formula 4:



$$\Delta Q = \Delta P * \frac{E}{P}, \quad (4)$$

Where:

$\Delta Q$  is changes in the quantity;

$\Delta P$  is changes in the price;

P is the base price at current production.

All of these formulas help to understand the consumers' behavior in the way of purchasing, their reflection to prices changes in the market.

#### **4.4 The demand price elasticity application in the econometric modeling and forecasting**

During the practical part, first of all the correlation should be estimated correlation which is a quantitative measure of dependence between two (agricultural) categories (price and demand). If these categories are labeled as x, y, correlation is usually expressed by the Pearson's product moment correlation coefficient (r) (Pearson correlation coefficient).

$$r = \frac{n \sum xy - \sum x \sum y}{\sqrt{n \sum x^2 - (\sum x)^2} \sqrt{n \sum y^2 - (\sum y)^2}}, \quad (5)$$

Then after calculating coefficients for each type of the production the analysis of values should be done. In dependence of the direction and the strength of correlation between x and y, the coefficient of correlation (r) takes index between -1 and 1. In the case when  $r > 0$ , the correlation is direct, while for  $r < 0$  there is an inverse correlation. In practice, the strength and degree of correlation, in dependence of absolute value  $|r|$  is interpreted by using the following explanations of the coefficient:

- Obtaining the result which is 0.0-0.7 this means that correlation is weak.
- If the result is 0.7-0.8 it is the emphasized correlation.
- If the result is 0.8 - 0.9 this means that correlation is high.
- Having the result which is 0.9-0.10 this means the correlation is very high.

To model the dependence of the demand volume from the price was used logarithmic function, which most fully reflects the studied dependence.

The log-linear demand model is shown in the 5<sup>th</sup> equation.

$$\ln Y = \ln \alpha_0 + \alpha_1 * \ln P + \varepsilon, \quad (6)$$

Where:

Y is the demands;

P is the average selling price;

$\alpha_0, \alpha_1$  are independent value of the equation.

The model is linear in logarithmic variables so it is possible to rewrite it in changing  $Ln\alpha_0$  by  $\alpha_1^*$ ,  $LnY=Y$ ,  $LnX=X$ . Taking care of these changes the model has the following equation:

$$Y = \alpha_0^* + \alpha_1^*X + \varepsilon \quad (7)$$

The formula for independent coefficients has the view in accordance with the economic theory :

$$b_0^* = \frac{\sum_{i=1}^n y_i^* \sum_{i=1}^n x_i^{*2} - \sum_{i=1}^n x_i^* \sum_{i=1}^n x_i^* y_i^*}{n \sum_{i=1}^n x_i^{*2} - (\sum_{i=1}^n x_i^*)^2}, \quad (8)$$

$$b_1^* = \frac{\sum_{i=1}^n x_i^* y_i^* - \sum_{i=1}^n x_i^* \sum_{i=1}^n y_i^*}{n \sum_{i=1}^n x_i^{*2} - (\sum_{i=1}^n x_i^*)^2}, \quad (9)$$

As the logarithmic model was chosen for the elasticity analysis the formula (4) should be rewritten by using logarithms by using the theory ground .

$$E = \left( \log \frac{Q_2}{Q_1} \right) / \left( \log \frac{P_2}{P_1} \right), \quad (10)$$

Summarizing this part, we can make a conclusion, that in this work the demand price elasticity will be found by using the logarithmic method. This choice was made because of the data set and time for prediction. Goods are interchangeable if their consumption volumes change in the opposite direction: with the growth of purchases of one commodity, the volumes of the other are reduced and, conversely, when the consumption of this product decreases, another good replaces it in consumer baskets, and the purchases of the second commodity increase. This is the rule for the elasticity which is going to be proved during analysis.

## **5 Analytical Part**

### **5.1 Analysis of the demand elasticity in the market of agricultural products**

Agriculture is the most important basis of countries economy. Even the most developed industrial countries are investing funds in the development of domestic agriculture. It provides vital to human products - basic food and raw materials for the production of consumer goods. Agriculture provides people with the job opportunity, security, working environment and technology.

In the second half of 2006 world prices for most basic food products increased. By the first half of 2008 world grain prices expressed in US dollars had reached their maximum level in almost 30 years, which threatened the food security of the world's poor and caused deep concern to the international community about the emerging global food crisis. In the second half of 2008 a rapid decline in world food prices happened due to a sharp drop in oil prices and a reduction in demand under the impact of the financial crisis and the global recession. However, current prices are significantly higher than in previous years and will be expected to remain so. For many poor consumers, food prices are still high or growing. In addition, despite the fact that world food prices fell, supply and unfavorable market conditions unchanged. The fall in prices was not due to the widespread expansion of food availability. In most developing countries, high food prices have not caused a positive response from the supply and demand sides (The state of agricultural markets).

One of the political challenges facing developing country governments is how to help agricultural producers increase production. A more pressing problem is how to guarantee consumers access to food at affordable prices. In most cases (obviously due to public discontent caused by high food prices), the introduced policies were aimed at addressing short-term short-term food security problems by attempting to slow down price increases and increase food availability.

In agriculture, as in other sectors, there are basic laws of economic development. Moreover, many of the laws of a market economy are manifested in a more agrarian economy than in other sectors since agriculture is represented by numerous and relatively small farms operating relatively autonomously from each other.

Nevertheless, the agrarian economy usually stands out in a special course, for the agrarian sector develops an independent economic theory. The reason for being discussed is a number of specific features of the agrarian sector which require its separate consideration.

First of all, agriculture in developed countries is a classic example of a completely competitive industry because agricultural production is conducted by a large number of sellers

where not all of them have a sufficient supply volume to price change, practically the product is not diversified, and there are no entry barriers and exit from the market.

The second feature is the strong dependence of agricultural production on natural conditions. Droughts, floods, pests, diseases of animals and plants make the agrarian sector a sphere of relatively risky capital investment.

Another peculiarity is that due to weak product differentiation sellers have few opportunities to raise prices. The parity of prices for agricultural products and means of production for agriculture from year to year around the world does not change in favor of the agricultural sector. But it changes preferences of consumers and technologies for the production. The finished agricultural product is food. But the price elasticity of demand for food is usually low. Other words, consumers acquire the main types of food, regardless of the growth or reduction of prices for them in almost constant amounts. On the other hand, the demand for agricultural and food products is also inelastic in terms of income (The state of agricultural markets).

The low demand for agricultural products creates a so-called long-term farming problem. By itself, the low elasticity of demand is not yet a problem for the economic sector if the supply is not growing or is growing slowly. But taking care of the fact that over the last century the agricultural sector has experienced significant scientific and technical progress, the productivity of agricultural labor has sharply increased, and the supply of agricultural products has grown rapidly it is worth for saying that agriculture situation moves positively in the contemporary world. And focusing attention on the situation when the market has the growth of real income, the demand of each individual family (which is imposed on the agro-food sector) is declining. But with the growth of well-being, the birth rate usually decreases and this means a decrease in population growth rates. As a result, the aggregate demand for agricultural products in society is growing more slowly than its supply (The state of agricultural markets).

Thus, due to the development of the economic, scientific and technological progress, agriculture is placed between two trends. On the one hand, with the increase in supply the total revenue of the sector tends to decrease. On the other hand, the prices of purchased goods overtake the prices of farm products. The resulting trend is the relative decline in farm incomes. In the long run, farm incomes always lag behind incomes in non-farm sectors of the economy. Since agriculture is a highly competitive industry, it would seem that with a fall in income, there should be an outflow of farmers from this industry to more profitable areas of activity. However, in practice this does not happen. The immobility of resources in agriculture leads to the aggravation of the long-term farming problem. The peculiarity of the rural resident and the rural worker is expressed in his special attachment to the foundations of life and work and causes a special social conservatism of this part of the population (The state of agricultural markets).

The price inelasticity of demand for agricultural products, combined with the high dependence of agricultural production on natural factors and the competition of producers, gives rise to a short-term farming problem: prices on the agricultural market are extremely unstable. The slightest fluctuations in the volume of supply, depending on the thousands of reasons beyond the control of the farmer (high or low yield) - and the price falls or soars at an inadequate speed (Debertin L., p.9)

In accordance with the Food and agriculture of Organization of the United Nations report about indexes the Table 6 can be constructed.

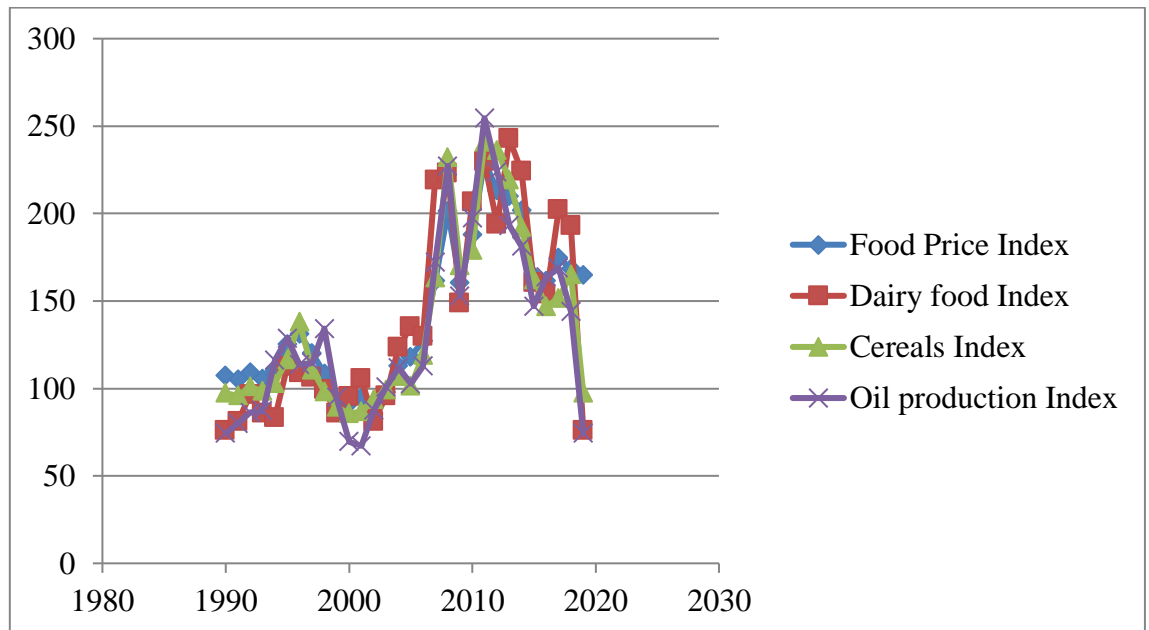
Table 6 – Price indexes for agriculture products

Year	Food Price Index	Dairy food Index	Cereals Index	Oil production Index
<b>1990</b>	107.2	75.8	97.3	74.2
<b>1991</b>	105.0	80.8	95.8	79.9
<b>1992</b>	109.2	96.5	101.1	86.2
<b>1993</b>	105.5	85.6	98.4	87.1
<b>1994</b>	110.3	83.3	103.0	116.2
<b>1995</b>	125.3	112.6	116.6	128.7
<b>1996</b>	131.1	108.7	137.9	113.7
<b>1997</b>	120.3	106.2	110.7	114.6
<b>1998</b>	108.6	99.4	98.3	134.2
<b>1999</b>	93.2	85.8	89.3	94.7
<b>2000</b>	91.1	95.3	85.8	69.5
<b>2001</b>	94.6	105.5	86.8	67.2
<b>2002</b>	89.6	80.9	93.7	87.4
<b>2003</b>	97.7	95.6	99.2	100.6
<b>2004</b>	112.7	123.5	107.1	111.9
<b>2005</b>	118.0	135.2	101.3	102.7
<b>2006</b>	127.2	129.7	118.9	112.7
<b>2007</b>	161.4	219.1	163.4	172.0
<b>2008</b>	201.4	223.1	232.1	227.1
<b>2009</b>	160.3	148.6	170.2	152.8
<b>2010</b>	188.0	206.6	179.2	197.4
<b>2011</b>	229.9	229.5	240.9	254.5
<b>2012</b>	213.3	193.6	236.1	223.9
<b>2013</b>	209.8	242.7	219.3	193.0
<b>2014</b>	201.8	224.1	191.9	181.1
<b>2015</b>	164.0	160.3	162.4	147.0
<b>2016</b>	161.5	153.8	146.9	163.8
<b>2017</b>	174.6	202.2	151.6	168.8
<b>2018</b>	168.5	192.9	165.3	144.0
<b>2019</b>	164.8	75.8	97.3	74.2

The source for the Table construction is (Food and agriculture of Organization of the United Nations).

Taking care of the data set it is worth to construct the graph in order to illustrate changes in the price index. For the constructing graph the Table 6 will be used.

Graph 1– Changes in the Price Index



The source for the constructing Graph 1 is the (Food and agriculture of Organization of the United Nations).

As it can be observed in the Graph 1 there is a growth in the price indexes for the production during last 30 years. From 1990 till 2000 there were fluctuations around the pretty similar price indexes the whole production but starting from 2000 till 2015 there is a rapid growth in the price index for whole types of products. There are some reasons for the mentioned rapid growth:

- **Inflation rate.** In this case inflationary there are changes in certain groups of goods because they cause changes in financial markets. The more numerous the changes the more significant they are. The behavior of any group of goods with the inflationary changes which may be the most significant and unexpected. When unforeseen changes come to a sector for which changes are unusual, they are usually less influential than price changes in the sector of net inflation (The modern economic theory).
- **The value of money and Industrial prices.** If the economy develops under normal conditions, in that case there is an increase in CPI and PPI which may lead to the raise in key interest rates in the country. This, in turn, leads to an increase in the dollar because it increases the attractiveness of investing in currency with a higher interest rate (The modern economic theory).

In January 2019, the average value of the FAO Food Price Index was 164.8 points, which is almost 3 points higher than in December 2018, but 3.7 points (2.2%) lower indicator of the corresponding period last year (FAOSTAT).

The average value of the FAO Grain Price Index in January was 168.1 points, which is slightly higher than the December figure and almost 11.5 points (7.3%) higher than in January 2018. Prices for major grains, with the exception of rice, remained generally high at the background of declining world production in 2018, reducing exports and maintaining steady global demand. There was particularly low activity in the wheat and corn markets in January, partly due to the lack of reporting on a number of key indicators in the United States due to the suspension of government work. Nonetheless, grain prices rose during the month due to adverse weather conditions in South America, with corn prices increasing the most. World prices for rice also increased, primarily due to strong demand for Japanese rice varieties (FAOSTAT).

There are some prognosis according to the FAO in case of corns market behavior:

- The world cereal consumption in the 2018/2019 agricultural year is projected at 2,657 million tons, which is almost 45 million tons (1.7%) more than in the 2017/2018 season, also it surpassed the number which is 8 million tons than it was predicted in December. The increase compared with the December forecast reflects upward adjustments to take into account the fodder use of wheat and the industrial use of coarse grains, mainly maize and barley. The global wheat consumption in 2018/2019 agricultural year is projected to reach almost 743 million tons, which is 3 million tons more than the December forecast and 5.6 million tons (0.8%) higher than expected consumption in 2017/2018. The increase is mainly due to an increase in the consumption of wheat for livestock feed, especially in Australia, where dry weather has led to a reduction in pasture land, which in turn has necessitated an increase in the consumption of feed wheat. In other regions, a slight increase in feed wheat consumption in the European Union was more than offset by a reduction in its consumption in the Russian Federation, where, according to some reports, poultry producers are switching to corn. The global consumption of rice in the 2018/2019 agricultural year will be 509 million tons. The mentioned annual increase of 1.1% is primarily happens due to an increase in food consumption in Asia and Africa.
- Global grain stocks are projected to decrease by 45 million tons (5.6%) compared with a record high of 772 million tons at the beginning of the season that means that stocks will be about 10 million tons higher than the December forecast. With such a volume, the ratio of grain stocks and their consumption in the world will remain at a relatively comfortable level of 28.5%, which is slightly lower than the figure for the 2017/2018 season, when it reached the maximum level from the 2000/2001 season which is 30.8%.

It is worth for constructing the Table 7 with the price indexes for the specific types of products.

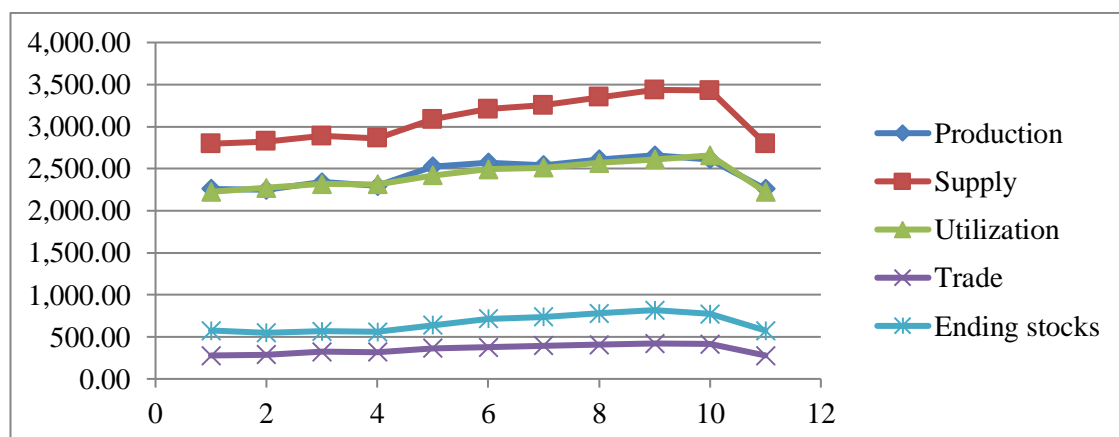
Table 7 – World cereal market

World cereal market						
Year	Production	Supply	Utilization	Trade	Ending stocks	World stock-to-use ratio
2009/10	2 260,5	2 796,0	2 224,1	278,3	573,0	25,2
2010/11	2 249,1	2 822,1	2 272,5	289,9	547,6	23,6
2011/12	2 341,0	2 888,6	2 317,2	322,5	567,4	24,5
2012/13	2 294,2	2 861,6	2 312,3	318,2	559,9	23,1
2013/14	2 526,5	3 086,5	2 419,0	364,2	638,1	25,6
2014/15	2 570,9	3 209,0	2 491,5	377,1	713,8	28,4
2015/16	2 540,9	3 254,8	2 511,6	393,0	737,5	28,7
2016/17	2 611,7	3 349,2	2 569,0	405,3	777,5	29,8
2017/18	2 658,8	3 436,3	2 612,0	421,3	817,9	30,8
2018/19	2 611,4	3 429,3	2 657,5	415,5	772,2	28,5
2009/10	2 260,5	2 796,0	2 224,1	278,3	573,0	25,2

The source for the Table 7 is the (Food and agriculture of Organization of the United Nations).

Relying on the Table 7 the Graph 2 can be constructed where the main tendencies will be illustrated. The elements for the construction are: production, supply, utilization, trade, ending stocks during and world stock-to-use ratio during 11 years.

Graph 2 – Changes in the world cereal market



As it can be observed in the Graph 2 there are small changes in case of trade and ending stocks, but significant changes in supply and utilization. Also, the falling tendency is illustrated in



this graph that indicates problems in case of the political and economical situation in case of agriculture (Food and agriculture of Organization of the United Nations).

In accordance with the FAO report the average value of oil price index in January was 131.2 points which is 5.4 points (4.3%) higher than last month, while growth continued for the second month in a row after a long period of decline.

This growth is mainly due to the increase in prices for palm oil against the background of a seasonal decline in production in the main producing countries and the preservation of active import demand in world markets.

International prices for soybean oil also increased in most cases due to stable demand for South American products (Food and agriculture of Organization of the United Nations).

The average value of the FAO dairy product price index in January was 182.1 points, which is 12.2 points (7.2%) higher than in December, 2018. A sharp increase in this indicator occurred after seven months of steady decline.

In January prices for all types of dairy products (included in this index increased and the quotations for skimmed milk powder) increased by 16.5% compared to the previous month. Such a sharp increase is due to the decline in exports from Europe as a result of strong domestic demand, as well as the seasonal decline in export opportunities in Oceania that is projected in the coming months.

Despite this price increase, the value of the index only slightly exceeds the level of the corresponding period last year (Food and agriculture of Organization of the United Nations).

In case to multiple the efficiency of agriculture some global policies were proposed and introduced.

The main proposals are presented in the Table 8 with the description of the policy.

Table 8 – Policies in the world agriculture

Policy	Description
Global Sustainable Livestock Program	This program is a partnership of stakeholders representing the livestock sector organized for its sustainable development. The program involves reaching a consensus on achieving sustainability in animal husbandry and contributes to making coherent and collective changes to existing practices through dialogue, consultation and joint analysis.
Global Soil Partnership	The GSP will engage in raising awareness and promoting capacity building, drawing on the best available scientific evidence and promoting /facilitating the exchange of knowledge and technology among stakeholders for the sustainable management and use of soil resources.
Commission on Plant Genetic Resources for Food and Agriculture	The Commission seeks to put an end to the loss of genetic resources necessary for food and agriculture and to ensure the global food security and sustainable development by promoting their conservation and sustainable use, including exchange, fair and equitable sharing of benefits from their use.

The source for the Table 8 constructing is (FAOSTAT).

All of these measures show that the world situation in case of agriculture is suffering from different problems. The formation of partnerships between sectors, in all fields of society, is the most important factor contributing to the effective involvement of all stakeholders in the process. Such measures help agriculture producers to be more concentrate on the production quality and the use of available resources. It forces some rules of leading the business but in the same time controls the production quality and damages to the environment.

## 5.2 The analysis of the agriculture market in Russia

Russia which obtains the third largest arable land in the world and a considerable non-urban population has a lot of problems in agriculture industry.

The Table 9 represents the main Russian agriculture data.

Table 9 – The main agriculture data for Russia

Country area ( $km^2$ )	Land area ( $km^2$ )	Agriculture area ( $km^2$ )	Forest area ( $km^2$ )
1709825	1637687	217721.82	814889.48

The source for the constructing Table 9 is the Food and agriculture of Organization of the United Nations.

Started in the 1990s. agrarian reform was educed mainly to the abolition of the state monopoly on land. Collective farms (kolhozy) and state farms (sovhozy) were transformed into limited liability companies, partnerships and cooperatives with the allotment of their members (former members of collective farms and state farms) with conditional shares in the total land ownership of these agricultural organizations and the right to withdraw from them with their share. Nowadays, former collective and state farms still being major producers of agricultural products - about 20-25% of its volume. Participants in societies, partnerships and cooperatives are interested in their existence largely because they remain a source of tangible income for them, and also because former collective and state farms provide their members with agro machines assistance (tractors, feed, and fertilizer) for their personal farms (Russia Agriculture Policy review).

Other agricultural organizations consist mainly of private agrofirms and agroholdings which have bought out land shares from former collective farmers and state farmers and use them as hired labor. These organizations produce the rest of agricultural products, i.e. about 25-30%. Like the former collective and state farms they specialize in the production of grain, sugar beet, meat, milk and eggs. They are the most dynamic sector of the Russian agro-industrial complex (Russia Agriculture Policy review).

Nevertheless, along with the traditional for Russia large imports of tropical and subtropical agriculture, milk and dairy products, have grown, primarily due to the reduction of herds of cattle.

However, due to the reduction of this herd, grain surplus was formed (the grain collected in the country goes mainly to feed livestock), and therefore the country exports it more and more.

The main reasons why agriculture in modern Russia does not cope with the mentioned problems are the following:

- The failure of the agrarian reform (the collective farmers did not become farmers).
- Lack of equipment.
- Unskilled personnel.
- Price disparity.
- Insufficient state support.

Thus, the price disparity (faster growth in prices for products for agriculture compared with growth in selling prices for agricultural products) dramatically reduces the already traditionally low profitability of agricultural activities. It happens is largely due to weak antitrust activity of the state in agricultural and retail markets where large retail chains often buy agricultural products at low prices which are close to costs (at the same time introducing high trade margins for these products) (Russia Agriculture Policy review).

Thus, the state company “Rosagroleasing” operates to assist farmers in the purchase of agricultural machinery and breeding livestock. It also intervenes in the grain market to maintain cost-effective domestic prices through the purchase of grain. To support domestic producers there are various quotas on the transportation of imported food, primarily meat.

The debt of agricultural enterprises is restructured. Various subsidies and compensations from the State budget were given to enterprises. State support from the budget is carried out within the framework of the State program for the development of agricultural products regulations, raw materials and foodstuffs of the Russian Federation (Russia Agriculture Policy review).

The aggregate budget support for agricultural producers in Russia was 15% of the gross agricultural output value, i.e. it was at the level of the United States and Canada. However, the main part of the subsidies was received by a rather narrow group of several hundred largest agricultural organizations, i.e. state support is aimed at large and profitable agricultural organizations (agro-firms and agro-holdings) which are natural for monopoly State capitalism. This conclusion is correlated with the fact that about 60% of the total funds (allocated from the state budget for agriculture and fisheries) were spent on intermediaries, contractors and suppliers.

In 2012 Russia faced 2 important events in the field of agriculture: firstly, Russia joined the WTO, and secondly it proposed the "State Program for the Development of Agriculture and Regulation of Agricultural Products, Raw Materials and Foodstuffs for 2013-2020". The most important fields of the mentioned program are:

- Russia's food security in the agriculture market.
- Improvements of the import substitution of meat, dairy products, vegetables, potatoes, fruit and berry products.
- Increase Russian products competitiveness in case of domestic and foreign markets.

- Estimate the efficiency of land use.
- Development of rural areas.
- The formation of an innovative agro-industrial complex (Russia Agriculture Policy review).

Also the Government supports agriculture by opening fund and investing money in different types of equipment. Over the past three years, the agrarian policy of the state has largely focused precisely on stimulating investment in agriculture. There is one conclusion that investments in agriculture are growing well: firstly, with budget support from the state, secondly, investors began to treat agriculture differently due to the rise in world food prices and the increasing importance of agriculture as a whole. According to expert estimates, in 2008–2013 the need for this sector in investments will amount to \$ 70 billion (Investments in agriculture as perspectives or uncertainty and risks).

Factors affecting the future development of agriculture:

- **The right to acquire land in property.** Today, land can be bought and sold. According to experts, about 13% of the total cultivated agricultural land is owned by individual farmers, 78% is owned by agrarian companies, 9% by individuals. About 40% are owned by regional administrations and state structures within the framework of agricultural enterprises (Investments in agriculture as perspectives or uncertainty and risks).
- **Tax benefits.** In 2005, the government established new taxes for agricultural producers. Namely, for 2006–2008, a zero income tax rate was adopted, which should increase in 2009 to 6%, and in 2010–2011 to 12% against the current 24% in other sectors.
- **Import regulation.** In 2003, quotas were established for the import of raw meat, and the quotas are reviewed annually (Investments in agriculture as perspectives or uncertainty and risks).
- **Created conditions for borrowing.** Money is allocated from the federal and local budgets to subsidize interest expenses on loan servicing, which are related to investments in agriculture. The state compensates interest expenses to agricultural companies in the amount of 95% of the Bank of Russia refinancing rate, but not more than 95% of total interest expenses. For example, if an agrarian company received a loan at a rate of 13%, the government pays the bank 9.5%, and the manufacturer itself pays the remaining 3.5% (Investments in agriculture as perspectives or uncertainty and risks).
- **Intervention in the grain market.** In order to influence the prices of the country's domestic market, the Ministry of Agriculture has created a special fund. Its grain reserves are replenished by government purchases in high-yielding years. Grain is placed in private vaults and stays there until the situation changes and domestic grain prices rise against the

background of significant exports or poor harvests (Investments in agriculture as perspectives or uncertainty and risks).

- **Compensation of the cost of fertilizers, seeds and fuel.**
- **Investments in the production of agricultural products.** Investing money gives Russian companies an opportunity to receive subsidies, as well as guarantee them preferential tax treatment. In addition, there is a favorable pricing policy inside the country, and in the future, Russian holdings are able to enter global agricultural markets. Moreover, investments in the production of grain reduce raw material costs if the value chain provides for further processing or if it is used as a raw material (Investments in agriculture as perspectives or uncertainty and risks).
- **Investment in land.** It is clear that prices do not reflect its real value, so consumers can purchase farmland as a rising asset that can generate rising cash flows. In addition, the land can be used as a loan for the future credits (Investments in agriculture as perspectives or uncertainty and risks).

In conclusion it should be said that the Russian agriculture sector has the potential to grow significantly in the years to come. In addition, by obtaining major significance for global food supply, this will create many investment opportunities for global agriculture sector investors in case of improvements some technologies and methods.

### 5.3 The analysis of the agriculture market in the Czech Republic

The most developed areas in the Czech republic are trade and tourism. As for agriculture the share of its product in the country's GDP is less than 2%. The climate of the Czech Republic and its geographical location have a beneficial effect on the cultivation of various fruit, vegetable, cereal crops, as well as for breeding livestock and poultry. The main grain crops are wheat, rye, barley, oats. Also, good yields of potato and sugar beet are obtained here. There are huge vineyards in South Moravia where wines are made. For the preparation of wine large areas of agricultural land are sown with hops.

The Table 10 represents the main Czech agriculture data.

Table 10 – The main agriculture data for Czech

Country area ( $km^2$ )	Land area ( $km^2$ )	Agriculture area ( $km^2$ )	Forest area ( $km^2$ )
7887	7722	3489	2669

The source for the constructing Table 10 is the (Food and agriculture of Organization of the United Nations)

Also, there are some organizations which are responsible for different duties in agriculture which are shown in the Table 11.

Table 11 – The main organizations in the field of Czech agriculture

Name	Description
<b>The Crop Research Institute</b>	<p>It was established in 1951 as the Central Research Institute of Crop Production.</p> <p><b>The basic aim of the CRI:</b></p> <ul style="list-style-type: none"> <li>- the development of scientific knowledge in the fields of integrated crop production;</li> <li>- production of hygienically-safe foodstuffs;</li> <li>- the creation of bases for sustainable development of agriculture;</li> <li>- environment protection.</li> </ul>
<b>Agricultural Association of the Czech Republic</b>	<p>It controls mainly co-operatives and trade companies dealing with agriculture and similar type of activities.</p> <p><b>The aim of the company activities:</b></p> <ul style="list-style-type: none"> <li>- defending the interests of its members;</li> <li>- contribution to the development of business activities;</li> <li>- provision of services;</li> <li>- consultation in the economic, entrepreneurial, legal and social areas.</li> </ul> <p><b>The aim of the Association:</b></p> <ul style="list-style-type: none"> <li>- coordination of common agricultural co-operatives procedures;</li> <li>- enhancement their competitiveness on the regional, as well as national scale and also abroad.</li> </ul>
<b>Institute of Agricultural Economics and Information</b>	<p>IAEI is the expert centre for the agricultural economy, food, agricultural advice and information.</p> <p><b>The main aims of IAEI</b></p> <ul style="list-style-type: none"> <li>- providing research and development in the field of agricultural economics and policy, including the development of the multifunctional character of agriculture and rural development;</li> <li>- analysis of obtained results;</li> <li>- teaching;</li> <li>- publishing articles in case of knowledge providing;</li> </ul>

The sources for the Table 11 are official sites (Institute of Agricultural Economics and Information, Agricultural Association of the Czech Republic, The Crop Research Institute).

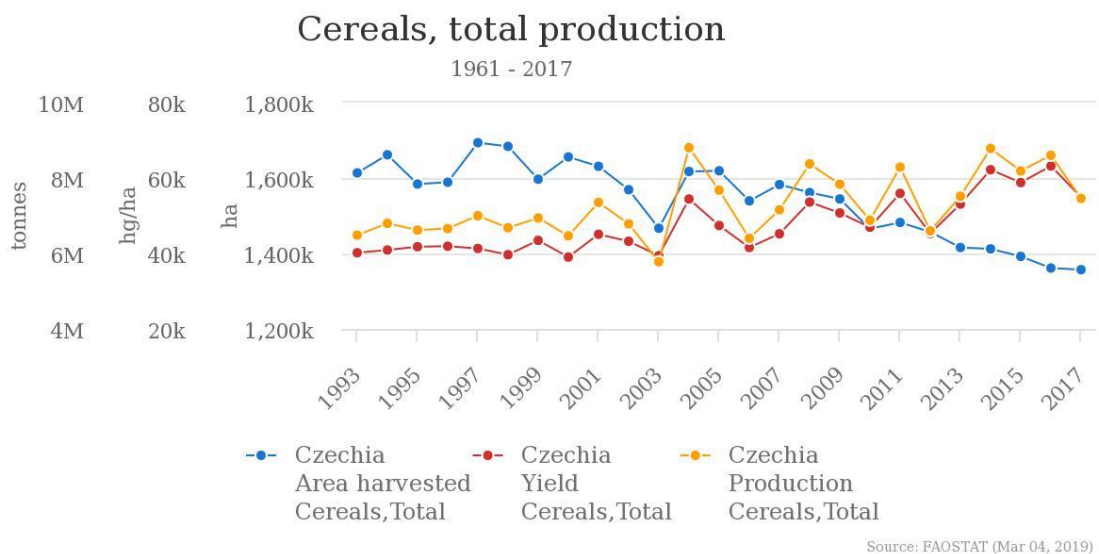
Agriculture in Czech is well automated. Previously, the Czech Republic did not only provide itself with basic agricultural products, but also exported a part of its production. Recently, however, agriculture is going through hard times and is considered the most risky business sector in the Czech Republic.

Salaries are low, policies to overcome the crisis led to lower prices for agricultural products, the struggle for the environment safe hit this industry also. The area under cultivation is reduced, livestock breeding is reduced, the vacated fields are planned to be given for an increase in forest land and villagers are beginning to move to the cities. In the case of not taking measures to support the agricultural producer from the government, the Czech Republic may be left without its agricultural base and be completely dependent on importers ((World Bank and Csaba Csaki,1999).

Since 2002, the Czech Republic has been financing a series of training programs in the Balkan region on the transfer of knowledge and best practices of a wide range of topics: from the consolidation of land and the collection of data disaggregated by sex to sustainable forest management and rural development technologies. The government has also contributed to a number of agricultural development and assistance programs in Africa (Agricultural Association of the Czech Republic).

It is better to illustrate total cereals production from 1993 till 2017 by implementing the Graph 3.

Graph 3 – Changes in cereal total production



The source of the Graph 3 is the (Food and agriculture of Organization of the United Nations).



According to the Graph 3 it can be noticed that at the start of the nineties, cereal production had a very difficult period. According to the history there are some reasons for having trouble times in 90<sup>th</sup>:

- Social changes.
- Transformation.
- Privatization.

The average yields per hectare decreased significantly, as did the production of all cereals compared to the results of harvests in the European Union (Ministry of Agriculture of the Czech Republic).

As it can be seen in the Graph 3 there is a growth in the total cereal production starting from 2006-2007. There are some reasons for this situation:

- In 2007 grain harvest in the Czech Republic was very high, with increased prices for grain crops which is primarily due to the use of grain for the production of biocomponents in automotive fuels and, consequently, an increase in demand for these crops. For example, the price of food wheat in 2007 doubled to \$ 289 per ton, and under long-term contracts - \$ 450. In addition to wheat, in 2007 there was a significant increase in prices for soybeans and rapeseed, which reached their historical maximums by the end of the year. At the same time, there was a decrease in corn prices (Agricultural Association of the Czech Republic).
- Cereal production had changes in quantity depending on the weather, its average for the 2006–2016 period was 7 696000 tones, which is more than sufficient for domestic consumption (Agricultural Association of the Czech Republic).
- The government was focused on organic farming (Agricultural Association of the Czech Republic).

Later on the ministry decided to have the deal with farmers and support them by organizing subsidies which are shown in the Table 12. In case to provide efficient support the Czech Republic European Commission approved the final version of the fundamental document which is focused on the Rural Development Programme of the Czech Republic. In accordance with the Rural Development Programme about EUR 3.5 billion will be delivered to the Czech agriculture over the next years. In details EUR 2.3 billion will come from the Union sources and EUR 1,2 billion will be obtained by the Czech budget

Table 12 – Subsidies in the Czech Republic

<i>No</i>	<i>Subsidies</i>
1	Organic Food 2008-2010 promotion campaign which includes a total subsidy which is 1 million EUR.
2	European Bioacademy, Biosummit, and Scientific Conference on OF which was focused on international conferences on Organic Farming support which placed in CZ .
3	Modernisation of agricultural holdings.
4	Setting up of young farmers.
	Organic Food Month which was set as support for Organic Farming.
5	Adding value to agricultural and food products.
6	Encouragement of tourism activities (in other words it calls agrotourism).
7	Diversification of activities in non-agricultural areas.

The source for the Table 12 is (Czech Ministry of Agriculture).

As it is known organic farming plays the important role for the Czech Republic started from 1990. Although the key role was played by the non-governmental sector until 2000 (OF associations, organic food traders, ecology-focused NGOs and).

But the Action Plan of the Czech Republic for the Development of Organic Farming until 2010 was adopted by the Czech Government in 2004 (Agricultural Association of the Czech Republic).

Organic farming is a holistic production management system that supports and contributes to the health of the agro-ecosystem, including biodiversity, biological cycles, and the biological activity of the soil.

It is a system that focuses on management practices, rather than on the use of external agricultural resources, taking into account that specific regional conditions require their own systems adapted to their region. All this is accompanied by the application, where possible, of agronomic, biological and mechanical methods, as opposed to using synthetic materials to ensure the functioning within the system (Ministry of agriculture of the Czech Republic).

Three different types for organic farming can be mentioned:

- Consumer and market oriented organic agriculture. Products are clearly identified as organic, subject to appropriate certification and labeling. The consumer in this case has its own impact on organic production.
- Service-oriented organic farming. In many countries of the European Union funds are being created that subsidize organic agriculture and produce ecological products and

services, such as combating pollution of groundwater or creating a richer and more biologically diverse natural landscape.

- Organic farming oriented to farmers. Some farmers believe that traditional farming methods are irrational and harmful, and develop their own alternative methods to improve family health, economic vitality of the farm and / or maintain self-reliance. In many developing countries organic farming methods are used to maintain the safety of food grown on the farm, as well as to reduce the cost of purchasing external resources. The products of such farms are not necessarily marketed, or may be sold without any extra charge, as they are not certified. In developed countries, small farmers are trying to establish a distribution channel for their organic non-certified products directly to consumers.

The Ministry of Agriculture supports the development of organic farming in the Czech Republic, it guarantees compliance with the rules for organic farming. It plays the active financial role in supporting marketing, awareness programmes, education and equipment. (Ministry of agriculture of the Czech Republic).

In collaboration with non-governmental organisations the Ministry of Agriculture have introduced “Action Plans for the Development of Organic Farming in the Czech Republic”. The period of the plan submission is 2016 – 2020 (Ministry of agriculture of the Czech Republic).

The preparation of the “Action Plans for the Development of Organic Farming in the Czech Republic” is a response to the current developments in the area of organic farming. It is taken a place in the EU. The new Common Agricultural Policy will be focused on some important fields. These fields are:

- Focusing on consumers and providing to EU farmers the ability to produce what is in demand on the market.
- Supporting the majority of subsidies which will not depend on production volumes in the future.
- Increasing quality of production which will be given priority over its quantity.
- Implementing the ability where farmers will have more money to spend on programmes related to the environment, production quality and rural development (Action Plans for the Development of Organic Farming in the Czech Republic in duration from 2016-2020)

Table 13 – Development in the organic farming

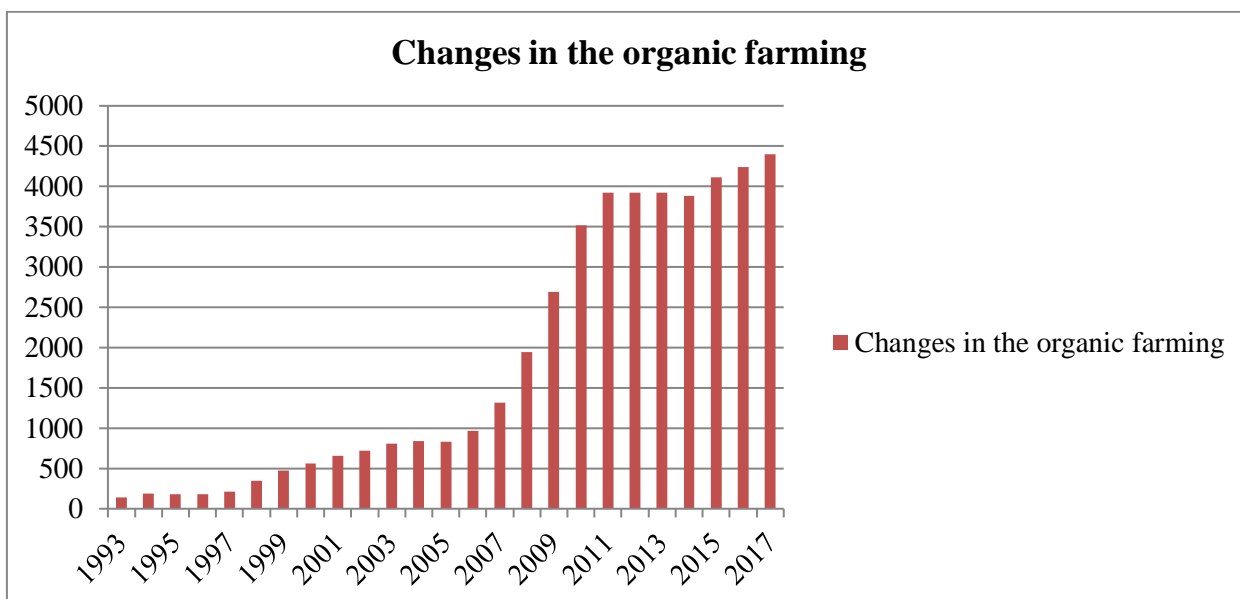
<i>Year</i>	<i>Number of Organic farms</i>	<i>Acreage of farmland under Organic farming (ha).</i>	<i>Percentage of total agriculture land (%)</i>
<b>1993</b>	141	15667	0.37
<b>1994</b>	187	15818	0.37
<b>1995</b>	181	14982	0.35
<b>1996</b>	182	17022	0.4
<b>1997</b>	211	20239	0.47
<b>1998</b>	348	71621	1.67
<b>1999</b>	473	110756	2.58
<b>2000</b>	563	165699	3.86
<b>2001</b>	654	217869	5.09
<b>2002</b>	721	235136	5.5
<b>2003</b>	810	254995	5.97
<b>2004</b>	836	263299	6.16
<b>2005</b>	829	312890	5.98
<b>2006</b>	963	254982	6.61
<b>2007</b>	1318	312890	7.35
<b>2008</b>	1946	341632	8.04
<b>2009</b>	2689	398407	9.38
<b>2010</b>	3517	448202	10.55
<b>2011</b>	3920	482927	1.4
<b>2012</b>	3923	488483	11.56
<b>2013</b>	3926	493896	11.7
<b>2014</b>	3885	493971	11.72
<b>2015</b>	4115	494661	11.74
<b>2016</b>	4243	506070	12.03
<b>2017</b>	4399	520032	12.37

The source of the Table 13 is (Organic farming in the Czech Republic).

In accordance with the Table 13 there is a growth tendency in the organic farming creation. As it can be notice the rapid growth in quantity of organic farming starts in 2006 and it is rising every year. In comparison with 2009 the quantity in 2009 increased by 27 % that means that the Czech government supports organic farming and takes a lot of care of its' development.

The changes in farming quantity can be presented by using the Graph 4.

Graph 4 – Changes in the organic farming development



The source for the Graph 4 is the Table 13.

Taking care of the organic farming in the Czech Republic it is developing especially in parts of the country where conditions for production system are rather poor. Nearly 90 % of organic land is situated in less favorable areas (it means that they are placed nearly all permanent grassland acreage and up to 70 % of arable land) (Organic farming in the Czech Republic).

At the end of 2017 674 businesses were registered as producers of organic foods. Comparing 2017 and 2016 there is an increase of 11 %, which represents a significant recovery from previous years (Organic farming in the Czech Republic).

In 2017 4399 firms were registered as organic farming which has quote the similar results which were obtained in 2016 with the number 4243. As it can be noticed the growth is small but important for the future development of organic farming.

Concentrating attention on exporter of organic foods from 3<sup>rd</sup> countries there is a rising tendency with the negative meaning. In 2017 the number was 190 but it increased in 2017 with the value 251. Such situation shows that there are some existing problems in case of Czech organic farming.

The Table 13 illustrates differences in quantity of organic farming in 2016 and 2017.

Table 14 – Numbers of registered organic farms in the Czech Republic.

<i>Type of organic business</i>	<i>Number of businesses</i>	
	<i>2016</i>	<i>2017</i>
Organic farmer	4243	4399
Feed producer	49	58
Seed producer	44	50
Producer of organic foods	607	674
Importer of organic foods from 3 <sup>rd</sup> countries	190	251
Exporter of organic foods from 3 <sup>rd</sup> countries	96	42
Farm processor	219	225

The source of the Table 14 is (Organic farming in the Czech Republic).

Nowadays about half of the organic food products that are sold on Czech markets are imported. On the other hand, the Czech Republic exports grain, medicinal and aromatic herbs. These products are mainly exported to the markets of organic products in Slovakia, Central and Eastern Europe. The index of organic food imports to the Czech Republic exceeds exports. It should also be mentioned that the majority of organic foods are sold in retail chains as well as in specialized health food stores.

In December 2010 the situation positively changed. The Action Plan of the Czech Republic for the Development of Organic Farming between 2011 and 2015 was adopted by the Czech Government in the mentioned year. The government aimed to achieve 15 % organic acreage, to increase the share of Czech organic food on the market to at least 60 %, 20 % arable land from organic acreage and to come up to 3 % of organic product from whole food consumption in the country. Also it was focused on research and education improvement (Czech Ministry of Agriculture).

In conclusion it should be mentioned that both countries faced problems in agriculture development during they history. The both countries have faced troubles in political situation in 90s that influenced on agriculture development. The strict political situation created the gap between producers and consumers. The Czech Republic have had similar problems but later on governments implemented different policies for increasing agricultural situation in the future.

Taking care of the Czech Republic it has the support from the EU which is interested in the organic farming. It introduces modernization and supplement of high quality equipment.

Analyzing both players in the agricultural field there are some troubles which can be a barrier for the future agricultural development. These problems were connected with the similar reasons for both countries:

- Weak local policy for the sustainable development of agriculture. Prices for leading independent business in Russia are very high also all rules of products quality should be followed. In case of the Czech Republic it has the support from the government and EU but it mostly is focused on the development of organic farming.
- Dependence on currency. Russia and the Czech Republic have their own currencies so in case of exporting or importing goods they need to rely on the currency of the abroad country. Mainly this problem occurs to Russia especially nowadays when the value of the Russian currency is falling down.
- Weather changes due to the environment sufferings. This factor is the most unpredictable because there are a lot of harvest problems due to environmental changes.
- Joining to the WTO which played the important role for the access to the abroad market.

## 6.1 Econometric Modeling

### 6.1.1 Panel Data Set of demand of the agriculture elasticity and its choice for the agricultural market

For the model construction two variables for all products were used, these variables are:

- 1) X is the price which is the independent variable.
- 2) Y is the production elasticity which is the dependent variable.

In the research 4 types agricultural product were used:

- Wheat.
- Barley.
- Eggs.
- Milk.

So there are 2 groups of products:

- 1) Livestock production.
- 2) Crops production.

The time for the analysis is 25 years. This choice was done in accordance with the Czech history. As it is known the Czech Republic became independent from Czechoslovakia in 1993, so the interest in the data set is connected with the political and social changes which influenced on the production volume.

The data set includes two variables: price (the currency is EUR per 100 kg) and volume (it is measured by million kilograms). All of variables were found in the official data sources such as Eurostat, FAOSTAT, Czech Statistical Office and etc.

In case of steps in analysis there is the following outline:

- 1) To introduce the data set for the analysis.
- 2) To implement the linear regression and correlation analysis.
- 3) To use the logarithmic regression and F-test.
- 4) To calculate changes in elasticities during 25 years.
- 5) To forecast future changes in elasticities.

First of all it is worth to present the data set for each type of the production. The data is represented in the Table 15.



Table 15 – The data set for the research

<i>Year</i>	<i>Wheat Prices (EUR per 100kg)</i>	<i>Wheat Volume (mln kg)</i>	<i>Cows' milk price (EUR per 100kg)</i>	<i>Cows' milk volume (mln kg)</i>	<i>Barley prices (EUR per 100kg)</i>	<i>Barley volume (mln kg)</i>	<i>Eggs prices (EUR per 100kg)</i>	<i>Eggs volume (mln kg)</i>
<b>1993</b>	7,16	3504	16,81	3453	7,83	2418	7,25	3100
<b>1994</b>	10,23	3713	16,70	3218	7,19	2419	7,78	2999
<b>1995</b>	11,58	3822	18,52	3112	6,88	2140	7,11	3047
<b>1996</b>	10,20	3727	19,90	3121	9,31	2262	8,99	2948
<b>1997</b>	10,38	3640	20,39	2776	9,8	2484	9,83	3322
<b>1998</b>	8,79	3844	22,48	2789	8,13	2093	9,29	3615
<b>1999</b>	6,86	4028	19,26	2810	6,07	2137	7,32	3307
<b>2000</b>	9,55	4084	21,38	2781	9,19	1629	8,62	3064
<b>2001</b>	11,54	4476	23,20	2774	11,65	1965	7,51	3190
<b>2002</b>	11,04	3866	25,47	2801	13,08	1792	9,36	1829
<b>2003</b>	10,61	2637	24,57	2717	11,12	2068	9,66	1858
<b>2004</b>	12,23	5042	26,04	2672	11,45	2330	8,16	1708
<b>2005</b>	9,23	4145	26,04	2812	9,4	2195	8,58	1556
<b>2006</b>	10,93	3506	27,45	2392	10,08	1897	5,22	1508
<b>2007</b>	16,49	3938	26,8	2445	14,17	1893	6,03	1618
<b>2008</b>	20,47	4631	36,82	2432	20,43	2243	7,03	1721
<b>2009</b>	10,93	4358	22,97	2353	11,33	2003	6,55	1667
<b>2010</b>	13,42	4161	25,61	2312	12,33	1584	6,46	1236
<b>2011</b>	20,49	4913	32,05	2366	18,03	1813	5,81	1271
<b>2012</b>	20,08	3518	31,72	2428	20,04	1616	8,87	1149
<b>2013</b>	20,36	4700	30,01	2358	20,82	1593	6,81	1233
<b>2014</b>	16,27	5442	34,35	2370	13,39	1967	6,68	1294
<b>2015</b>	15,84	5274	29,62	2481	16,61	1991	6,89	1245
<b>2016</b>	13,69	5454	26,27	2793	14,91	1845	6,18	1313
<b>2017</b>	14,51	4718	27,78	2979	14,51	1712	7,82	1468

Sources for the Table 15 are (Eurostat, FAOSTAT, Czech Statistical Office).

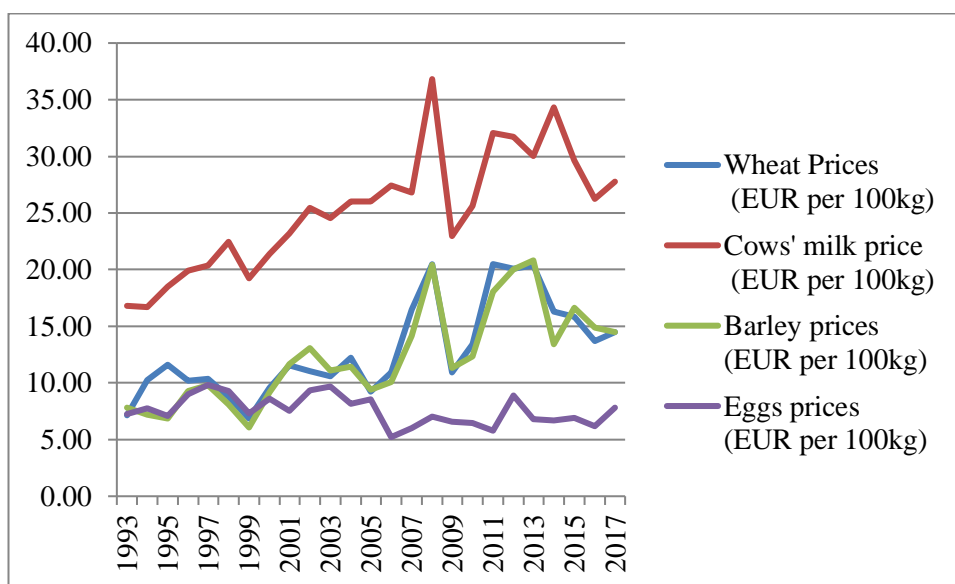
As it can be seen in the table the most expensive product among four is milk. The price starts from 16,7 Euro per 100 kg and the highest price was 36,82 in 2008. As for eggs their price is pretty the same during all years. This situation is connected to the fact that eggs do not depend on

weather and equipment so there are not so high costs as for milk production where the technology and feed play the important role in quality and quantity.

Analyzing the corn production it can be seen that barley has quite equal price as wheat has. These two products have the negative tendency for consumers: their price doubled in 2011 and continued growing.

The Table 15 can be presented by constructing graphs 5 and 6. The graph 5 introduces changes in prices, the graph 6 shows changes in volume.

Graph 5 – Changes in prices for agriculture production during 25 years

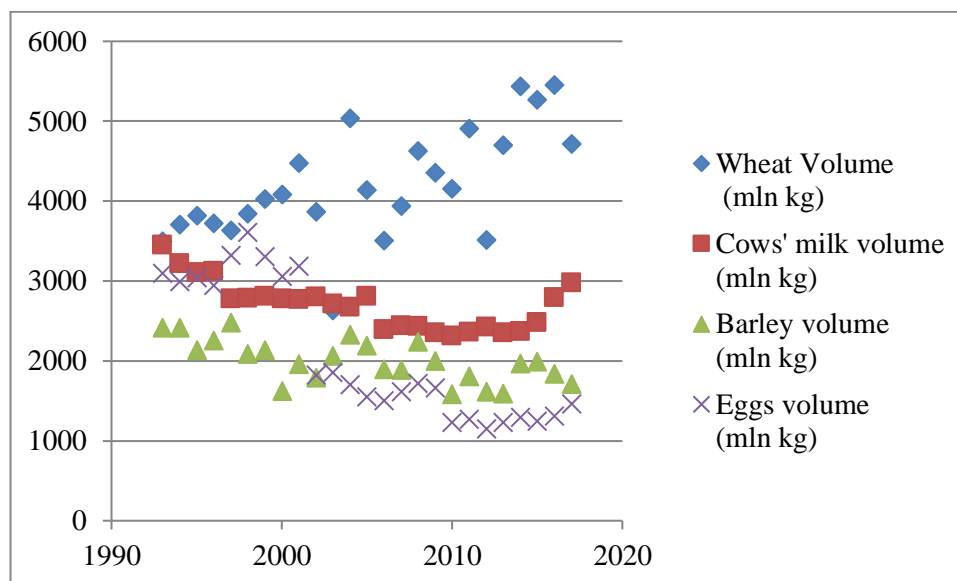


Sources for the Graph 5 are (Eurostat, FAOSTAT, Czech Statistical Office).

Relying on the Graph 5 the rising trends in prices can be observed for all products. Starting from 1993 prices are growing sharply in case of milk, barley and wheat products. Analyzing eggs it can be noticed that they are staying at the same level during 25 years. This situation can be explained by the fact that there are not a lot of changes in consumers' behavior, machinery or production approach.

Having analyzed changes in prices, analyzes in volume shifts should be done accordingly. The Graph 6 shows changes in volume during 25 years.

Graph 6 – Changes in volume for agriculture production during 25 years



Sources for the Graph 6 are (Eurostat, FAOSTAT, Czech Statistical Office).

As it can be seen wheat production has the biggest volume and the trend in cultivation is rising that means that this product is high popular in the market and it is used like a basic element for products manufacture.

In contrast eggs production has the falling trend in making because of high prices and limited resources.

Relying on milk production it can be observed that till 2010 the trend in volume is falling but from 2010 it is growing that can be a reason of policy implementation or support by the government.

Concentrating attention on barley production it should be noticed that it has the level trend in volume that can be explained by analyzing the fact that this product does not have a lot of subsidies in case of agriculture products.

In case of better understanding trends which include prices and volume the linear regressions with equations for wheat, barley, milk and eggs should be constructed.

In accordance with the mentioned before, the next step is to construct trend lines for all types of products which will show tendencies for the production.

Taking care of wheat and eggs there is the direct tendency the price raises, the quantity rises. Analyzing milk and barley there the law works: if prices growth, quantity falls. In accordance with this law there is the falling trend line which means that farmers grow fewer products if prices rising due to the fact are consumers depend on the price and buy less.

As the common equation for the wheat trend has the following view:

$$y = 76,93x + 3212, \quad (11)$$

It means the tendency when  $x$  increases by 1,  $y$  slop increases by 53.23. As it can be seen there is the direct connection between  $x$  and  $y$  that indicates the following behavior of variables: if price increases, the quantity increases too.

Taking care of barley production it has the following trend equation:

$$y = -33.05x + 2410, \quad (12)$$

It can be noticed that the barley equation indicated the rule where  $x$  increases by 1,  $y$  slop decreases by 33.05. Also it has the convert connection between  $x$  and  $y$ , this indicates the following behavior of variables: if price increases, the quantity of the product decreases.

Milk production has the same situation as barley has, i.e. the convert relation between variables where  $x$  increases by 1,  $y$  slop decreases by 44.3:

$$y = -44.30x + 3822, \quad (13)$$

Eggs production has the same direct tendency as wheat where  $x$  increases by 1,  $y$  slop decreases by 296.1:

$$y = 296.1x - 158.1, \quad (14)$$

In accordance with the linear regression there are good results in case of ANOVA and regression analysis. First of all the correlation coefficient ( $R^2$ ) should be found for each type of the product in case of improvement that the research is relevant. In accordance with the theory there are following situations in obtained results:

- 1 is a strong positive relationship.
- 0 indicates no relationship at all.
- -1 shows a strong negative relationship.

In case of data analysis the calculated regression values should be presented in the Table 14 and examined.

Table 16 – Regression data analysis

Product	Indicator	Volume
<b>Wheat</b>	Multiple R	0,461079253
	R- square	0,212594077
	Adjusted R-square	0,178359037
	Standard Error	625,7191935
	Observations	25
<b>Barley</b>	Multiple R	0,525198571
	R- square	0,275833538
	Adjusted R-square	0,24434804
	Standard Error	234,3269934
	Observations	25
<b>Milk</b>	Multiple R	0,759108661
	R- square	0,57624596
	Adjusted R-square	0,557821871
	Standard Error	205,5129319
	Observations	25
<b>Eggs</b>	Multiple R	0,442184794
	R- square	0,195527392
	Adjusted R-square	0,160550322
	Standard Error	788,3681918
	Observations	25

In accordance with the Table 16 there are good results. All regression coefficients have the sense for calculations due to the fact that all of regression coefficients are more than 0, which means that there is a good correlation between variables and they have the scientific meaning for the research.

Table 17 – The ANOVA analysis for the selected products

Product	Indicator	df	SS	MS	F	Significance F
Wheat	Regression	1	2431304,051	2431304,051	6,209838707	0,020351862
	Residual	23	9005063,709	391524,5091		
	Total	24	11436367,76			
Barley	Regression	1	481039,9436	481039,9436	8,760653416	0,00702082
	Residual	23	1262910,216	54909,13984		
	Total	24	1743950,16			
Milk	Regression	1	1320992,001	1320992,001	31,27676864	1,08606E-05
	Residual	23	971417,9992	42235,56518		
	Total	24	2292410			
Eggs	Regression	1	3474420,427	3474420,427	5,590159284	0,02688059
	Residual	23	14295061,33	621524,4058		
	Total	24	17769481,76			

By using the Excel program,  $\ln$  functions and calculations of the correlation coefficient can be done. The Table 18 shows results in the logarithmic functions: equations and correlation coefficients.

Table 18 – Data analysis for the research

Country	Production	Logarithmic function	$R^2$
Russia	Wheat	$y = 1066\ln(x) + 1527$	0.23
	Barley	$y = -425\ln(x) + 3046$	0.3
	Milk	$y = -1149\ln(x) + 6388$	0.62
	Eggs	$y = 2271\ln(x) - 2483$	0.2

As it can be seen in accordance with the Table 18 all of coefficients are relevant for the analysis because the regression coefficient is more than 0 so the future research has the sense. In case of trend line it is better to show its change for each type of products.

To check the significance of the regression equation, the calculated value of the Fisher test is compared to the tabulated value taken for the number of degrees of freedom  $f_1$  (larger variance) and  $f_2$  (smaller variance) at the selected significance level  $\alpha$  (usually 0.05). If the calculated Fisher criterion is higher than the tabulated one, then the explained variance is much larger than the unexplained one and the model is significant.

In accordance with this rule, we have  $f_1 = 1$  because in the model is one factor which is the price. As for  $f_2$  it is 23 because the duration or the number of observations is 25.

Finally the result 23 was calculated by using the following formula:

$$f_2 = n-k-1, \quad (15)$$

Taking care of the Fisher's table criteria the result is 1.98. The Table 19 shows F-test criteria for selected products.

Table 19 – F-test two Sample for Variances

<i>Product</i>	<i>F-test</i>	<i>Variance 1</i>	<i>Variance 2</i>
Wheat	Mean	4205.64	12.91545687
	Variance	476515.3233	17.11448567
	Observations	25	25
	df	24	24
	F	27842.80712	
	P (F<=f) one-tail	6.22444E-48	
	F critical one-tail	1,983759568	
Barley	Mean	2003.56	12.30997
	Variance	72664.59	18.34804
	Observations	25	25
	df	24	24
	F	3960.345	
	P (F<=f) one-tail	9.03E-38	
	F critical one-tail	1.98376	
Milk	Mean	2701.8	25,28868
	Variance	95517.08	28,03942
	Observations	25	25
	df	24	24
	F	3406,528	
	P (F<=f) one-tail	5,5E-37	
	F critical one-tail	1,98376	
Eggs	Mean	2090,64	7,592674
	Variance	740395,1	1,650343
	Observations	25	25
	df	24	24
	F	448631,2	
	P (F<=f) one-tail	2,03E-62	
	F critical one-tail	1,98376	

In accordance with the theory, F critical should be less than F, so it has the view:

$$F > F \text{ critical} \quad (16)$$

As it can be noticed all products have F which is more than F critical that means that the model is relevant for further calculations.

By using results which are shown in the Table 18 the theoretical volume can be calculated. There are logarithmic equations for the each product.

Wheat has the view:

$$y = 1066\ln(x) + 1527, \quad (17)$$

Barley has the equation:

$$y = -425\ln(x) + 3046, \quad (18)$$

Taking care of milk it has the following view:

$$y = -1149\ln(x) + 6388, \quad (19)$$

Relying on eggs result it has the equation:

$$y = 2271\ln(x) - 2483, \quad (20)$$

By putting prices into the independent variable which is X, the theoretical volume can be calculated. All results are shown in the Table 20.

Table 20 – Results in the theoretical volume

<i>Year</i>	<i>Theoretical wheat volume</i>	<i>Theoretical barley volume</i>	<i>Theoretical milk volume</i>	<i>Theoretical eggs volume</i>
1993	3625.43	2171.37	3145.55	2015.85
1994	4005.80	2207.61	3153.10	2176.08
1995	4137.93	2226.34	3034.24	1971.57
1996	4002.67	2097.79	2951.66	2504.37
1997	4021.31	2075.99	2923.71	2707.23
1998	3844.07	2155.39	2811.59	2578.92
1999	3579.80	2279.57	2989.22	2037.68
2000	3932.47	2103.30	2869.24	2408.93
2001	4134.24	2002.49	2775.37	2095.87
2002	4087.03	1953.29	2668.11	2595.97
2003	4044.68	2022.28	2709.45	2667.61
2004	4196.15	2009.85	2642.68	2284.38
2005	3896.14	2093.70	2642.68	2398.36
2006	4076.35	2064.01	2582.09	1269.82
2007	4514.74	1919.27	2609.63	1597.41
2008	4745.21	1763.77	2244.66	1945.87
2009	4076.35	2014.33	2786.82	1785.27
2010	4295.13	1978.38	2661.81	1753.84
2011	4746.25	1816.88	2404.08	1513.01
2012	4724.71	1771.96	2415.97	2473.85
2013	4739.47	1755.74	2479.64	1873.67
2014	4500.42	1943.33	2324.44	1829.90
2015	4471.87	1851.75	2494.67	1900.19
2016	4316.37	1897.64	2632.58	1653.21
2017	4378.38	1909.19	2568.36	2187.73



## 6.1.2 Algorithms of the Econometric Modeling Process of the demand elasticity

Analyzed and proved the relevance and scientific meaning of the model the price elasticity can be found by using the formula (10) which was presented in the theoretical part. Results are shown in the Table 21.

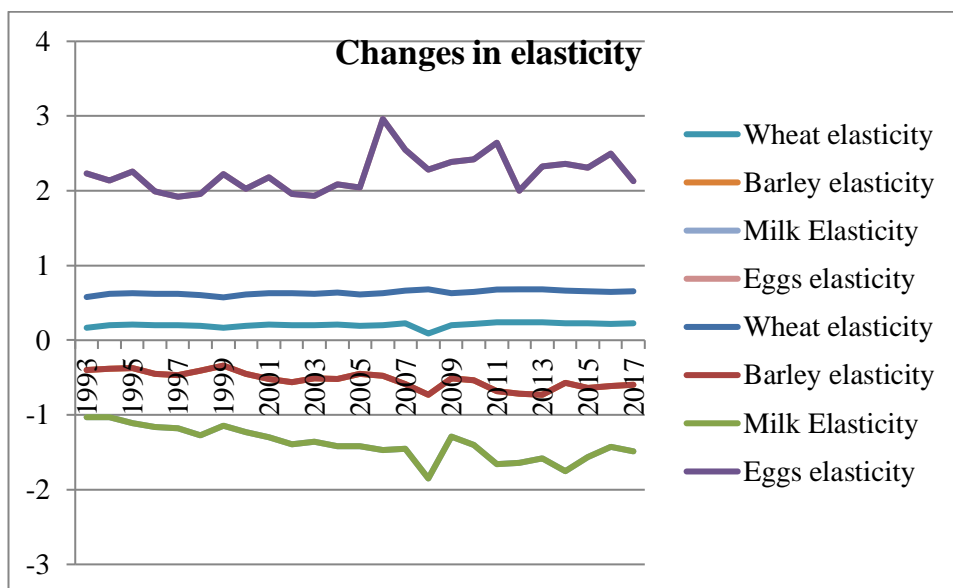
Table 21 – Results in elasticity

<i>Year</i>	<i>Wheat Elasticity</i>	<i>Barley Elasticity</i>	<i>Milk elasticity</i>	<i>Eggs Elasticity</i>
1993	0.58	-0.40	-1.03	2.23
1994	0.62	-0.38	-1.03	2.14
1995	0.63	-0.37	-1.11	2.26
1996	0.62	-0.45	-1.16	1.99
1997	0.62	-0.47	-1.18	1.92
1998	0.60	-0.41	-1.27	1.96
1999	0.57	-0.34	-1.14	2.22
2000	0.61	-0.45	-1.23	2.03
2001	0.63	-0.52	-1.30	2.18
2002	0.63	-0.56	-1.39	1.96
2003	0.62	-0.51	-1.36	1.93
2004	0.64	-0.52	-1.42	2.09
2005	0.61	-0.45	-1.42	2.04
2006	0.63	-0.48	-1.47	2.96
2007	0.66	-0.59	-1.45	2.55
2008	0.68	-0.73	-1.85	2.28
2009	0.63	-0.51	-1.29	2.39
2010	0.64	-0.54	-1.40	2.42
2011	0.68	-0.68	-1.66	2.64
2012	0.68	-0.72	-1.64	2.00
2013	0.68	-0.73	-1.58	2.33
2014	0.66	-0.57	-1.75	2.36
2015	0.66	-0.64	-1.56	2.31
2016	0.65	-0.61	-1.43	2.50
2017	0.65	-0.60	-1.49	2.13

The source for elasticity calculation was the Table 13

The Table 21 can be presented by constructing the Graph 6 which shows changes in elasticity during 25 years.

Graph 7 – Changes in elasticity for the chosen products



The source is the Table 21.

As it can be noticed from the Graph 6 the most elastic products are milk and eggs. Eggs reached a peak in their elasticity in 2010 with the value 2.64. Milk faces the smallest elasticity in 2008 with the value -1.85. Taking care of eggs products there is a growth from 2005 till 2006 (with a peak in 2006 with the value 3.96).

Also, according to the Graph 6 there are not a lot of changes in wheat elasticity. It has the smallest value in 1999 with the result 0.57. As it can be seen the elasticity is leveled and there are not a lot of changes that means that consumers are not sensible for price shifts by 1%. It is connected with the situation that it is hard to replace this product with another.

Taking care of barley production it has the similar situation as wheat. There are not a lot of changes in its elasticity. The biggest value was in 1999 with the result -0.34. The smallest value is -0.73 in 2008.

On the contrary, elastic product as milk and eggs tend to be influenced by different factors:

- In 1993 Czech Republic separated from Czechoslovakia so faced a lot of problems with agriculture stabilization.
- In 2004 the Czech Republic joined EU so it became being dependent on foreign currency. Also the EU agrarian policies are focused on equal pricing and market stabilization.
- In 2009 Europe faced drought which influenced on harvest and then consumers found changes in its quantity and prices.
- In 2010 heavy rains period happened.
- Private farmers have no support for statement and request processing.
- Low protection of the domestic agricultural products market.

In other words people can buy another product with the least price or replace the existing (expensive) product by another.

The Table 19 can be re-constructed by using three results:

- Elastic when the value is  $> 1$ .
- Inelastic when variables are included in the period which is  $[0:1]$ .
- Single elasticity which is 1.

Table 22 – Elasticity reconstruction

<i>Year</i>	<i>Wheat Elasticity</i>	<i>Barley Elasticity</i>	<i>Milk elasticity</i>	<i>Eggs Elasticity</i>
1993	Inelastic	Inelastic	<b>Elastic</b>	<b>Elastic</b>
1994	Inelastic	Inelastic	<b>Elastic</b>	<b>Elastic</b>
1995	Inelastic	Inelastic	<b>Elastic</b>	<b>Elastic</b>
1996	Inelastic	Inelastic	<b>Elastic</b>	<b>Elastic</b>
1997	Inelastic	Inelastic	<b>Elastic</b>	<b>Elastic</b>
1998	Inelastic	Inelastic	<b>Elastic</b>	<b>Elastic</b>
1999	Inelastic	Inelastic	<b>Elastic</b>	<b>Elastic</b>
2000	Inelastic	Inelastic	<b>Elastic</b>	<b>Elastic</b>
2001	Inelastic	Inelastic	<b>Elastic</b>	<b>Elastic</b>
2002	Inelastic	Inelastic	<b>Elastic</b>	<b>Elastic</b>
2003	Inelastic	Inelastic	<b>Elastic</b>	<b>Elastic</b>
2004	Inelastic	Inelastic	<b>Elastic</b>	<b>Elastic</b>
2005	Inelastic	Inelastic	<b>Elastic</b>	<b>Elastic</b>
2006	Inelastic	Inelastic	<b>Elastic</b>	<b>Elastic</b>
2007	Inelastic	Inelastic	<b>Elastic</b>	<b>Elastic</b>
2008	Inelastic	Inelastic	<b>Elastic</b>	<b>Elastic</b>
2009	Inelastic	Inelastic	<b>Elastic</b>	<b>Elastic</b>
2010	Inelastic	Inelastic	<b>Elastic</b>	<b>Elastic</b>
2011	Inelastic	Inelastic	<b>Elastic</b>	<b>Elastic</b>
2012	Inelastic	Inelastic	<b>Elastic</b>	<b>Elastic</b>
2013	Inelastic	Inelastic	<b>Elastic</b>	<b>Elastic</b>
2014	Inelastic	Inelastic	<b>Elastic</b>	<b>Elastic</b>
2015	Inelastic	Inelastic	<b>Elastic</b>	<b>Elastic</b>
2016	Inelastic	Inelastic	<b>Elastic</b>	<b>Elastic</b>
2017	Inelastic	Inelastic	<b>Elastic</b>	<b>Elastic</b>

The source is the Table 21.

Relying on the Table 22 it can be noticed that elastic products are: eggs and milk which are in the livestock group. Inelastic products are: wheat and barley which are in the corn group. Also, according to table there is no single elasticity that shows the situation that income from a decrease or increase in price does not change, since the loss of revenue as a result of a decrease in sales due to price growth will be compensated by additional income from such growth, and vice versa - as the price decreases loss of revenue for this reason will be compensated by an increase in sales.

If the demand is elastic then the cash proceeds from the sale increase with a decrease in the price of a commodity since a higher rate of increase in sales compared to a lower rate of decrease in

price allows compensating for the losses from such decrease. An increase in the price of an elastic demand for a product will lead to opposite effects - the total cash income will decrease, since its increase in price does not compensate for losses from a decrease in sales.

With relatively inelastic demand for goods a decrease in their prices always leads to a decrease in cash proceeds from their sale. Indeed, with such a demand, a significant reduction in price will result in only a relatively insignificant increase in sales. The resulting additional income does not compensate for losses arising from price reductions. However, if the price of goods with relatively inelastic demand rises, cash revenue will increase since the additional income from price increases will be greater than the loss from a decrease in sales.

The relative inelasticity of demand for agricultural products is the result of several factors that determine the degree of consumer sensitivity to changes in the price of goods. The main factor is the substitution factor when a consumer can satisfy his or her need with the increase in price for one product by buying another product for which the price has not changed or decreased.

Here a general pattern is manifested: the fewer substitutes for the product are existed, the less elastic the demand for it is and vice versa. Also, the fewer products are used to make other products, the less elasticity will be. Taking care of this fact it becomes clear that, for example, grain is inelastic due to the fact that it is almost impossible to replace this product with another. Therefore, with a significant increase in the price of grain, its sales will change little. After all, the grain will be part of another product, for example bread or beer, etc.

## 6.3 Forecasting of demand elasticity

### 6.3.1 Forecasting of the demand elasticity in the sphere of the agricultural products

In case of making predictions about future prices and values for 4 types of products, it is obligatory to indicate the period. It will be the period with the duration which is 5 years started from 2018 till 2022. This period was chosen due to the fact that in the present time there are not the whole data sets about price and volume in production for 2018, so the prediction period starts from 2018. The prediction is made by using the Excel programming which is called Forecast and then are checked by using the logarithmic functions. The results are shown in the Table 23.

Table 23 – The prediction in Price and Demand for the Czech market of the agricultural products

Year	$\widehat{Wheat}$ price (EUR per 100kg)	$\widehat{Wheat}$ volume (mln kg)	$\widehat{Barley}$ price (EUR per 100kg)	$\widehat{Barley}$ volume (mln kg)	$\widehat{Milk}$ price (EUR per 100kg)	$\widehat{Milk}$ volume (mln kg)	$\widehat{Eggs}$ price (EUR per 100kg)	$\widehat{Eggs}$ volume (mln kg)
2018	18.51	4990	32.85	2323	18.15	1695	6.58	1364
2019	18.57	5051	33.44	2293	18.59	1671	6.50	1381
2020	18.98	5111	34.02	2264	19.04	1648	6.42	1395
2021	19.38	5171	34.60	2235	19.49	1624	6.34	1356
2022	19.78	5232	35.18	2206	19.94	1600	6.26	1401

As it can be observed from the Table 23 can see there is a growth in price and quantity for the next five years. According to the table the wheat is going to be the most popular and preferable product among other products because its quantity is going to grow in accordance with the similar changes in price. Barley will remain as the cheapest product with the least quantity in case of the discussed products. Taking care of predicted prices and quantity it is possible to forecast changes in elasticity by using the formula (10) which was discussed in the theoretical part. Results of future elasticity changes are shown in the Table 24.

Table 24 – The prediction in Elasticity for the Czech market of the agricultural products.

Year	<i>Wheat</i> $\widehat{elasticity}$	<i>Barley</i> $\widehat{elasticity}$	<i>Milk</i> $\widehat{elasticity}$	<i>Eggs</i> $\widehat{elasticity}$
2018	0.67	-0.68	-1.69	2.38
2019	0.67	-0.69	-1.71	2.40
2020	0.67	-0.70	-1.74	2.43
2021	0.67	-0.71	-1.76	2.45
2022	0.68	-0.72	-1.78	2.48

In case of better demonstrating calculated variables it is better to change numbers by the results and introduce the Table 25 which shows:

- Elastic.
- Inelastic.
- Single elasticity.

Table 25 – The prediction in Elasticity for the Czech agricultural market

Year	<i>Wheat</i> $\widehat{elasticity}$	<i>Barley</i> $\widehat{elasticity}$	<i>Milk</i> $\widehat{elasticity}$	<i>Eggs</i> $\widehat{elasticity}$
2018	Inelastic	Inelastic	<b><i>Elastic</i></b>	<b><i>Elastic</i></b>
2019	Inelastic	Inelastic	<b><i>Elastic</i></b>	<b><i>Elastic</i></b>
2020	Inelastic	Inelastic	<b><i>Elastic</i></b>	<b><i>Elastic</i></b>
2021	Inelastic	Inelastic	<b><i>Elastic</i></b>	<b><i>Elastic</i></b>
2022	Inelastic	Inelastic	<b><i>Elastic</i></b>	<b><i>Elastic</i></b>

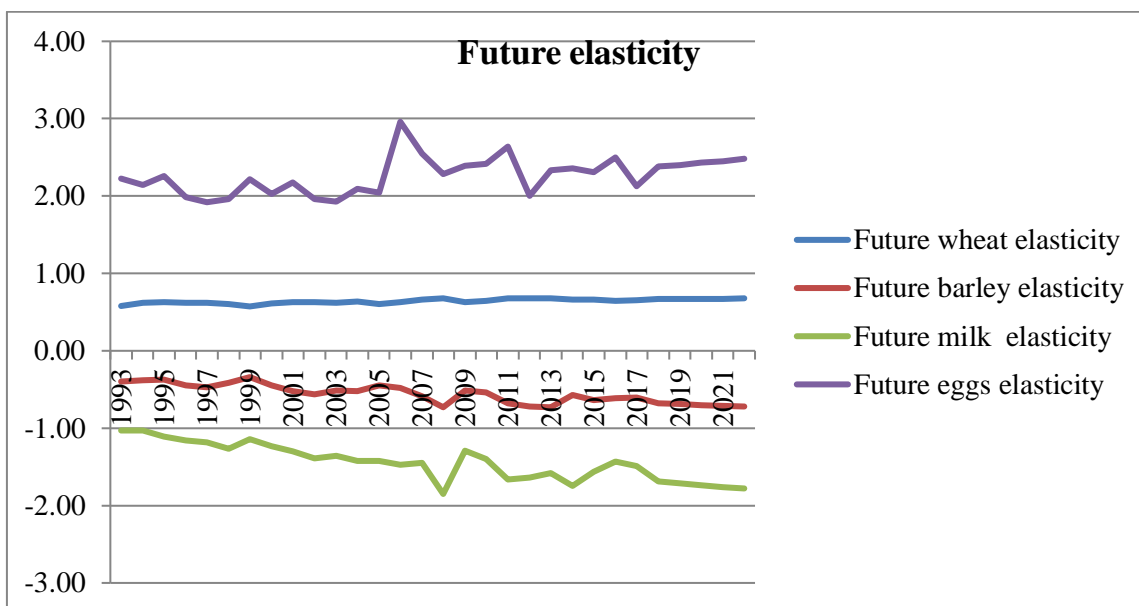
The source is the Table 24.

As it can be found in the Table 25 the situation in elasticity remains the similar for all products:

- Wheat and barley remain inelastic that means that it is hard to find substitutes for this product in the market, so consumers' behavior in case of decrease or increase in price is not going to change.
- Milk and eggs remain elastic that shows the situation when price increases or decreases consumers are tending to replace the product by another.

By constructing the Graph 7 elasticity changes can be shown for the future 5 years.

Graph 8 – Future changes in elasticity



In accordance with the Graph 8 barley and wheat productions are going to be inelastic and do not have a lot of changes in consumers' behavior by 1 % increase in price during future 5 years. There are some reasons. For example, wheat and barley (unlike other products) are characterized by a low sensitivity to price changes and accordingly have the lowest coefficient of elasticity. This is due to the fact that wheat and barley have few substitute products that are close to it for its nutritional properties and have similar uses in the food industry but they cannot replace wheat and barley at all.

Having obtained and discussed all results it is possible to make the SWOT analysis for Czech agrarian sector which will examine all strengths, opportunities, weaknesses and strengths. Table 26 introduces the SWOT analysis.

Table 26 – SWOT analysis for the Czech agrarian market

<p style="text-align: center;"><b>Strengths:</b></p> <ul style="list-style-type: none"> <li>✓ Good quality of products.</li> <li>✓ Good reputation among consumers.</li> <li>✓ Modernization and supplement of high quality equipment.</li> <li>✓ Government support for organic farming.</li> <li>✓ EU support in case of agrarian policy.</li> <li>✓ Agriculture representatives have adequate technical background.</li> <li>✓ Legislative framework for organic farming (the Organic Farming Act, Council Regulation 2092/91) which is continuously updating.</li> </ul>	<p style="text-align: center;"><b>Opportunities:</b></p> <ul style="list-style-type: none"> <li>✓ Entering new markets and segments.</li> <li>✓ Increase in the volume of production.</li> <li>✓ Increase in the range of products.</li> <li>✓ Reducing the cost of production through the use of modern equipment.</li> <li>✓ Increase in case of the investments intensity in new machinery and equipment.</li> <li>✓ Continuous improvement of the employees' qualification skills.</li> <li>✓ Increase in the gross fixed capital.</li> <li>✓ Application of foreign experience.</li> <li>✓ The Action Plan affirmation before the European Commission.</li> <li>✓ Media cooperation.</li> <li>✓ Foreign trade.</li> <li>✓ Supply without any borders in case of the EU.</li> <li>✓ Stability of the policy in the Czech Republic and in the EU.</li> <li>✓ New possibilities to acquire financial support for organic sector.</li> </ul>
<p style="text-align: center;"><b>Weaknesses:</b></p> <ul style="list-style-type: none"> <li>✓ Dependence on foreign currency.</li> <li>✓ Seasonality of demand.</li> <li>✓ Decrease in profit due to falling demand because of competitors' proposals in the agrarian market.</li> <li>✓ Dependence on weather conditions.</li> <li>✓ Here is need to improve producers, processors, members, marketing organizations, vendors and other players attitudes in case of organic farming principles (reliability, conviction) which will facilitate the establishment of marketing links, cooperatives etc.</li> <li>✓ Training, education and consulting do not have the proper development. Moreover, the knowledge of certain phenomena and situations is still insufficient (for example the scope and potential of the market of individual commodities). Also, here is a lack of well specialized tutors.</li> </ul>	<p style="text-align: center;"><b>Threats:</b></p> <ul style="list-style-type: none"> <li>✓ Emergence of new competitors from the EU.</li> <li>✓ Aggressive exports of the same products among competitors.</li> <li>✓ Slower growth in the market for individual segments.</li> <li>✓ Extending the standard production and reducing the high quality production because of competitors 'supply.</li> <li>✓ Risk of insufficient capitalization.</li> <li>✓ Dependence on the WTO (removal of subsidies, policy changes).</li> <li>✓ Low stability in case of the economic environment and market volatility.</li> <li>✓</li> </ul>

In accordance with the SWOT analysis recommendations and conclusion are done and introduced in the part of Results and Discussions.



## 7 Results and Discussion

As results calculations in elasticities for four types of products (wheat, barley, milk and eggs) were done. Also predictions for the future 5 years (from 2018 till 2022) were estimated.

In case of the literature review part some scientific researches, experience in the problem of the elasticity demand are generalized and systematized in tables. It was concluded that the demand price elasticity will be found by using the logarithmic and linear methods of modeling in this work. Some applications of logarithmic and linear regression are introduced, and found that pricing is the basis for financial plans acceptance and economic activities in terms of providing products service, expanding sales markets and maximizing profits.

In the analytical part the analysis of the Czech agricultural market and its development was done. Some reasons of extra pricing or low sales are discussed in accordance with the history. Also, the organic farming is discussed as the new area for making investments which has a lot of future possibilities in farming.

In the practical part calculations in case of linear, logarithmic regressions were done and discussed for relevancy in the master work. After models affirmation the price elasticity for wheat, barley, milk and eggs was found. It was found that eggs are the most elastic product among others which were analyzed. The least elastic product is barley which tendency can be explained as following: this product does not have a lot of subsidies, so it can be replaced by another one. All results are shown in tables and graphs with descriptions and explanations.

In accordance with the SWOT analysis there are some serious weaknesses in case of the Czech agricultural situation. Relying on the Table 26 it can be noticed that farmers have some problems in case of organic support in case of doing business as key factors. A lot of farms are unable to effectively ensure project in the financial part and to effectively apply for structural funds and from the state budget support. In other words many farmers cannot be considered as good businessmen.

In case of opportunities there are a lot of in case of the farming with the help of the EU support, which have to be used in support of the development of all farming. There are possibilities to deal with foreign agricultural markets, to organize promotions by using mass media channels, increase the volume of production by exporting it abroad. Moreover, applying for government support private or small farmers can achieve funds support. In this case, it should be said that the State support plays the significant role in case of agriculture development in the Czech Republic.

Relying on the SWOT analysis there are a lot of strengths for the Czech agrarian market. It has the governmental support for agrarian sectors, special funds which are organized not only in the

Czech Republic but also around the EU. Organic farming has the legislative framework which is updating from time to time that means the great interest in case of the organic development. Also, there are well-equipped and modernized machines which allow to produce products with the high quality.

Concentrating attention on the threats there are some serious which play the important role in the agrarian sector. For example, emergency competitors from the EU play the depressive tendency for the Czech development because there are a lot of suppliers who can produce better production. In this case, the Czech Republic may extend the standard production and reduce the high quality production because of competitors 'supply. Relying on the fact that there are a lot of competitors, it can be concluded that aggressive exports of the same products among competitors can damage Czech inner trading system.

## 8 Conclusion

The goals of the master work called: “Price elasticities for chosen agricultural products in the Czech Republic” are achieved. The theoretical experience of researchers, main definitions of elasticity and demand are examined. To generalize the theoretical experience of researchers in the field of price elasticity. The research and predictions of the demand price elasticity was carried out in the practical part. In case of predictions for the future 5 years they are done and analyzed. In the end of the practical part the SWOT analysis is constructed as the source for making recommendations.

Now it is possible to answer all the research questions.

*What are the most practical and economic methods for determining the price elasticity?*

There are some methods for determining price elasticity: formulas and econometric models. In this work linear and logarithmic regressions were used for calculating trends and prediction for the price elasticity.

*Do all types of agricultural products have the similar price elasticity or we have the special goods? How does the price elasticity change in case of long period?*

In accordance with calculations all of the discussed products have own trends in the price elasticity. Some of them are elastic or inelastic. It happens due to different factors which cannot be controlled only by government. Differences in the values of the coefficients determined for the types of products under consideration are due to the peculiarities of the production processes, the possibility of long-term storage of products, the attraction of resources that are employed in other industries and other factors. The calculations showed that the greatest price elasticity among the types of products under consideration is eggs, the smallest is grain products.

*What approaches (operational or agronomic) can be developed to increase efficiency in Czech agriculture? What are the best farmers' tools in agriculture to improve elasticity for wheat, barley, milk and eggs?*

Thus, the above calculations show that in order to optimize the production program of the Czech Republic agriculture, it is necessary to take into account the elasticity of demand for each type of product, evaluating the possibilities of using various types of pricing policies, increasing sales volumes, taking into account the changing demand that ensures the organization's work in the long term. So, it is the combination of operational and agronomic approaches.

*What type and specific combinations of improved technologies, farming practices, institutions and policies will result in the maintenance of elasticity?*

Food producers face the basic problems in case of output especially in the domestic market. Above all, it is necessary to strengthen marketing with regard to improving the Czech agricultural

possibilities by organizing special funds. It is possible to organize the cooperation with a number of important organizations and state authorities support on the national and regional level (i.e. among regional and local self-government, research institutes and universities).

*How do the outside factors influence on the elasticity of wheat, milk, barley and eggs?*

It can be concluded that there are a lot of factors: inside and outside which influence on agricultural production. Some factors cannot be controlled (for example weather coordination), others need governmental or investment support. In case of the Czech Republic these factors played the sufficient role in case of pricing and consumers' behavior. Relying on the period (2009) when draught bit the whole EU prices were awful in case of insignificant harvest.

*If the Czech government spends more investments on agriculture, will it help to stabilize the price elasticity?*

In accordance with the theory there are a lot of factors for price elasticity: subsidies, inflation, consumers' behavior, exports of foreign goods and etc. So, in case of the governmental support it can help to stabilize prices or equip farmers better but it cannot change any situation due to the mentioned factors.

## 9 The list of literature

- 1 Action Plans for the Development of Organic Farming in the Czech Republic in duration from 2016-2020 (Akční plán ČR pro rozvoj ekologického zemědělství v letech 2016–2020) [online]: [http://eagri.cz/public/web/file/442986/Akcni\\_plan\\_CR\\_pro\\_rozvoj EZ Czech Action Plan for Development of OF.pdf](http://eagri.cz/public/web/file/442986/Akcni_plan_CR_pro_rozvoj_EZ_Czech_Action_Plan_for_Development_of_OF.pdf)
- 2 *Agricultural Association of the Czech Republic* [online]: <http://www.dacr.cz/agricultural-association-of-the-czech-republic/>
- 3 Czech Ministry of Agriculture (2011): Action plan for Organic Farming 2011 – 2015, Adopted by the Government of the Czech Republic in 2010. MZe ČR, 32 p.
- 4 *Czech Statistical Office* [online]: <https://www.czso.cz/csu/czso/home>
- 5 Deaton A. and Muellbauer J. *Economics and Consumer Behaviour*. Cambridge: Cambridge University Press.
- 6 Debertin L. David. *Agricultural Production Economics*. The 2<sup>nd</sup> edition, University of Kentucky, 2012. (ISBN-13: 978-1469960647).
- 7 *Eurostat* [online]: <https://ec.europa.eu/eurostat/>
- 8 *FAOSTAT* [online]: <http://www.fao.org/sustainable-development-goals/en/>
- 9 *FAOSTAT (eggs production)* [online]: <http://www.fao.org/faostat/en/#data/QL>
- 10 *FAOSTAT (wheat production)* [online]: <http://www.fao.org/faostat/en/#data/QC>
- 11 *Farm-gate milk prices in Czech* [online]: <https://www.clal.it/en/index.php?Section=1&attrepecca>
- 12 *Food and agriculture of Organization of the United Nations* [online]: <http://www.fao.org/employment/home/en/>
- 13 *Institute of Agricultural Economics and Information* [online]: <http://www.iaei.cz/>
- 14 *Investing.com* [online]: <https://ru.investing.com/currencies/eur-czk>
- 15 *Investments in agriculture as perspectives or uncertainty and risks (Инвестиции в сельское хозяйство перспективы или неопределенность и риски)* [online]: [www.vip.1-du.ru](http://www.vip.1-du.ru)
- 16 *Ministry of Agriculture of the Czech Republic* [online]: [http://eagri.cz/public/web/file/581592/publikace MZe 210x210mm ENG.pdf](http://eagri.cz/public/web/file/581592/publikace_MZe_210x210mm_ENG.pdf)
- 17 *Organic farming in the Czech Republic*. Ministerstvo zemědělství, 2017. (ISBN 978-80-7434-470-1).
- 18 *Pearson correlation coefficient* [online]: <https://newonlinecourses.science.psu.edu/stat501/node/256/>
- 19 *Russia Agriculture Policy review* [online]: [http://www5.agr.gc.ca/resources/prod/doc/pol/pub/ra-ra/pdf/russia\\_e.pdf](http://www5.agr.gc.ca/resources/prod/doc/pol/pub/ra-ra/pdf/russia_e.pdf)

- 20 Story John. Price Elasticity of Demand and Marketing: Mastering elasticity to market strategically. Independent Publishing Platform, 2016.
- 21 *The state of agricultural markets (Состояние рынков сельскохозяйственной продукции)* [online]: <https://docplayer.ru/62134903-Sostoyanie-rynkov-selskohozyaystvennoy-produkcii-vysokie-ceny-na-prodovolstvie-i-prodovolstvennyy-krizis-nakoplenyy-opyt-i-izvlechennye-uroki.html>
- 22 *The Crop Research Institute* [online]: [https://www.vurv.cz/?p=index&site=default\\_e](https://www.vurv.cz/?p=index&site=default_e)
- 23 *The modern economic theory* [online]: <http://modern-econ.ru/micro/rynok/elasticnost/spros.html>
- 24 *T. Van Zandt. Elasticity of demand. Copyright, 2012* [online]: <https://faculty.insead.edu/vanzandt/teaching/FPM-Aug2012.pdf>
- 25 World Bank and Csaba Csaki. Food and Agriculture in the Czech Republic: From a Velvet Transition to the Challenges of EU Accession (World Bank Technical Paper), 1999.

## **10 List of Figures**

Figure 1 – Conceptual approaches in the theory and practice of pricing.....	13
---	----

### **13 List of Graphs**

Graph 1– Changes in the Price Index .....	30
Graph 2 – Changes in the world cereal market .....	32
Graph 3 – Changes in cereal total production .....	40
Graph 4 – Changes in the organic farming development.....	45
Graph 5 – Changes in prices for agriculture production during 25 years .....	50
Graph 6 – Changes in volume for agriculture production during 25 years.....	51
Graph 7 – Changes in elasticity for the chosen products .....	58
Graph 8 – Future changes in elasticity.....	63



## 14 List of Tables

Table 1 – The main research questions .....	10
Table 2 – Market classification in accordance with specific characteristics .....	14
Table 3 – Types of demand elasticity .....	16
Table 4 – The shift of the Demand curve .....	20
Table 5 – The main factors for the elasticity .....	21
Table 6 – Price indexes for agriculture products .....	29
Table 7 – World cereal market .....	32
Table 8 – Policies in the world agriculture .....	34
Table 9 – The main agriculture data for Russia .....	35
Table 10 – The main agriculture data for Czech .....	38
Table 11 – The main organizations in the field of Czech agriculture .....	39
Table 12 – Subsidies in the Czech Republic .....	42
Table 13 – Development in the organic farming .....	44
Table 14 – Numbers of registered organic farms in the Czech Republic. ....	46
Table 15 – The data set for the research .....	49
Table 16 – Regression data analysis .....	53
Table 17 – The ANOVA analysis for the selected products .....	53
Table 18 – Data analysis for the research .....	54
Table 19 – F-test two Sample for Variances .....	55
Table 20 – Results in the theoretical volume .....	56
Table 21 – Results in elasticity .....	57
Table 22 – Elasticity reconstruction .....	59
Table 23 – The prediction in Price and Demand for the Czech market of the agricultural products	61
Table 24 – The prediction in Elasticity for the Czech market of the agricultural products. ....	62
Table 25 – The prediction in Elasticity for the Czech agricultural market .....	62
Table 26 – SWOT analysis for the Czech agrarian market .....	64