Czech University of Life Sciences Prague

Faculty of Economics and Management

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Diploma Thesis

Foreign trade of the Czech Republic - Case study of coffee import

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Faculty of Economics and Management

DIPLOMA THESIS ASSIGNMENT

Bc. Tarek Rebai

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Thesis title

Foreign trade of the Czech Republic – Case study of coffee import

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Objectives of thesis

The main aim of the thesis is to conduct analysis of foreign trade of the Czech Republic with the focus on coffee import. Partial objectives are to analyze trade balance of the Czech Republic, to identify determinants influencing coffee import and consumption and to test which factors has a significant impact on coffee consumption in the Czech Republic.

Methodology

The literature review of the diploma thesis is processed on a basis of available books and scientific articles connected with foreign trade. The analytical part of the thesis is based on the construction of one-equation econometric model, through which is processed the quantitative analysis of coffee import to the Czech Republic. There are used statistical techniques and tests elaborated in Gretl software and MS Excel to achieve set objectives.

The proposed extent of the thesis

50 -60 pages

Keywords

Coffee, Import, Export, Foreign trade, Economy, Market

Recommended information sources

AUGUSTÍN, Jozef. U kávy o kávě a kávovinách. Brno: Jota, 2016. ISBN 978-80-7462-850-4.

ČESKÁ ZEMĚDĚLSKÁ UNIVERZITA V PRAZE. KATEDRA EKONOMIKY, – ČECHURA, L. *Cvičení z ekonometrie*. V Praze: Česká zemědělská univerzita, Provozně ekonomická fakulta, 2009. ISBN 978-80-213-1976-9.

INTERNATIONAL TRADE CENTRE. The Coffee exporter's guide. 3. vyd. Ţeneva: International Trade Centre, 2011. 267 s. ISBN 978-929-1373-949.

VESELÁ, Petra. Kniha o kávě: Průvodce světem kávy s recepty na její přípravu. Praha: Smart Press, 2010. ISBN 978-80-87049-34-1.

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Declaration

I declare that I have worked on my diploma thesis titled "**Foreign trade of the Czech Republic - Case study of coffee import**" 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 third person.

In Prague 27th of March 2019 _____

Tarek REBAI

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I would like to thank Assoc. Prof. Ing. Mansoor Maitah, Ph.D. et Ph.D. for his excellent support and advices that he provided me. I would like also thank all other persons, for their advice and support during my work on this thesis.

Foreign trade of the Czech Republic - Case study of coffee import

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Zahraniční obchod České republiky – případová studie dovozu kávy

Summary

The diploma thesis is focused on the foreign trade of the Czech Republic, namely on the import of the coffee in the years 1997 - 2017. The main aim of the thesis is to analyze the foreign trade of the Czech Republic with a focus on the import of the coffee. The thesis is divided into the theoretical and practical part. The theoretical part deals with world's production, growing conditions, different kinds of coffee beans and fair trade . It also describes the importance of coffee for the world economy, the major exporter and importer of coffee, the determinants of coffee exports and international organizations on the world coffee market. Practical part describes econometric analysis and its methods. This is followed by the analysis of coffee consumption in the Czech Republic in time period of 1997 and 2017. In the analysis of coffee consumption there is a single econometric model, which determines which factors significantly influence value of the coffee import to the Czech Republic. Furthermore, economic, statistical and econometric verification of the model is performed. Furthermore, variables elasticities are calculated, and the forecasts for all variables for years 2018, 2019 and 2020 are derived.

Keywords: Coffee, Import, Export, Foreign trade, Economy, Market

Souhrn

Diplomová práce je zaměřena na zahraniční obchod České republiky, konkrétně na dovoz kávy v letech 1997 – 2017. Hlavním cílem práce je provést analýzu zahraničního obchodu České republiky se zaměřením na dovoz kávy. Práce je rozdělena na teoretickou a praktickou část. Teoretická část se zabývá světovou produkcí, pěstebními podmínkami, různými druhy kávy a fair trade. Dále popisuje význam kávy pro světovou ekonomiku, hlavní vývozce a dovozce kávy, determinanty produkce kávy a mezinárodní organizace na světovém trhu s kávou. V praktické částí se zabívá ekonometrickou analýzou a jejímy metodami. Následuje analýza importu kávy do České republiky v období 1997 – 2017. V rámci analýzy importu kávy byl sestaven jednorovnicový ekonometrický model, který posuzuje faktory významně ovlivňující import kávy. Následně bylo provedeno ekonomické, statistické a ekonometrické ověřování modelu. Dále jsou zde vypočítány pružnosti proměnných a odvozeny prognózy všech proměnných pro rok 2018, 2019 a 2020.

Klíčová slova: Káva, Dovoz, Vývoz, Zahraniční obchod, Ekonomie, Trh

Table of Content

List of Pictures

List of Figures

List of Tables

1 Introduction

The coffee plant as a plant belongs to fruit trees that produce the fruits of the so-called coffee cherry. Coffee is grown in more than 70 countries. Most of the growing countries are located in a tropical and subtropical belt where the most suitable climatic conditions are to grow the coffee. There are around 6,000 types of coffee in the world, but the most common species are arabica and robusta (Veselá, 2010). The majority of arabica coffee grows in Latin America and the homes of robusta coffee for its lower processing demands, are some African but mainly Asian countries.

The coffee market in recent years has to deal with many barriers such as climate change and the environment. It also has to respond to changes and developments in world coffee preferences. All in conditions of high price inequality in the market, the rise in input prices for production and the sustainability of the whole industry. Improvement of the market environment for all participants in the coffee sector is the responsibility of the International Coffee Organization (ICO). The mission of this organization is to strengthen the global coffee sector and ensure sustainable development by establishing common and fair trade conditions. It brings together 94 % of all producer countries and 75 % of consumers. An important part of coffee trading is also a social impact on the grower himself, taking into account that most exporting countries are among so-called developing countries and countries of final consumption are the so-called advanced countries. For the development of coffee trade, it is important to know whether the volume of traded off-market is increasing. Producer countries and farmers themselves seem to behave in production rather towards quality or quantity.

Daily around the world, about 2.5 trillion cups of coffee are consumed and coffee consumption is growing steadily. Growth in consumption is influenced by global globalization and raising the standard of living, which leads to growing interest in luxury goods to which coffee is ranked. The largest consumers are the states of the European Union and the United States of America, the developed countries. Conversely, the leading coffee producers are developing countries, where the profits from coffee production are often the largest share of total farm income.

Now we are in the third coffee wave, which is characterized by a greater focus on the quality, origin and individual qualities of coffee (taste, aroma, acidity, etc.). There is a gradual rise in quality coffee in the world coffee field, although it still accounts for less than 5 % of the world coffee market. This current in the coffee world is also noticeable on the Czech coffee market. But the coffee shop is focused on commodity coffee, which is mainly traded on world stock exchanges.

The Czech Republic is not one of the largest coffee consumers, but coffee has a certain tradition here. Most of the imported coffee in the Czech Republic comes from European Union countries in the form of green coffee, roasted coffee and coffee extracts. Coffee extracts are used for the production of instant coffee, which is very popular in the Czech Republic.

2 Objectives and Methodology

In order to conduct Czech foreign trade there are objectives that should be reached by choosen methods. Describtion of objectives and methodology is written below.

2.1 Objectives

The main objective of the diploma thesis is to conduct analyses of foreign trade of the Czech Republic with the intention of coffee import during the period 1997-2017. Partial aims are to analyze trade balance of the Czech Republic, to identify determinants influencing the import of coffee from the countries that exports this commodity, and test which of the determinant has an important impact on coffee import to the Czech Republic.

2.2 Methodology

The literature review of the thesis is processed on a basis of available scientific articles and books with a focus on the foreign trade of coffee, econometrics and statistics. The analytical part of the thesis firstly deals with the trend analysis of selected determinants of coffee import within the period from 1997 to 2017. This is followed by an econometric analysis in which the main instrument is an econometric model. The model is constructed through the transformation of economic theory into economic-mathematical model. There is performed one-equation econometric model, a linear regression model. In the first part of the econometric analysis, there is constructed economic model corresponding to the relevant economic theory, which is subsequently transformed into econometric model. The following step is the collection of data and its verification and the estimation of the formulated model.

The data are gathered from the International Coffee Organisation, Eurostat, Euromonitor, World Trade Organisation WTO, Czech Statistical Office and ICO and some other sources. The individual parameters of the model are estimated through the method of Ordinary Least Square. After the estimation, there are performed economic, statistic and econometric verification of the one-equation econometric model. The econometric analysis is concluded by the application of the model, which consists of calculation of elasticities and prognosis for the year 2018, 2019 and 2020. The analytical part of the thesis is conducted using statistical test and techniques elaborated in Gretl software and MS Excel.

3 Literature Review

3.1 History of coffee

The first mention of coffee dates back to the 9th century from East Africa - today's Ethiopia. Residents are gradually beginning to discover its encouraging effects and this information is spreading. From East Africa, coffee extends to the Arabian peninsula to Yemen, to the Mokha's commercial harbor whose name is used for coffee today. It is then cultivated and cultivated in the 15th century.

Arabs start trading with coffee but there are restrictions on the export of grain suitable for growing. For a long time coffee planting is their privilege since all grains must be cooked or cooked to prevent cultivation in other parts of the world.2 in the mid-17th century, the Dutch managed to transport live coffee plants to the Netherlands. Here, coffee is grown in greenhouses and the Dutch are transported to India and to Batavia on Java, where the plant has perfect conditions for growth. [1]

At the beginning of the 18th century Dutch merchants donated the coffee plant to King Louis XIV of France. Sprouts from this plant are transported to Martinique Island in the Caribbean Sea in 1720, where coffee begins to grow, and it succeeds that 50 years after the introduction of the plant there are over 18 million coffee beans. Martinique is then extended to Central and South America. (Smeklová, 2006)

Over a relatively short period of 100 years, coffee has become a global commodity. Travelers, merchants, and missionaries continue to bring coffee beans to new places, and coffee shops are further propagated. By the end of the 18th century, coffee became the most profitable export crop

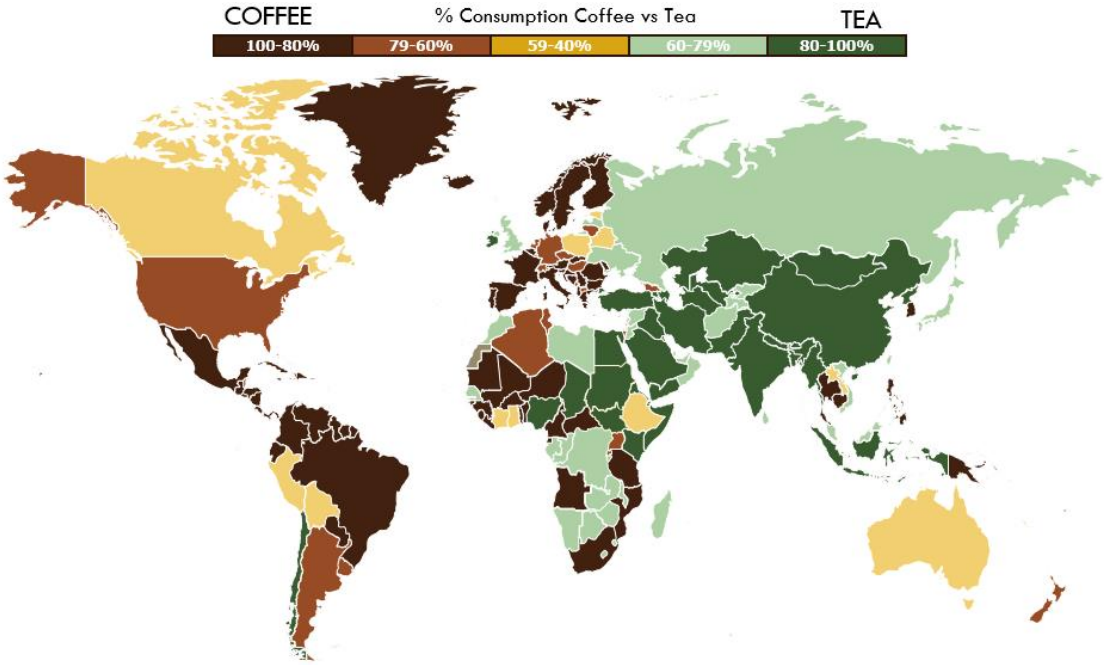
In Brazil coffee machines are gradually replacing sugar plants, in the early 1930s Brazil is the world's largest producer with 600 000 sacks a year followed by Cuba, Java and Haiti. Colombia is the second-largest producer in the early 20th century, the popularity of

[1] ICO. *The Story Of* Coffee [online]. ©2014. Dostupné z: http://www.ico.org/coffee_ story.asp/

Colombian coffee is growing rapidly in American and European consumers. In the 20th century, the demand for coffee continued to grow and the tradition of coffee culture and the café itself expanded.

Coffee is not the most consumed hot beverage in the world. Most consumed hot beverage is tea, however coffee is second most traded comodity after cuid oil. On the map below we can see the geographical segmentation preferences of tea and coffee. We can see that easter part of the world prefers to drink tea rather than coffee. Europe and western side of the world are prefering to have a coffee rather than tea. [2]

Picture 1: Geographical segmentation of consumption preferences



Source: Chart of the Week: Coffee and tea around the world | Pew Research Center. Pew Research Center | Nonpartisan, non-advocacy public opinion polling and demographic research [online]. Dostupné z: https://www.pewresearch.org/fact-tank/2013/12/20/chart-of-the-week-coffee-and-tea-around-the-world/

3.2 Coffea

Coffea is a genus of flowering plants whose seeds called coffee beans, are used to make various coffee beverages and products. It is a member of the family Rubiaceae. They are

[2] ICO. *The Story Of* Coffee [online]. ©2014. Dostupné z: http://www.ico.org/coffee_story.asp/

shrubs or small trees native to tropical and southern Africa and tropical Asia. It is grown in the so-called "coffee belt", which is spread among Cancer and Capricorn. The coffee tree grows in the wild to ten feet high, but it is most often grown as a cultivar with a height of about three meters for easier access and harvesting [3]. The coffee is grown mainly in acidic soil. Seeds of germ 3-4 weeks. The first crop usually comes after 3-4 years. Coffee can live up to 50 years (Veselá, 2010). Coffee ranks as one of the world's most valuable and widely traded commodity crops and is an important export product of several countries including those in Central and South America, the Caribbean and Africa.

Picture 2: World‘s 10 largest producers of coffee

Source: Escuela Nº 4 "Dr. Juan Zorrilla de San Martín" Salto, Uruguay.: Top 10 Best Coffee Producing countries in the World. Escuela Nº 4 "Dr. Juan Zorrilla de San Martín" Salto, Uruguay. [online]. Dostupné z: http://escuela4salto.blogspot.com/2014/08/top-10-best-coffee-producing-countries.html

The coffee bean that is most commonly encountered with the consumer is actually a processed, roasted coffee plant brew. Coffee is a very widespread plant, which is a fruit tree. This plant grows virtually throughout the tropical and subtropical zones. It is grown in over 70 different countries around the world. Farmers cultivate it differently, grab it and control it for higher resistance to pests, diseases and more fruits. Cauliflowers also go through cultivation by improving the taste properties of the coffee beans. Subsequently, this plant is processed in countries around the world (Veselá, 2010)

[3] KÁVOVÉ LISTY. Arabica vs. Robusta: Najdete 15 rozdílů? [online]. 2013 Dostupné z: http://www.kavovelisty.cz/arabika-vs-robusta-najdete-15-rozdilu/

Around 2.5 trillion cups of coffee are dipped around the world every day. Access to coffee has an increasing number of people around the world and the relationship to coffee is gradually changing. Thanks to the social media more attention is paid to select coffee, fair trade coffee and organic coffee (Daviron, Ponte, 2005)

Trade in organic products and, above all, products bearing Fair Trade certification have increased exponentially in the last millennium. This increase is exacerbated by greater customer interest when there is a noticeable increase in consumption of FT products, including coffee (Nicholls, 2010)

3.2.1 Classification of the type of coffee

Below are classified the two main coffee types.

Arabica

The most known varieties of Arabika coffee are Typica and Bourbon. Of these two varieties were cultivated many different cultivars such as Caturra (Brazil, Colombia), Mundo Novo (Brazil), Tico (Central America) and Jamaican Blue Mountain. Arabic is the descendant of the original coffee found in Ethiopia.13 "Coffee is distinguished by its acidity, fruity, fine flavor with greater flavor. The grain is rather elongated and flat with a curved ridge. "14 This coffee accounts for approximately 70% of the market share. Arabic is better quality coffee and its price is also higher than Robusta. This species is grown at higher altitudes around 1000-2000 m. A very important factor is the temperature, it must remain moderate, 15-24 ° C, the plant is prone to cold weather, temperature below 10 ° C does not. Cultivation and cultivation of Arabias is very demanding and costly because the plants are predominantly in steep mountain terrain, and collection must take place manually. Also, pest and disease protection costs are higher and the plant needs more care.[4] The plant gives the first fruits after three years of planting and, under favorable conditions, yields can be expected from 6 years after planting. The crop then provides 25-35 years depending on the variety and climatic conditions. In 1 kg of coffee, there are approximately 2200 larger seeds. Although

[4] NCA. What is coffee? [online]. ©2014. Dostupné z: http://www.ncausa.org/i4a/pages/index.cfm?pageid=68/

Arabica covers about 70% of world production, only a fifth of this production is of high quality grain without any defects. Grains ripen after 7-9 months, depending on the species, and coffee is grown mainly in South American, Central America, Western and Central Africa, India and Indonesia. [5] [6]

Robusta

Most Robust are grown in Central and West Africa, Southeast Asia including Vietnam and Indonesia and Brazil. Robusta's production continues to grow, although it occupies only about 30% of world production. Robusta is more susceptible to temperature fluctuations than Arabic, requiring a warm climate with temperatures around 24-29 ° C. However, it is more resistant to pests and diseases and its cultivation is simpler and cheaper than Arabika. He does not need altitudes like Arabic to grow, growing up to 700 m. Robust grains are smaller and round (1 kg is about 3300 seeds). Grains of this coffee have a bitter taste, they contain 50-60% more caffeine than Arabika grains (Arabica 120 mg, robusta to 250 mg) and they are mainly used in mixtures and in the production of instant coffee. The first harvest at robusta takes place 2-3 years after planting. The fruits mature continuously throughout the year and are ripe for a shorter period of time than the fruits of Arabia. Robusta is nowadays planted on Arabian plantations that have been damaged by pests or frost.There are also hybrids between Robusta and Arabia. These types of coffee have been created primarily for greater resistance to Arabika pests and, on the other hand, to improve the taste of Robusta, and to improve the individual growth and flowering characteristics, harvest, grain size and caffeine content. These include, for example, Hibrido de Timor, Catimor or Ruiru Eleven. [7]

3.3 Harvesting and processing of coffee

Coffee beans are actually the seeds hidden in the fruit, called cherries, in each fruit there are 2 seeds - grains, placed opposite each other (like 2 half nuts). Sometimes a mutation of a fetus, known as "peaberry," may occur, when only one grain is developed. The harvest time varies according to the geographical location. North of the equator is mostly harvested at the end of the calendar year; in the southern hemisphere, coffee is harvested in the spring. As

[5] NCA. What is coffee? [online]. ©2014. Dostupné z: http://www.ncausa.org/i4a/pages/index.cfm?pageid=68/
[6] SVĚT KÁVY. Kávovník [online]. ©2014. Dostupné z: http://www.svetk avy.cz/info_kavovnik.php/
[7] NCA. What is coffee? [online]. ©2014. Dostupné z: http://www.ncausa.org/i4a/pages/index.cfm?pageid=68

has been said, coffee by species needs to produce fruits for about 6 -11 months. Therefore, only one harvest per year is possible. The exception is areas with alternating periods of humidity and drought such as Colombia and Kenya, where there is also a smaller second harvest. [8]

3.3.1 Harvesting

The mature fruits of the coffee have a deep red color. The fruits do not ripen all at once, so only the ripe must always be chosen. This is one of the reasons why hand picking still prevails. Another reason is bad accessibility in higher positions. However, nowadays, due to time and money savings, methods are also used to harvest all the fruits at one time and not to consider the immature fruits. Coffee beans The Arabias tend to fall off, so they are more often harvested by hand, while the Robust ripe fruits remain on the trees and are also suitable for mechanical harvesting.The total harvesting method, when the harvest is harvested all at once, can be done both mechanically and manually. Hand picking less damages the plant. Mechanical harvesting takes place only on large plantations with good accessibility (mainly in Brazil). It works in two ways. Either the fruits of the branches are thrown away, or there is a second, more gentle method, when the machine shakes the tree at different intensities and only ripe fruit leaves. The selective collection method is performed manually only. Gatherers bypass individual plants every 8-10 days. This type of harvest is more expensive and is used primarily for Arabic coffee. Each collector collects on average 45-90 kg (100-200 pounds) of coffee cherries per day. 9-18 kg of coffee beans.[9] [10]

3.3.2 Fruit processing

Once the coffee is picked up, it must be processed as quickly as possible to avoid spoilage. Processing usually begins on the day of harvesting. Due to the location of the farm and the

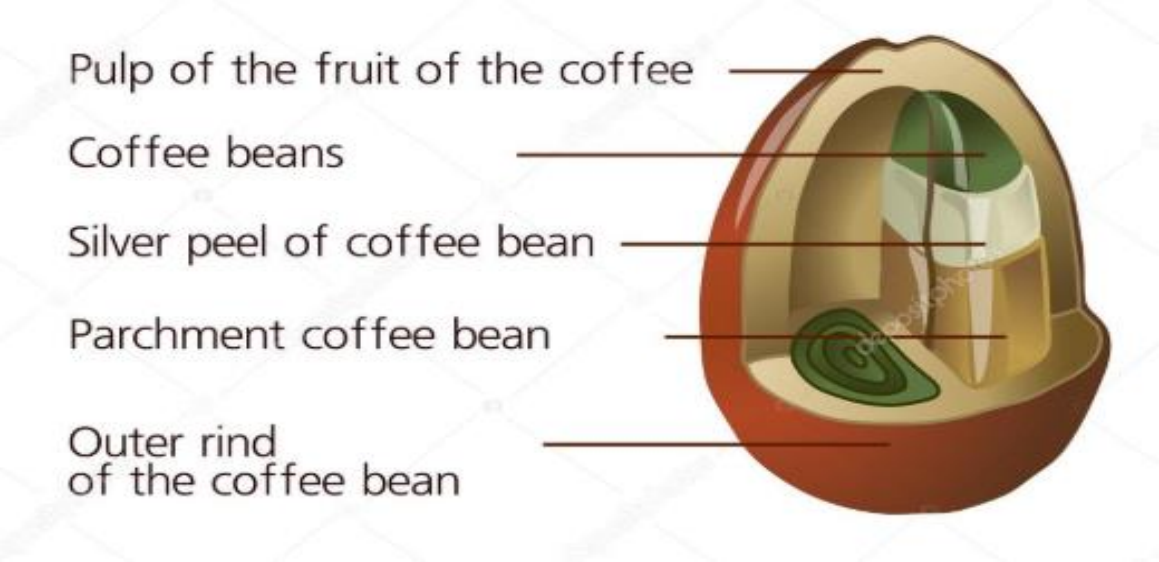
[8] KÁVOVÉ LISTY. Arabica vs. Robusta: Najdete 15 rozdílů? [online]. 2013 Dostupné z: http://www.kavovelisty.cz/arabika-vs-robusta-najdete-15-rozdilu/

[9] NCA. Ten Steps to Coffee [online]. ©2014. Dostupné z: http:// http://www.ncausa.org/i4a/pages/index.cfm?pageid=69

[10] HANDLOOM COFFEE ANF TEA.From Bean to Cup – How Coffee is Harvested and Processed [online]. 17.7.2014 . Dostupné z: http://www.handloom.co.uk/blog/from-bean-to-cup-how-coffee-is-harvested-processed/

water sources, three methods of processing are used - dry, wet and semi-dry. The goal of all methods is to separate coffee beans from other layers and mites. [11]

Picture 3: Structure of the coffee bean



Source: Romagnoli, Elio. "TRAINING & CULTURE – Romcaffè." Romcaff, 2017, www.romcaffe.it/en/training-culture/.

Dry method

Also known as the natural method is the original and traditional way of processing coffee. Harvested grains are spread on concrete surfaces or sails on the sun. Fruit must be constantly swallowed and turned over during the day. During the night and the rain they cover, because they can not moisten. The drying process takes about three weeks. When the grains are about 10-12 % moisture, they are stored either in the skin or already after the peeling process only in the so-called "silver skin". This method is traditionally used in areas with limited water resources. If the grains are dried in the fruit, it has a major effect on the taste. Coffee tastes fruity and sweeter. [12]

[11] HANDLOOM COFFEE ANF TEA.*From Bean to Cup – How Coffee is Harvested and Processed* [online]. 17. 7. 2014. Dostupné z: http://www.handloom.co.uk/blog/from-bean-to-cup-how-coffee-is-harvested-processed/
[12] HANDLOOM COFFEE ANF TEA.*From Bean to Cup – How Coffee is Harvested and Processed* [online]. 17. 7. 2014. Dostupné z: http://www.handloom.co.uk/blog/from-bean-to-cup-how-coffee-is-harvested-processed/

Wet method

In this method, the fruits are first placed in a machine for removing the flesh and the top skin. Thereafter, the peeled grains are "loaded" into the water bath and allowed to ferment. Thanks to natural enzymes, the "mucilage" layer is removed during fermentation. Fermentation takes between 12-76 hours and must be monitored. If the grains were left to ferment for too long, their taste would be destroyed. The grains are then rinsed and dried. Drying takes place in the sun or in a mechanical dryer. If the humidity is again around 10-12 %, grains are stored.

The wet-treated coffee has mostly a cleaner taste and more acidity. This method brings consistent results but consumes a lot of water and the cost of acquiring machines is considerable. There is a need for costly filtering systems for water purification to avoid pollution of local sources. [13]

Milling and storage of the beans

Following the method of processing, coffee is left in the warehouse for one to three months. This will always bring about the stability of moisture. Then the grains are again sent to "grind" again, depending on how they were processed. Milling is meant here as removing excess layers of grain (either whole skin or only "silver skin." The optional polishing process is polished grains are considered to be better than untreated but in practice there is only a small difference

Hulling machinery removes the parchment layer (endocarp) from wet processed coffee. Hulling dry processed coffee refers to the removal of the entire dried husk - the exocarp, mesocarp and endocarp - of the dried cherries.

[13] 10 Steps from Seed to Cup. National Coffee Association [online]. Copyright © National Coffee Association of U.S.A., Inc. [cit. 08.03.2019]. Dostupné z: http://www.ncausa.org/about-coffee/10-steps-from-seed-to-cup

Polishing is an optional process where any silver skin that remains on the beans after hulling is removed by machine. While polished beans are considered superior to unpolished ones, in reality, there is little difference between the two.[14]

3.3.3 Sorting of the beans and preparation for export

Prior to export, grains are carefully sorted by shape and look. Grains are mechanically and manually sorted and at the same time removes dirt, damaged grains, too small grains, insect-infested grains or unrefined peel. In many countries, both methods are used by sorting to export only the best quality coffee.

This coffee is called "green coffee" and is ready for export. It is transported in jute or sisal bags weighing 60 kg. Coffee is exported unprepared because coffee is a fresh product designed for fast consumption. [15]

3.4 Coffee roasting

Coffee is known and also consumed for its strong characteristic aroma, which was achieved by the roasting process. It is a complex process involving many sub-activities such as green coffee importing, cleaning, sorting, weighing, transport, storage, roasting, cooling, polishing and packaging itself (Mastronardi, 2014). Methods of roasting have evolved since 1700 when cultivated roasting began. From the beginning, coffee beans burned on an open fire, later used iron baskets, and today we commonly encounter semiautomatic rods which thanks to modern technology and constant development, are increasingly precise and more independent (Augustín, 2016).

The human factor plays a unreplaceable role in the process of roasting. Roasting is considered to be one of the most important phases of coffee grain processing and one of the most critical stages of coffee bean processing. A roaster or coffee roaster is responsible for the whole batch that is in the process of roasting. In the case of unprofitable roasting, even

[14] [online]. Dostupné z: (http://www.ncausa.org/about-coffee/10-steps-from-seed-to-cup)
[15] HANDLOOM COFFEE ANF TEA.From Bean to Cup – How Coffee is Harvested and Processed [online]. 17.7.2014. Dostupné z: http://www.handloom.co.uk/blog/from-bean-to-cup-how-coffee-is-harvested-processed/

the best selection coffee can be degraded or even completely destroyed. At the same time, however, a capable roaster can produce acceptable coffee quality from below-average green grains. It all depends on the skills, qualities, years of experience of the roaster, and also the method of getting roasted coffee beans. In Europe, roasters with a special rotating drum, which rotate during the roasting process, are routinely used, and all grains are roasted evenly. After the end of the required period, the coffee beans are immediately cooled, wrapped in marked bales and put to rest (Augustín, 2016). Cooling is a very important point in the roasting process. There are two methods of cooling - air cooling and water cooling. Each of these two methods has its advantages and, of course, negative properties. Air cooling is used more often due to lower financial costs, but also for gentler handling of the grain (Mastronardi, 2014).

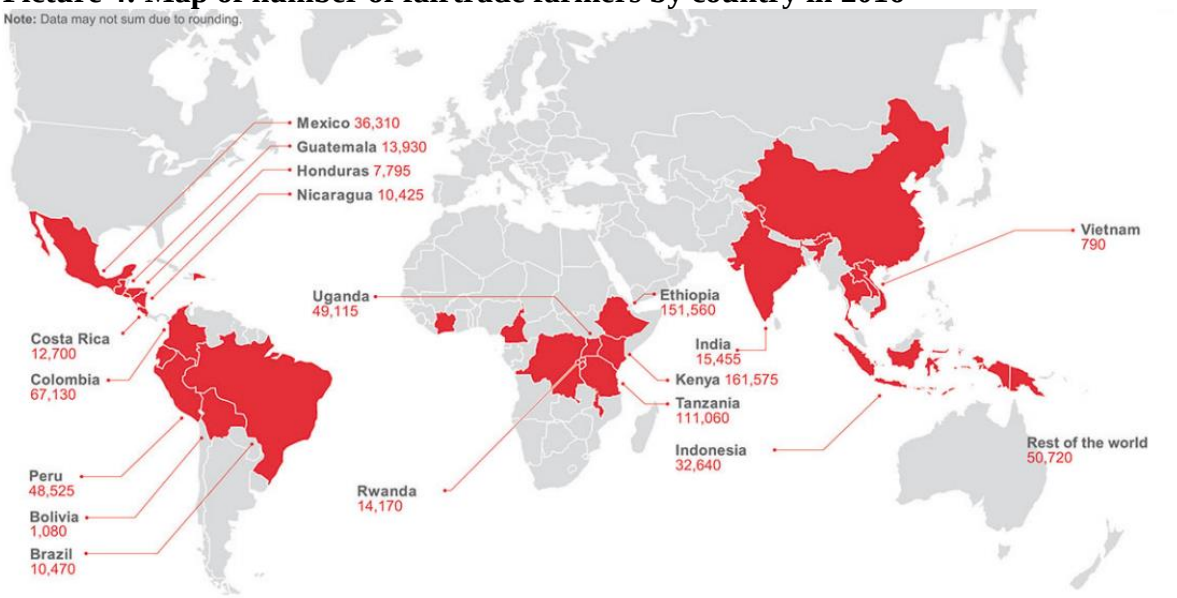
Modern roasting machines are increasingly automated and human activity is limited but still irreplaceable. Each batch of green grain, which comes from another type of coffee machine, has been modified in a different way and has been grown in a different geographic area than the others, it needs another suitable temperature and roasting time for itself. Before the start of the process of roasting the main batch of coffee beans, the roaster will perform a test. A small amount of given green grains goes into the small hand-held roaster. The three final samples of light city roast, the city plus roast and the full city roast are then sensitively evaluated and the best batch is selected. Coffee grain roasting has a direct effect on the resulting flavor, aroma and fragrance of prepared coffee. This very sensitive process must be done with maximum precision and perfection. If too high a temperature is used, so called grain sweating. The fats inside the grain would get too quickly to its surface, where the oxidation process would cause an unpleasant aroma-like scratch, and would have a negative impact on the quality of the resulting coffee. On the other hand, in the case of slow roasting with low temperature, only the inner part of the grain is roasted in the imperfect way. As a result, the potential properties of coffee beans are not fulfilled and their resulting fluid is not full (Augustín, 2016).

3.5 Fair trade

Infact that coffee is mainly grown in developing countries, the issue of fair trade or "fair trade" is closely linked to this issue. Under this term is called the global movement, which

seeks to restore the basic ethics trade, eliminate child labor and give everyone the possibility of a fair earnings. The history of this idea comes from the period after the Second World War. Then some humanitarian organizations are starting to buy handmade products from people in need instead of direct financial support. The traditional form of FairTrade was established in the 1970s. The main objective of the project is to support, in particular, smaller growers and craftsmen. Consumers of products bearing this name contribute a certain amount of money to improve their standard of living vendors from third countries. Apart from creating "fair" trade conditions, strict observance of labor law, environmental protection and also the corresponding product quality.[16] In the picture no. 4 we can see the number of fair trade farmer in coffee producing countries.

Picture 4: Map of number of fairtrade farmers by country in 2016



Source: 10 facts about Fairtrade coffee. [online]. Copyright © [cit. 14.03.2019]. Dostupné z: http://www.fairtrade.org.uk/Media-Centre/Blog/2016/April/10-facts-about-Fairtrade-coffee

Basic principles of FairTrade

There are basic princliples of fair trading that are listed below

[16] Co je FairTrade. bio-info.cz [online]. [cit. 2011-07-09]. Dostpné z:http://www.bio-info.cz/zpravy/co-to-je-fair-trade)

- **Fairness** - the two-way assurance of fair trade. For third-party manufacturers countries means that their product will be appropriately valued. For FairTrade organization again that the product meets certain qualities;

- **Community development** - FairTrade co-ops receive social contributions by which can improve their education or healthcare, for example;

- **Conservation of nature** - producers from third countries are trying to get the longest production time;

- **Chemical** and other uses are only used to kill pests, not to kill them as a preventive protection;

- **Long-term business relationships** - an effort to maintain the longest possible cooperation. Manufacturers have the certainty of money, and can better plan their business steps in advance;

- **Dignified working conditions** - ensuring respect for labor rights, safe working conditions and always at least a minimum wage;

- **Equality** - supporting national minorities as well as women;

- **Democracy** - Equal status of all members of the movement. Everyone has the right to hold leadership and to come up with new ideas for improvement;

- **Prohibition of child labor** - a ban on any work that could have a bad influence on physical and mental development of the child.

Picture 5: Fair trade logo

Source: https://3blmedia.com/News/CSR/Fair-Trade-Certified%E2%84%A2-Coffee-Imports-Hit-Record-High-2012

Products that can be referred to by this term are quite a lot. For example, coffee, tea, cocoa, chocolate, bananas, chewing gum and other foods can be used. These products are all labeled with the appropriate FairTrade logo which could be seen on the picture no. 5. Products, however, may not only be food. These can be, for example, musical instruments, toys, ornaments and other similar items that come from arts and crafts workshops and the logo of fair trade. These products can be purchased both in smaller shops that specialize in sales and in larger common chains.[17]

At present, thousands of different world organizations are involved in this movement and over five million smaller growers, craftsmen and other producers are helping this project to live a better life. The number of specialized Fairtrade stores in Europe is around 3,000 and we can find these products in more than 55 000 supermarkets. In 2016 Czech sonsumers has bought 326 tons of fair trade coffee, that is by 88 % more than in year 2015 we can notice a significant growth even with fair trade cocoa.[18]

3.6 Foreign trade with coffee

Foreign trade contributes to building lasting and high-quality neighborhood relations that reduce conflict and, on the contrary, promote the peaceful co-operation of two or more countries. It also greatly contributes to education, especially in countries where exports are

[17] ([20] Spravedlivý obchod. Nazemi.cz [online]. [cit. 2012-05-11]. Dostpné z:http://www.nazemi.cz/cs/fairtrade)
[18] ([21] Co je FairTrade. bio-info.cz [online]. [cit. 2011-07-09]. Dostpné z:http://www.bio-info.cz/zpravy/co-to-je-fair-trade)

significant. Applied to the example of coffee, the world's largest export countries are trying to make the most of their technical education and improvement in their production so that their actions have the least impact on the environment, making their production more efficient and less costly. In addition to technical innovation, learning with the new world languages, which is necessary for communication with other countries interested in the commodity, can also be included here.

When we are talking about the world coffee trade, it is necessary to mention the International Coffee Association (ICO). It is an association founded in 1963 under the auspices of the United Nations (UN). ICO is an international organization that brings together export and import countries in the industry, and currently we have 43 exporting countries and 7 importing countries. It is also a member of the Czech Republic, which belongs to import countries within the framework of typology.

ICO aims to develop international co-operation in world coffee trade as well as to solve any problems that may arise between its members or between a member and another non-member state. Another important goal is to strengthen the global coffee sector, promote the sustainable development of the sector and to reduce poverty in developing countries, which are the world's leading coffee producers and exporters. These goals are fulfilled by following steps:

- they allow the exchange of views on coffee matters, market conditions and trends between governments and the private sector, and coordinate political meetings;
- get funding for projects benefiting the world coffee economy;
- promoting the quality of coffee through the Coffee Quality Improvement Program and promoting market transparency by providing statistics on the coffee sector;
- developing coffee consumption as well as its market through innovative activities;
- supporting the development of strategies to increase the capacity of local communities and small farmers, support for educational and information programs;

- facilitate information on financial instruments and services for manufacturers;

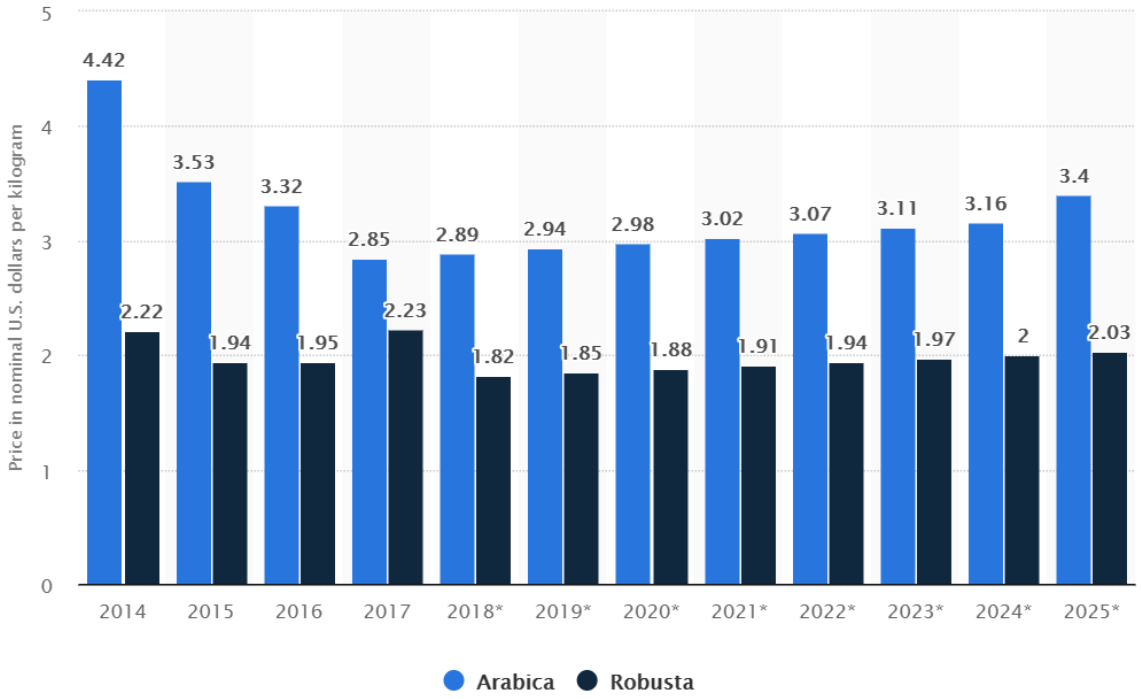
- provide objective and comprehensive economic, technical and scientific information on the world coffee sector.

As already mentioned, coffee is the second most tradable commodity in the world, and it trades with it on stock exchanges. "The popularity of coffee over the past 100 years has seen rocket growth.[19] The most important commodity traded is only crude oil. Robusta, which is of a lower quality, but represents commodity coffee, which represents about 40% of the market and with respect to world production, is traded on the London Stock Exchange. On the other hand, Arabica which is a high-quality selection coffee, and which accounts for around 60 % of world production, is traded on the Intercontinental Exchange in New York. [20]

In the figure no. 1, we can see the price development from 2014-2017 and the prediction for the years 2018-2025. Arabica is generally more valuable than Robusta by about 30 % but does not face price fluctuations unlike Arabica which has a slight price fluctuation.

[19] KÁVA zkušený matador na burze. Kávové listy [online]. 2017 [cit. 2017-10-27]. Dostupné z: http://www.kavovelisty.cz/kava-zkuseny-matador-na-burze/
[20] 1.2.5-World coffee trade-World production by type: arabica and robusta. ITC [online]. Dostupné z: http://www.intracen.org/coffee-guide/world-coffee-trade/world-production-by-type-arabica-and-robusta/

Figure 1: Average prices of Arabica and Robusta coffee worldwide from 2014 to 2025



Source: Average prices for Arabica and robusta coffee worldwide from 2014 to 2025 | Statistic. • Statista - The Statistics Portal for Market Data, Market Research and Market Studies [online]. Copyright © Statista 2019 [cit. 08.03.2019]. Dostupné z: https://www.statista.com/statistics/675807/average-prices-arabica-and-robusta-coffee-worldwide/

3.6.1 Factor influencing coffee price

In the international coffee market, it is necessary to focus on the price of coffee, which can be influenced by several, but simultaneously acting factors. It is the price of coffee and its development that not only affects the local coffee production within countries but, on the contrary, they affect the global coffee market on a global scale.

Regulation of price by supply and demand

As in all markets, self-regulating mechanisms operate in the coffee market. The price then adapts to demand. If demand is above supply, so coffee is deficient in terms of the quantity that is demanded in the world, the price of coffee goes up. On the contrary, if coffee is on the market higher than demand for coffee, coffee makers are willing to go down

significantly, in order to say what they produced. It is precisely these mechanisms that ensure that the balance of the global coffee market is maintained. [21]

Geopolitical factors

Most countries that grow coffee are developing countries. At the same time, circa 70 % of world coffee production is offered on the market by the world's five largest producers of this commodity, namely Brazil, Vietnam, Indonesia, Colombia and Ethiopia. For possible changes within these countries, the global coffee market reacts very quickly, usually by lowering the price of coffee. In this respect, the overall market situation is most affected by Brazil and Vietnam, whose production accounts for up to 50 % of world production. As an example, the relatively recent situation can be mentioned. "*There was a crisis before the 2014 FIFA World Cup (Brazil). While there was little emphasis on coffee prices at the time, since coffee prices have increased for most of the year, this event has certainly caused significant changes in the coffee market. There were fears that the crisis could escalate and jeopardize the production of green coffee in the country.* [22] This changes present risks not only at the local level, but the threat is reflected in the coffee market as a whole.

Overall, this category includes threats from the point of view of various war conflicts, the political stability of the country and the associated security risks.

[21] Price Volatility in the Coffee Market | tutor2u Economics. tutor2u | The Exam Performance Specialists [online]. Copyright ©2019 tutor2u. [cit. 08.03.2019]. Dostupné z: https://www.tutor2u.net/economics/reference/price-volatility-in-the-coffee-market

[22] The Top Factors that Move the Price of Coffee. Futures knowledge [online]. 2017 [cit. 2017-10-28]. Dostupné z: http://www.futuresknowledge.com/news-and-analysis/softs/the-top-factors-that-move-the-price-of-coffee/

Climatic factors

As has been mentioned before, each type of coffee needs specific conditions for cultivation, prosperity. Generally, we can say that coffee as a plant is quite sensitive to weather conditions, and these are just affecting the subsequent crop. In essence, this is primarily about the following conditions:[23]

- a reasonable amount of sun;
- adequate amount of hydration.

If coffee beans are often exposed to direct sunlight, or sunshine is deficient, as well as too much or too little rain in the breeding area, this will not only affect the quality of 120 but above all the quantity of coffee bean production. This fact subsequently affects the development of coffee as a commodity on the market. The global warming is a threat that will be affecting the many areas where this commodity is being cultivated, as well as the world in general, in the coming years to decades. In terms of cultivation of this commodity, it is caused by unfavorable weather conditions. For example, in 2014, due to extreme droughts and therefore lower crops, there was a significant increase in prices. An example is also the forecast of experts on Vietnam and the rainy season, which should be extended for up to three months over the next four decades, which would also greatly reduce coffee production in this area as well as increase the price of commodities of Vietnamese origin world coffee market. [24]Finally, we can also mention India, another major producer, where Indian coffee production dropped by almost 30% between 2002 and 2011. This fact shows us how fast and, above all, the sweeping consequences can be small changes in climate conditions in coffee growing areas.

[23] The Top Factors that Move the Price of Coffee. Futures knowledge [online]. 2017 [cit. 2017-10-28]. Dostupné z: http://www.futuresknowledge.com/news-and-analysis/softs/the-top-factors-that-move-the-price-of-coffee

[24] The Top Factors that Move the Price of Coffee. Futures knowledge [online]. 2017 [cit. 2017-10-28]. Dostupné z: http://www.futuresknowledge.com/news-and-analysis/softs/the-top-factors-that-move-the-price-of-coffee

Development of global demand and US dollar exchange rate

Countries that are the world's largest coffee producers are generally not among the largest consumers of this crop. Given that developed countries are increasingly targeting developing countries, the demand for coffee is rising, often resulting in an increasing cost of this commodity. Among the largest coffee consumers are the highly developed countries with a strong purchasing power and a strong economy.

With regard to trading on stock exchanges, it is also necessary to mention the development of the dollar, which undoubtedly has a significant effect on the development of commodity prices, including the development of the price of coffee beans. The reason is that the US dollar represents the world's currency in which the price of coffee is quoted. The US dollar is the most widely used currency on the international market.

3.7.1 Import of coffee to the Czech Republic

In 2017 Czech republic has imported coffee for 256.8 million US dollar and it made 0.8% of the global export. As for Europe, demand for coffee has remained stable over the past few years - by 2.5 million tonnes in 2017, or 41.6 million (60 kilos) bags of coffee. Similar developments, ie in terms of stability in consumption and demand, are also expected in the future, especially with regard to market saturation. Generally speaking, there is an increasing interest in specialized quality production in Europe, with the exception of countries that are price-sensitive and still look for affordable coffee, to the detriment of quality. These include, among others also Czech Republic. Europe represents 30 % of total coffe market. Thus is also caused by European countries that represents wolrd's largest coffee consumers which is for example Finland with consumption of 12kg per capita or Norway with 9.9kg per capita. [25]

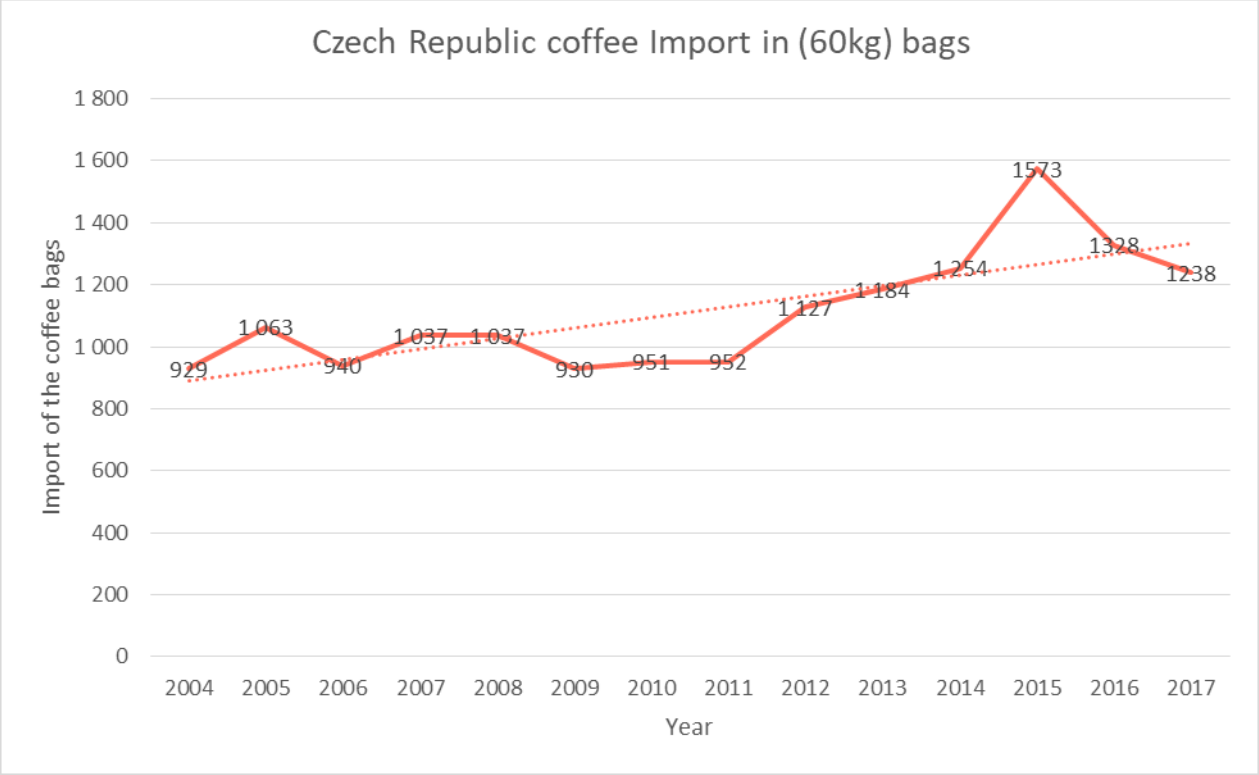
According to the euromonitor, there is a decline in the retail sale of coffee in the Czech Republic in 2017, mainly due to inflation and the growing demand for premium coffee. In

[25] Mapped: The countries that drink the most coffee. The Telegraph - Telegraph Online, Daily Telegraph, Sunday Telegraph - Telegraph [online]. Copyright © Telegraph Media Group Limited 2019 [cit. 08.03.2019]. Dostupné z: https://www.telegraph.co.uk/travel/maps-and-graphics/countries-that-drink-the-most-coffee/

the Czech Republic, where there is a growing demand for fresh coffee and coffee beans, however the consumption of instant coffee is prevalent on the Czech market, accounting for roughly 60 % of total consumption.

In terms of the Czech Republic, the coffee segment revenues for the year 2018 are estimated to be US $ 421 million and the total annual market growth should be approximately 3.4 % between 2018-2021.[26]

Figure 2: Development of coffee imported quantity



Source: Own elaboration

3.7. Czech coffee market

The first cafes were opened in the Czech Republic at the beginning of the 18th century in Brno and Prague. First, coffee was sold in pharmacies for its bitterness as a stomach cure. Extending generally expensive coffee among ordinary people did not occur until the servants got acquainted with the coffee. Subsequently, drinking coffee was popular with the tradition of Prague cafes. Coffee has begun to prosper during the world wars, when coffee drinking

[26] Euromonitor International [online]. 2018 [cit. 2018-03-14]. Dostupné z: http://www.euromonitor.com/

has become part of lifestyle. The boom was interrupted by World War II, when coffee was inadequate and replaced by coffee substitutes. After the war, most of the First Republic Cafes were closed, the roasters were nationalized, and the quality coffee and coffee machines were not getting enough. For this reason, he was soon in love with a low-priced Czech "Turkish" [23]. During the communist era, until November 1989, the coffee market was exclusively dominated by the state-owned Balinese Trade Company. After the revolution, in January 1991, the company collapsed, privatized and sold to Tchibo, Mondelez International Inc. (by 2012 Kraft Foods) and Sara Lee.[27]

According to the household consumer panel, GfK bought coffee in year 2012 to 93 % of Czech households, with an average of 900 cups of coffee per household. Czech coffee purchases approximately 14 times a year with an average coffee price exceeding CZK 80. Coffee is not as prone to seasonality as tea in the winter months. Customers consume coffee all year round, with a slight predominance of grain or ground coffee, which almost 3/4 Czech households purchased in the survey period. Instant coffee was bought by only a fraction of households.

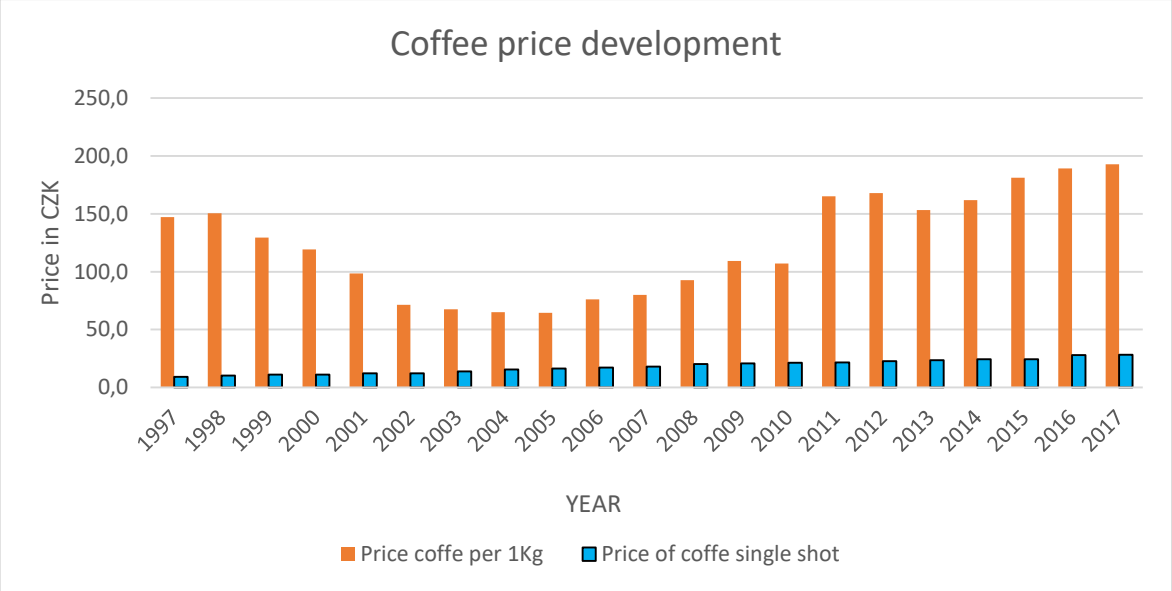
If we focus on the type of coffee for which Czech consumers spend the most money, the first place is instant coffee with over 650 cups during the period under review, second is the ground coffee or bean with 400 cups and the third place coffee specialties with 100 cups. [28]

Based on BENDLOVÁ Kateřina, every Czech has an average of 400 cups of coffee, which corresponds to a weight of 3kg of coffee beans. Yet, we are lagging behind the largest coffee drinkers in Europe. The residents of Finland drink on average over 12kg of coffee per person. In addition to coffee shops, coffee shops and coffee shops, coffee offers over two and a half thousand cafes. Of all regions, most coffee is drunk in Prague, this volume reaching 14% of the total consumption of the Czech Republic. Households are still the most popular Czech "Turkish". The rising pace of lifestyle puts people at high demand for time savings. That's why coffee is a trend in "big go" coffee or a variety of coffee capsules. Uncooked coffee has

[27] Ze světa komoditní kávy: Kdo ovládá trh?. Kávové listy.cz [online]. 2013 [cit. 2014-11-03]. Dostupné z: http://www.kavovelisty.cz/ze-sveta-komoditni-kavy-kdo-ovlada-trh/.
[28] V českých domácnostech se nakupuje více kávy neţ čaje. GfK [online]. 2013 [cit. 2014-10-31]. Dostupné z: http://www.gfk.com/cz/news-and-events/News/Stranky/v-ceskych-domacnostech-se-nakupuje-vice-kavy-nez-caje.aspx.

a negligible share of the market, while Czech consumers consume coffee mainly because of its stimulating effects. Czechs prefer coffee "aromatic, moderate, slightly sweetish or bitter, more sophisticated tones do not tell us anything.[29]

Figure 3: Price coffee developement from 1997 – 2017



Source: CSO own elaboration

Looking at the figure no. 3 we see an increase in the price of one portion of coffee by almost 10 CZK over a decade. The price of coffee per serving has been steadily rising over the past two decades, but has seen a slightly faster increase in inflation in the last decade, which is due to inflation. The price of roasted coffee beans has a very fluctuating development compared to the price of coffee per serving. We can experience sharp falls in prices, but have tended to grow slightly faster since 2005, with a slight decrease in 2012. From 2013, the price of roasted coffee is growing steadily.

The coffee market is dominated by multinationals where half the volume of coffee is marketed through Nestlé and Mondelez International Inc. (formerly Kraft Foods). These two companies with J. M. Smucker Company, Sara Lee and Tchibo occupy 2/3 of the world coffee market. The Swiss company Nestlé operates Nescafé, Nespresso and Dolce Gusto coffee machines on the coffee market. American company Mondelez International Inc. Jacobs and Carte Noire. The German company Tchibo still owns a family of founders who

[29] Umíme pít kávu?. BENDLOVÁ, Kateřina. Svět potravin [online]. 2014 [cit. 2014-11-03]. Dostupné z: http://www.svet-potravin.cz/clanek.aspx?id=4217.

offer various types of coffee and specialties under the Tchibo brand. American company Sara Lee delivers goods to the domestic market under the Douwe Egberts brand. [30]

The coffee market in the Czech Republic is completely dependent on imports of coffee from major growing countries. In table no.1 we can see the values of coffee imports to the Czech Republic according to the International Coffee Organization from 2017. The first place in the volume of imported coffee is roasted coffee beans, followed by green coffee beans, and in the third place instant coffee. The value of consumed coffee was 1.98 kg per capita in the Czech Republic with a wholesale price of roasted coffee of 197.8CZK/kg.

Table 1: Imported quantity in year 2017 (in kilograms)

Import of green coffee beans	17 700 900
Import of roasted coffee	23 590 740
Instant coffee	15 850 320

Source: ICO own elaboration

The price of coffee in the domestic market is influenced by European market prices, since the price of coffee, especially Arabic, has been growing since 2002. The price of this coffee declined considerably from an average of around 267.3 to 136.5 US cents per Brazilian pound (0.459kg) by 2013. The price of Arabica coffee rose to 187.4 US cents per pound by September this year. The Robusta coffee price tends to grow moderately with occasional price declines. The classic non-selective coffee mix is made up of less quality coffee with a high proportion of Robusta, mainly from Vietnam and developed African countries. Decrease in the price of the standard coffee mix in 2013 affected a slight decrease in the prices of Robusta coffee in the European market.

3.8 Czech coffee market

Czech coffee market has 10.5 billions citizens, and 51 % of them are female and 49 % are male. Czech market contains 4.5 billion housheols and 95 % of the households are active buyers of the coffee. Daily czech coffee consumpion of coffee per household is 3.5 cups, which is 538 cups of coffee per person annualy. Typical czech coffee cup drunk in the Czech

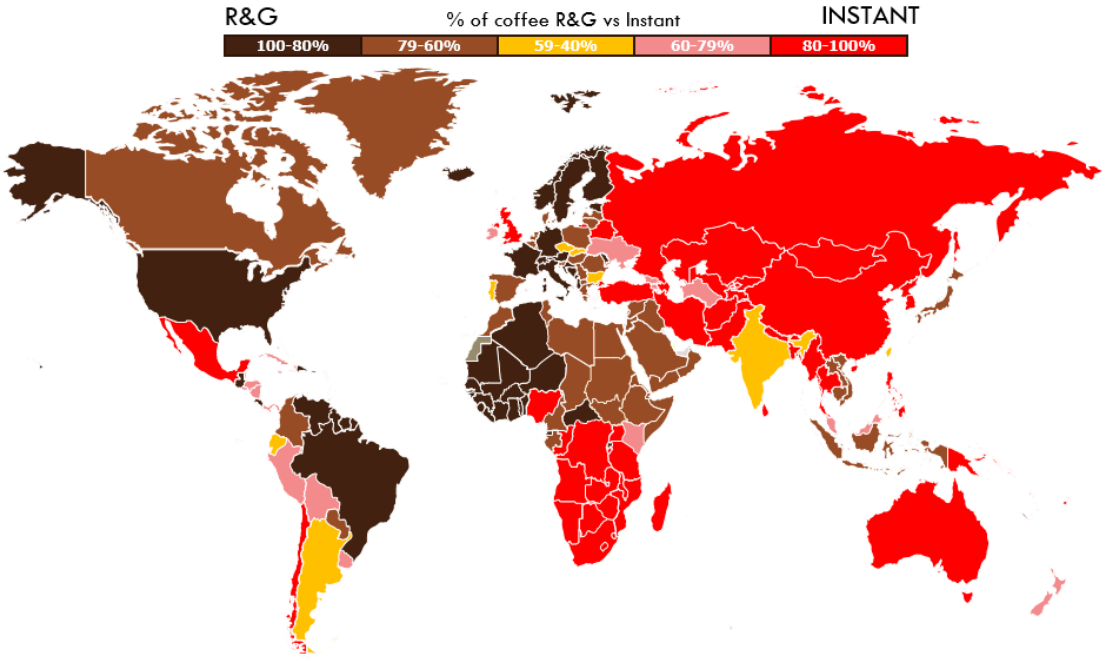
[30] Ze světa komoditní kávy: Kdo ovládá trh?. Kávové listy.cz [online]. 2013 [cit. 2014-11-03]. Dostupné z: http://www.kavovelisty.cz/ze-sveta-komoditni-kavy-kdo-ovlada-trh/.

republic is about 180ml and 70 % are consumed with a milk 60 % of the cups are consumed with sugar. The most frequent time for coffee cup is around 8:30 and 16:00.

Average household buys 5kg of coffee per year, in 15 times, in average 330g of coffee per on shopping. Average Czech citizen spends 602.8 czk on coffee speaking of retail purchaise yearly. For houselhold i tis 1430.8 czk yearly (Nielsen brand bank data, 2016).

On the map below we can see global coffee typ preferences. Czech republic is percieved as country with high preference of instant coffee. Regarding to the map below 41 % of consumers prefers instant coffee and 59 % prefers roasted and ground coffee. This share maight be influenced by high popular "Turkish coffee" which is made by same methond as instant coffee but is used grounded coffee beans.

Picture 6: Map of coffee type preferences



Source: Keeping Robust: Global Trends in Instant Coffee | Market Research Report | Euromonitor. Euromonitor International | Strategic Market Research, Data & Analysis [online]. Copyright © 2019 Euromonitor is privately owned [cit. 25.10.2018]. Dostupné z: https://www.euromonitor.com/keepingrobust-global-trends-instant-coffee/report

Regarding the competitive environment of companies in 2017 two companies, Jacobs Douwe Egberts (JDE) and Nestlé Česko, were the market leader in the Czech Republic. Both of these companies recorded a loss of part of the market last year for the benefit of Tchibo,

which offers premium quality coffee. Similarly, the market share of Lavazza or Segafrado. This, in fact, reflects an increasing consumer demand for quality coffee. Tchibo coffee also gains a more significant market share, coupled with both quality and popular coffee, as well as marketing the company and its promotion both in stores and on social networks. This is the result of selected strategies of other competing firms, especially L'Or Espresso and Carte Noir. In terms of coffee machines, which are widely used in the Czech Republic, the popularity of Senseo, Philips and Tassimo coffee makers is growing

3.9 World Trade Organisation

The WTO is an institution that primarily oversees the observance of the established trade rules in all its Member States. It was founded in 1995 and its main headquarters are in Geneva. It currently has more than 160 Member States. They account for about 90 percent of global trade. The rules and provisions for world trade are based on the 1986 GATT Uruguay Round. In addition to the control function, the WTO seeks to promote the development of world trade as such and also resolves disputes between Member States.[31]

The institution is based on the following principles:

- trade without discrimination - equal treatment for all Member States, absence discriminatory practices;

- gradual liberalization of trade - liberalization of trade, from the outset, it was only about tariff measures such as customs duties, non-tariff and non-tariff measures industrial products and services, intellectual property, agriculture, and so on;

- Predictability within the trading system - all changes must first discuss and then approve, if necessary;

- fair competition - oversight of compliance with established rules, removing practices that could jeopardize fair competition;

[31] WTO | What is the WTO? - Who we are. World Trade Organization - Home page - Global trade [online]. Dostupné z: https://www.wto.org/english/thewto_e/whatis_e/who_we_are_e.htm

- Development principle - support and a number of reforms for less developed Member States.

[32]

3.9.1. WTO bodies

Below you can see the main classification of the main WTO bodies.

Ministerial Conference

Forms the highest authority of the World Trade Organization. Their meetings are held every two years, and all issues related to trade agreements are discussed. Any vote or decision making is usually done in the form of a consensus. In the absence of a consensus, a majority vote shall be held where each of the representatives of the member states has one vote. The first ministerial meeting was held in Singapore in 1996.

General Council

Composed of representatives of individual member countries. Its powers are, in principle, the same as those of the Ministerial Conference. He is in charge of managing the world organization between conferences. There are three working bodies under the General Council, which then deal with different areas of trade.

These bodies are: Trade in goods, Business Services and Commercial aspects of intellectual property rights.

Executive bodies (committees)

Follow on advice and deal with specific areas of business. These include, for example, the Sanitary and Phytosanitary Measures Committee, the Market Access Committee or the Committee on Agriculture.

The WTO Secretariat

[32] WTO | Understanding the WTO - principles of the trading system. World Trade Organization - Home page - Global trade [online]. Dostupné z: https://www.wto.org/english/thewto_e/whatis_e/tif_e/fact2_e.htm

serves as an administrative and technical background for these bodies. The Head of the Secretariat is represented by the Director-General of the WTO, who is elected for a four-year term of office. Currently, this position is represented by Frenchman Pascal Lamy, who has also served as the EU Trade Commissioner (Svatoš, 2009)

3.9.2 Criticism of WTO

In spite of all good intentions and goals, the World Trade Organization often encounters criticism, whether by anti-globalization or by the Member States themselves. In the first case, for example, the Seattle Conference turned into an open protest action. However, the second case is a little worse - it concerns the decision-making process itself. As has already been mentioned, decision-making is mostly the form of a consensus. But there is one more way to make major decisions, the so-called "Green Room Meetings". Only representatives of selected Member States are invited to these meetings, and other Member States may regard such access to the case as discriminatory (Svatoš, 2009).

3.10 Global coffee crisis

One of the most important milestones in the development of the coffee market, especially after the liberalization of trading, has become a crisis that has escalated negatively in 2001. Coffee prices have fallen to their historically lowest values since 1971 and remained at the same level for about six years. No new ICA has been adopted at this time, but the 1994 agreement has just been extended for several years, but this was not sufficient for the necessary market regulation. The coffee crisis has had devastating consequences for many small farmers, but also for bigger producers. Their revenue during the crisis reached about 25 % of the 1960 sales, which highlights the fatal situation on the market, as world production in about 1960 was lower by half. A number of significant factors were involved in the collapse of prices. (Bush, Berger, 2012)

- Structural change in the market following the abolition of the quota system and after liberalization. It was this change that brought the biggest negative issue a few years after its inception. There was a huge imbalance between supply and demand. Coffee, and especially low-grade coffee, flooded the market. The global supply grew by 3.6 % on average each year and 115 million sacks were produced, while demand was relatively stable with a slight increase of 1-1.5 %. Volume demand was about 105-106 million cups of coffee. Vietnam was a major contributor to this situation, which expanded most in the production of inferior coffee from all countries. Nor did the other countries that were driven by two significant price increases in 1994 and 1997;

- Imbalances in the market, poor farmers and profitable piggy banks. The problem was to reduce the proportion of raw coffee prices in the sale of the final product. This share fell by more than 18 percent. Likewise, the price farmers received for their production in the early nineties was $ 10 billion and the total value of the market was $ 30 billion. During the ten years of crisis, proportional distribution has changed in favor of market prices. Farmers received less than $ 6 billion and market value doubled;

- New technology to reduce coffee quality and demand for it. High competition has led farmers to discover and use new technologies and techniques that have fostered

fruit growth. However, this has not always led to an improvement in the quality of the crop, on the contrary. At the same time, demand for poor quality coffee has never been so high before. During the time of the regulated market, black grains of immature fruits were discarded, while after liberalization, demand in Europe grew. Many countries were looking for a way to change their laws that did not allow the export of grain from unseen fruits. Last but not least, the low-quality Robust was supplied mainly by Vietnam, which does not have more favorable climatic conditions for the cultivation of this variety. The high interest in low-quality and cheap coffee also led to the crisis.

Absence of rural development. Many producer countries have and still have non-diversified agricultural production. Their export earnings were solely dependent on the sale of coffee. This was also shared by Europe and the US with their protectionist measures that did not allow the productive, developing countries, to benefit from the sale of other commodities. It kept the countries in a constant poverty cycle. They did not develop their infrastructure, lack capital and limited market access. All these conditions have led to limited information about realistically possible and permissible prices. [33]

Despite the export, which was one third higher than the previous decade in the nineties, producers could not cover their production costs. However, from the point of view of the consumer or the importing countries, the crisis has been an excellent driving force for the emergence and development of coffee trading. For the future, they have created higher demand, and in the developed countries the caviar industry has been fully enforced. For producers, however, the situation has not improved for a long time and it would not help even an immediate matching of demand with the world offer (Tickell, Gresser, 2002).

3.11 Coffee stock market trading

Most of the worlds coffee production is traded on commodity exchanges. These are organized markets that follow strict rules. It deals with commodities (such as oil, wheat, gold coffee) and not with securities. For coffee, these are mainly stock exchanges in New York and London.

[33] ICO, 2002. The Global Coffee Crisis: A threat to sustainable development. [Online], Dostupné z: http://dev.ico.org/documents/globalcrisise.pdf

- New York: The Intercontinental Exchange (NYSE, ICE). This trade is trading with Arabia under the trade mark KC;

- London: London International Financial Futures and Options Exchange (NYSE Liffe), Robusta deals with RC.

On the ICE, the volume of one contrac is 37 500 lbs on the Liffe stock minimum volume is 10 tons. Both exchanges are traded in US dollars. Other coffee shops are in Brazil, Singapore, Japan and Vietnam (ICT, 2011).

Coffee is traded on so-called futures contracts. This contract represents coffee that will be available in the future, in a certain amount and quality at a certain price, agreed in this futures contract. The term store deals only with the price and delivery date. The delivery date is selected from predetermined periods of the calendar year, called trading position. On the stock exchanges, coffee and coffee mixes of standard quality are in large volume, not premium or selective coffee. With the onset of information technology, the essence of coffee trading has changed, and market speculation has led to up to fifty owner changes from growers to consumers.

Participants in these deals are primarily interested in risk management (hedging), investment opportunities and speculation on the market. It is not primarily about purchasing physical coffee. These futures are high risk. For example, it may happen that the harvest is lower and the price rises, but the seller is bound by a contract at a lower price than the price of the current and then the track (if there is a fall in prices, then the buyer lines). Against these fluctuations the participants are insured by contracts that offset the prices of futures contracts and prices real coffee in the real world. Changes in prices are offset by this contract, called "hedging". "Hedging" - hedging is an operation that replaces a later transaction in a market with an immediate delivery date. [34]

[34] *Hedging: nejistá budoucnost – zisk jistý*. [online]. 6.6.2003. Dostupné z: http://finance.idnes.cz/hedging-nejista-budoucnost-zisk-jisty-dh7-/inv.aspx?c=A030605_180631_fi_osobni_dvo

Traded coffee is officially divided into 4 categories. The category in which the country is classified is determined by the main export category and the type of coffee in that country. This division is based on ICO and ICA (ICT, 2011).

Table 2: Distribution of producer countries by trading groups on the stock exchange

Catergory	**Producers**
Colombian arabica	Colombia, Kenia, Tanzania
Other arabica	Bolivia, Burundi, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, India, Jamaica, Malawi, Mexico, Nicaragua, Panama, Papua New Guinea, Peru, Rwanda, Venezuela, Zambia, Zimbabwe
Brasilian and other coffee proces by dry method	Brazil, Ethiopia, Paraguay, Timor-Leste, Yemen
Robusta	Angola, Benin, Cameroon, Congo, Equatorial Guinea, Indonesia, Liberia, Madagascar, Nigeria, Philippines, Sierra Leone, Sri Lanka, Thailand, Togo, Trinidad and Tobago, Uganda, Vietnam

Source: Coffee exporter guide own elaboration

4 Practical part

This chapter deals with the description and statistical relationship between Czech coffee imports and coffee consumption in the Czech Republic, the average wage, the us dollar exchange rate per Czech crown and the retail price of coffee in the Czech Republic. I chose the annual data between 1997-2017. The time was chosen because in this period it referred to the Czech market of several renowned events. One of these events is a milestone for the Czech economy and it is the entry of the Czech Republic to the European union. The czech economy was going in the last 15 years trough the significant reform and the main in the last decade where you can seek the very positive growth of the czech economy. A reasonable fluctuation of the values of the indicators at that time should clearly indicate that there is a dependence between coffee imported to the Czech Republic and selected macroeconomic indicators. At the first time of our monitoring period, you can see less than the importance of coffee to the Czech Republic, where the american dollar rate has been largestly lower in our monitored period. The drinking of coffee is stained in the world with a current daily need and then the coffee consumption is not merely durable to fluctuations.

The European Union as a whole is the largest importer of coffee and with a population of around 500 million people is the largest barrier-free market. The EU market is bigger than the US, Canadian, and Mexican markets combined. The largest suppliers of coffee to the EU are five suppliers. Brazil (33 %), Vietnam (20 %), Indonesia (6 %), Honduras (6 %), and Peru (5 %). Otherwise, the largest coffee importer in the world is the United States of America. To the US, as in most of the world, imports from Brazil are on average 28 % of total American coffee imports, Vietnam (18 %) and Colombia (13 %). For 2012, a total of 26 million sacks were imported into the US, accounting for 34 % of EU imports. The US has been the largest importer of coffee for a long time. Coffee is filtered primarily for up to 92 of the 100 consumed drinks. From EU countries, the largest amount of coffee is imported into Germany. In 2012, for example, 21.8 million bags were imported into Germany, which is 30% of total imports into the EU. Germany is a country re-exporting and most of the imported coffee is further exported to other countries. In 2012 Germany has re-exported 12.6 million bags out of 21.8 million bags, which is over half of the imported quantity. One of these countries is the Czech Republic. Already in the theoretical part we mentioned that Germany beside of other Eurpean countries such as Poland, Slovakia etc. is the largest

importer of coffee in the Czech Republic, from most roasted coffee and coffee extracts are imported. A similar trade balance is between the Czech Republic and Poland, which imported nearly 5,500 tonnes of roasted coffee, coffee extract and essences to the Czech Republic in 2012. Imports of green coffee, roasted coffee and coffee extracts with essences are shown in Table 1. As we already mentioned in the theoretical part of this thesis, according to the European Coffee Federation (2014), 2012 is the world's largest producer of green coffee for the world's largest producer and exporter of Brazil for 2012. About half the amount of imported green coffee to the Czech republic compared to Brazil came from Vietnam (2 864 tonnes) and about a third of imported imported coffee from Honduras (1 680 tonnes). This points to the fact that most of the coffee that goes to the Czech Republic directly from the production countries is in the form of green grains and the coffee transported through another European country comes to the Czech Republic already processed in the form of roasted coffee or coffee extracts or essences.

On the table below we can see imported quantities devided in to the 3 main categories, from the largest importing countries to the Czech Republic.

Table 3: Coffee import to the Czech Republin in 2012 by country and category

Green coffee	**Tons**	**Roasted coffee**	**Tons**	**Instant coffee**	**Tons**
Brasil	5010	Germany	5189	Germany	6240
Vietnam	2834	Poland	4678	UK	3277
Honduras	1680	Austria	1568	Spain	1436
Indonesia	1329	Italy	856	Poland	817
Sierra Leone	886	Slovakia	774	Switzerland	353
Others	5548	Others	2360	Others	800
Total	**17316**	**Total**	**15424**	**Total**	**12923**

Source: data from: ecf-coffee.org own elaboration

4.1 Dataset and analysis of choosen variable

To analyse import of the coffee to the Czech Republic we have selected variables that are relevant according to the economical theory. We concluded that the choosen variables could be important for importing coffee. For building an econometric model we need to define a dataset. Data set is a collection of data. Most commonly a data set corresponds to the contents of a single database table, or a single statistical data matrix, where every column of the table represents a particular variable, and each row corresponds to a given time unit, in our case years. The data set lists values for each of the variables for a given year.

Table 4: Dataset table observation from 1997 - 2017

Date	Import of the coffee	Unit vector	Coffee price	Income	Coffee consumption	Rate USD/CZK
1997	1,66	1	300,68	10,80	3,95	31,71
1998	1,76	1	362,11	11,80	3,15	32,27
1999	1,88	1	297,63	12,80	2,83	34,60
2000	1,61	1	285,26	13,22	2,69	38,59
2001	1,29	1	243,52	14,38	3,05	38,04
2002	0,96	1	215,34	15,52	3,07	32,74
2003	1,04	1	192,51	16,43	2,85	28,23
2004	1,23	1	195,64	17,47	2,91	25,70
2005	1,65	1	199,67	18,34	3,14	23,95
2006	2,03	1	196,47	19,55	3,35	22,61
2007	2,44	1	196,13	20,96	3,36	20,31
2008	2,45	1	215,87	22,59	3,80	17,04
2009	2,56	1	216,34	23,34	3,85	19,06
2010	2,68	1	210,64	23,86	3,74	19,11
2011	3,62	1	256,05	24,46	3,63	17,69
2012	3,47	1	307,18	25,07	3,94	19,58
2013	3,35	1	301,30	25,04	3,79	19,57
2014	5,99	1	301,69	25,77	4,07	20,75
2015	12,63	1	311,19	26,59	3,73	24,60
2016	8,64	1	330,03	27,76	3,87	24,43
2017	5,94	1	338,48	29,50	3,47	23,38

Source: CSO, WTO, ICO with own elaboration

Variable could be in different units and has a different role, for this reason we need to declarite variables and their units. Most important is to define our endogenous a exogenous or also called dependent and independent variables. For this reason we have create table below to declare variables.

Table 5: Declaration of variables

Variable	Units	Type
Import of coffee	bill.CZK	Exogenous
Unit vector	-	Exogenous
Price of the coffee	CZK/1kg	Exogenous
Foreign exchange rate USD/CZK	CZK	Exogenous
Income	thous.CZK	Exogenous
Cunsumption of coffee	Kg per capita	Exogenous

Source: own elaboration

4.1.1 Analysis of chosen variables

There is choosen variables analysis in the following section.

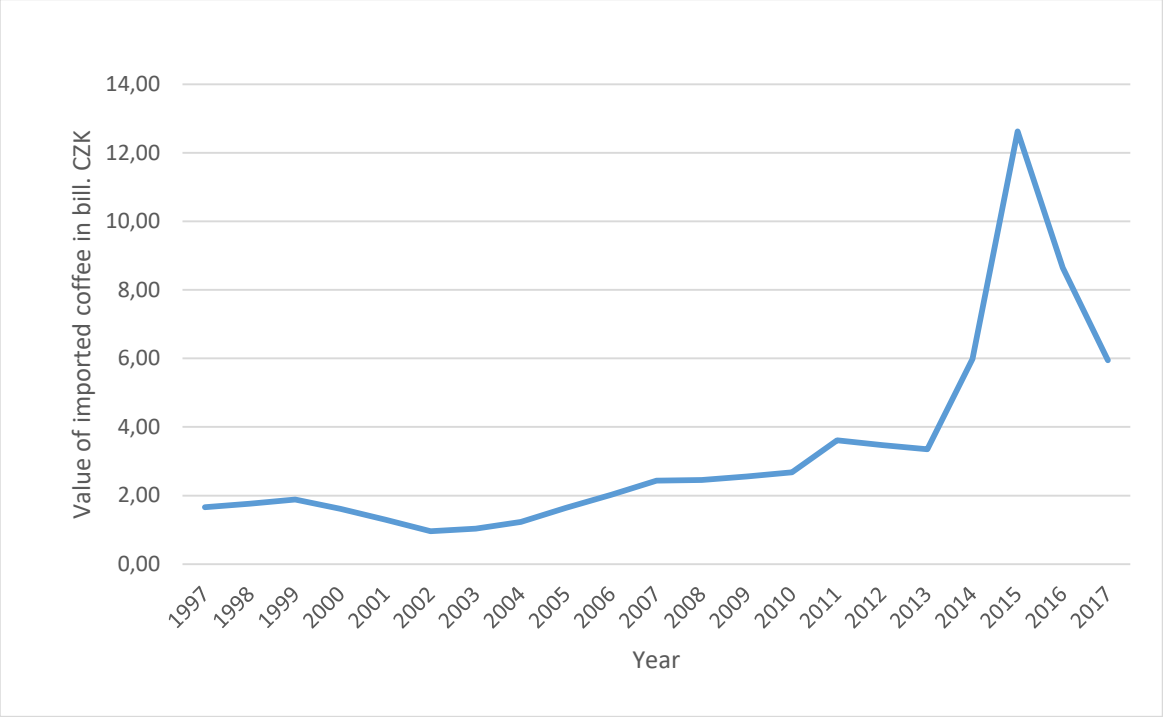
Import of the coffee to he Czech Republic

All coffee is imported into the Czech Republic as this commodity is not grown here. Coffee is imported both in the form of roasted coffee and green ungraded grains, as well as coffee with caffeine and decaffeinated coffee. The following chart shows the development of net imports of coffee into the Czech Republic in thousands of tons of coffee in the years 1997-2017. Net imports of coffee means total coffee imports adjusted for possible coffee exports in individual years.

The graph below shows that coffee imports have a slightly rising trend, probably due to a slightly rising trend in coffee consumption. Average coffee imports during the monitored period amounted to 3.28 billion Czech crowns per year. Between 2000 and 2003, the value

of the imported saw a decreasing trend, but since 2004 the value of the imported coffee decreases, mainly in the rising trend, mainly in 2015, when almost 100% year-on-year growth was recorded, partly due to the rise in the average USD and EURO exchange rates the majority of imported coffee comes from EU countries. The further reason for this is the real increase in the tonnage imported, which is almost 30% higher than in 2014. Since 2016, the value of imported coffee has decreased significantly by 53% between 2015 and 2017

Figure 4: Developement of coffee import (in billions CZK)



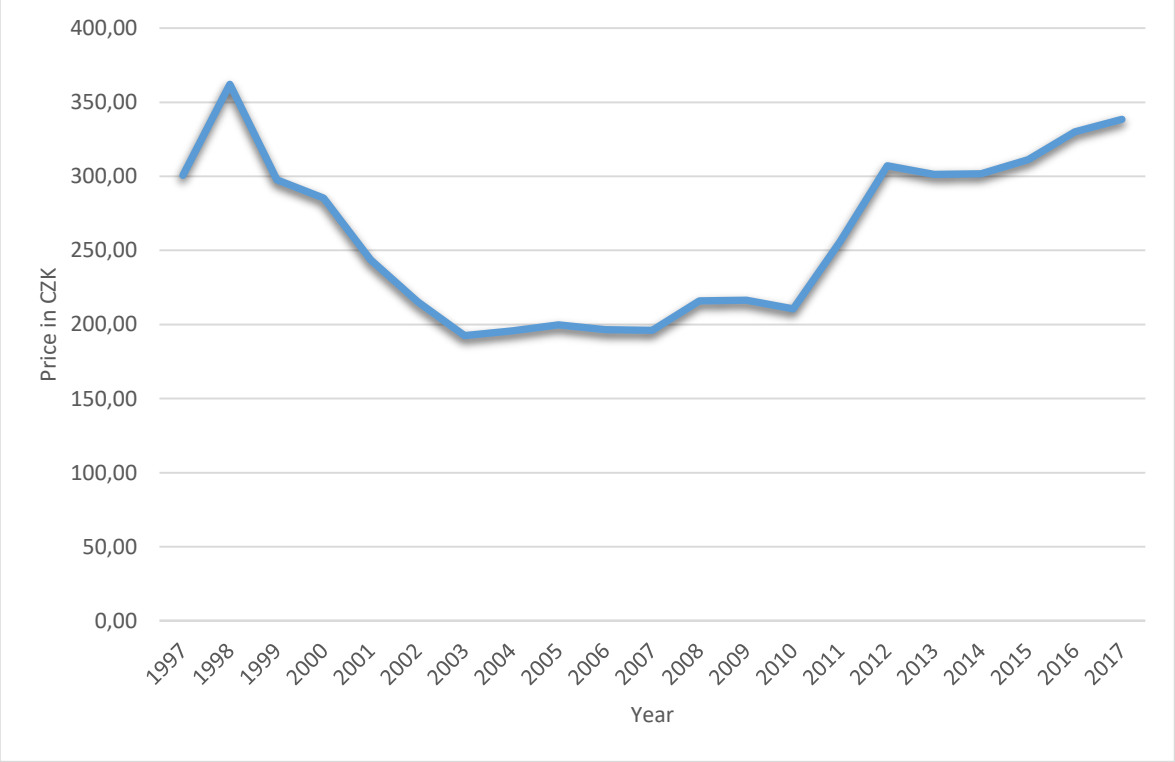
Source: CSO own calculation and elaboration

Consumer price of the coffee

We have chosen average retail rice of the coffee. This is according to the economical theory important factor in case that we are not speaking about products essential for life where price is not the key factor because there will be a certain level of consumption regardless on the price or income. Coffee is not percieved as essential product for living, however consumtion of coffee became over the last decades a daily ritual and is widespread in almost all countries of the world. Thus shoul cause a light iportance of coffee price but it should be insignificant factor of consumption which is considered as main factor of import.

From the graph below that the consumer price of coffee beans has a slightly declining trend in the long run. However, the development of the bean coffee price has shown that by 2007 the price of coffee bean had a decreasing tendency and fell by about 30%. Since 2008, its price has been rising. The fall in prices between 1997 and 2007 could have been affected by many factors, such as coffee prices on the US stock market, different weather conditions, or the political situation but, above all, a certain degree of impact on the coffee crisis over the period. In this case, it can be stated that to a certain extent, this fall in the price of bean coffee has been affected by the US dollar, which has declined sharply since 2000. The average price of bean coffee in 1997 - 2017 is 260.65 CZK per 1kg of coffee.

Figure 5: Developement of coffee price (in CZK)



Source: Own elaboration

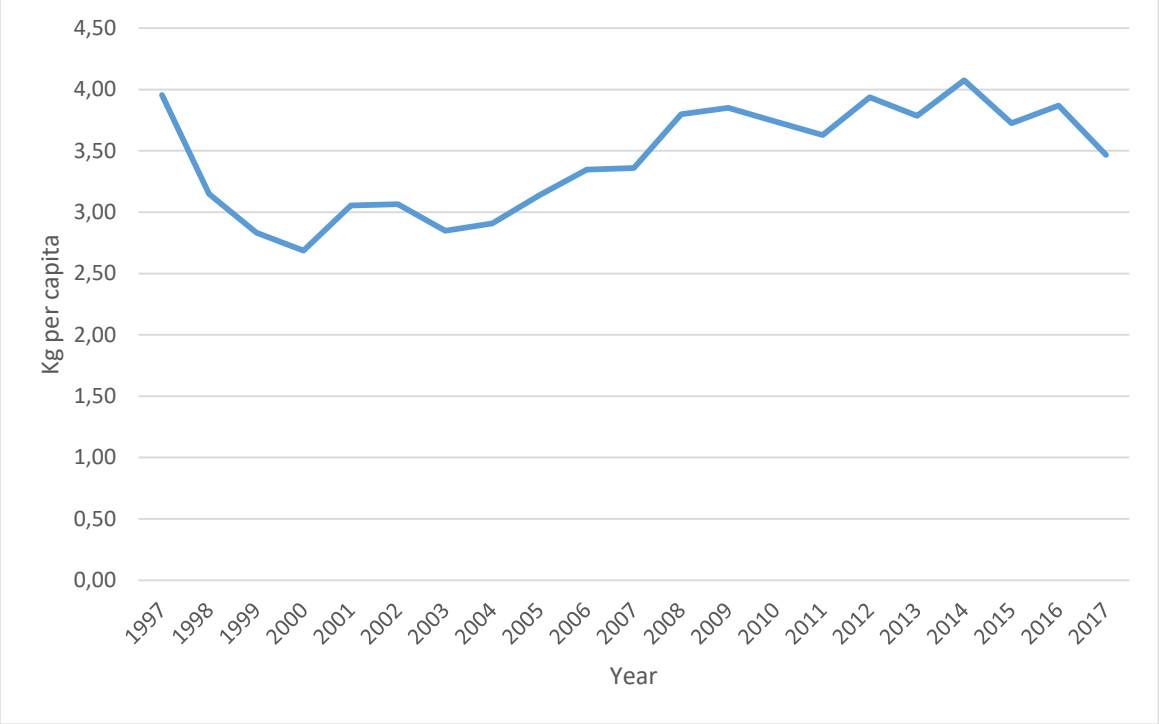
Coffee consumption per capita

One of the key factor for importation of product or service to the selected country based on economic theory is consumption. In economy consumption is generally considered as final purpose of economic activity, and thus the level of consumption per person is viewed as a central measure of an economy's productive success. Consumption drives production,

therefore for our model should be consumption the biggest influence of our endogenous variable import. [35]

The consumption of coffee beans has a slightly increasing trend over the monitored period since 2000, but in previous years the consumption of bean coffee recorded a sharp decline. Consumption of soluble coffee in the Czech Republic is a primary way of consuming coffee. Average consumption of coffee bean in 1997 -2017 is 3.44 kilograms per capita per year. The annual consumption of bean coffee was recorded in 2014 with a value of 4.07kg per person per year.

Figure 6: Developement of coffee consumption per capita



Source: ICO own calculation and elaboration

Average income

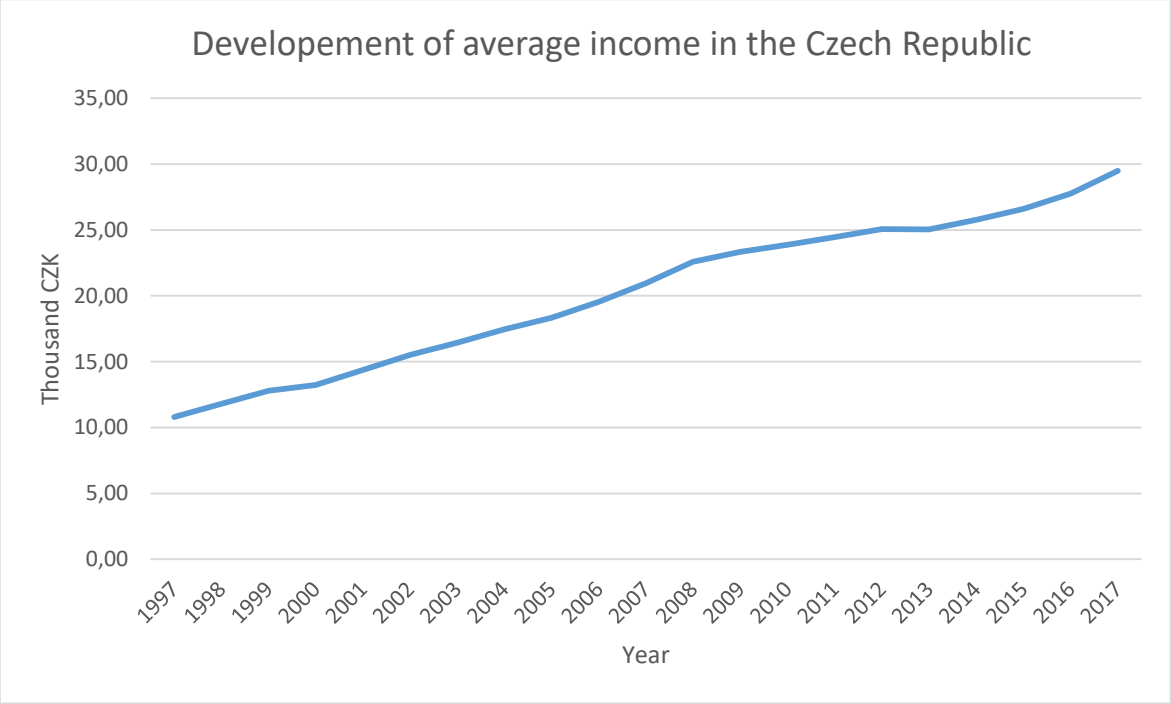
In our model should be also playing a very important role. Income defines consumers position, and together with the price defines consumers role. Across different income levels, the difference in product choices and buying patterns can easily be marked. A person in the

[35] Consumption | economics | Britannica.com. Encyclopedia Britannica | Britannica.com [online]. Copyright ©2019 Encyclop [cit. 09.03.2019]. Dostupné z: https://www.britannica.com/topic/consumption

middle class makes his buying decisions based on utility. However, someone higher income would prefers, more quality and is not limited by purchaised quantity. The level of income determines what kind of products someone regularly purchases. [36]

In the figure no. 6 we can see that the average monthly gross wage grows almost constantly. The wage increased in year 1997 CZK from CZK 10 800 to CZK 29 500 in 2017. The average annual wage increased by CZK 930 on average, that is by 6 % on average. Based on the linear trending function, it is estimated that the gross monthly wage of consumers will continue to grow.

Figure 6: Development of Average income



Source: CSO own calculation and elaboration

Foreign exchange rate USD/CZK

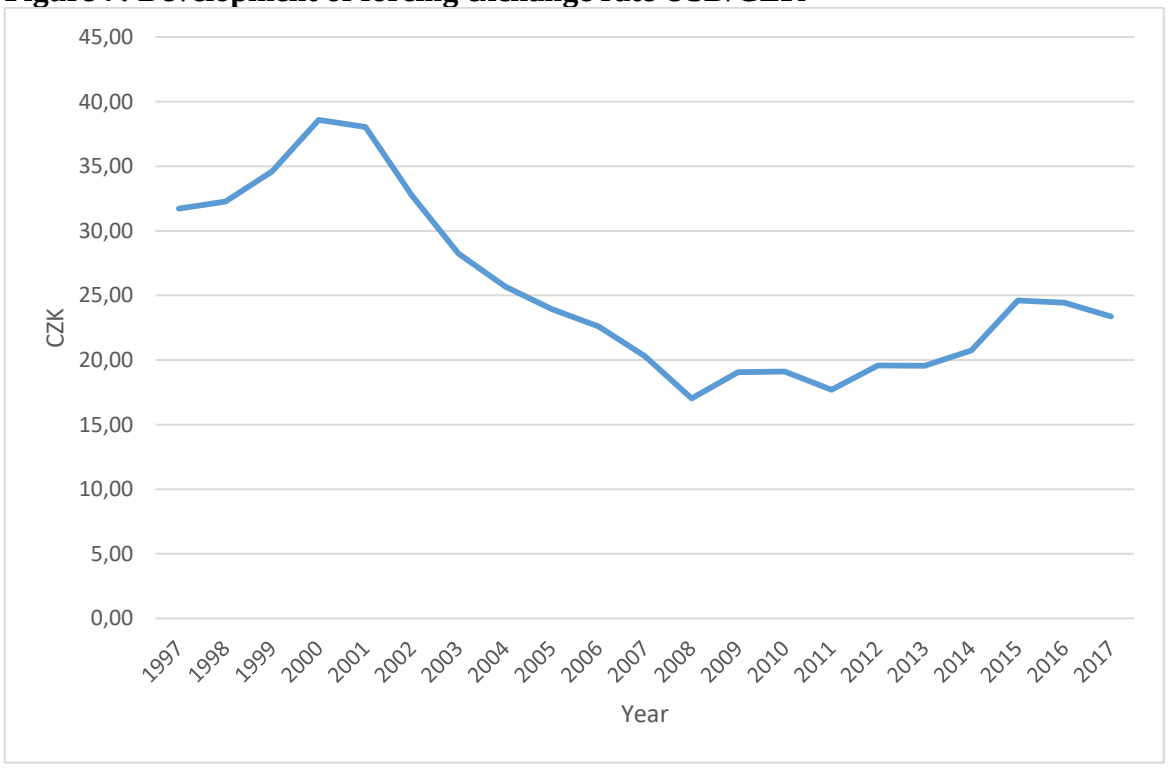
In macroeconomics foreign exchange rate represent very important determinant of foreign trade, and it also determines the purchasing power of the selected country. In a global

[36] Effect of Demographic Factors on Consumer Behavior: Age, sex, Income and Education - cheshnotes. cheshnotes - [online]. Dostupné z: https://www.cheshnotes.com/2017/07/effect-of-demographic-factors-on-consumer-behavior-age-sex-income-and-education/

economy where countries trade among themselves, it is necessary to establish a relationship between the two currencies so as to maintain the balance value of goods and services with which both countries traded. The exchange rate as one of the most important indicators of the economy gives us the ratio between the two currencies. It is the ratio between the currency of one country's currency and the country's second. Of course there are also supranational currency, which are common to several countries. (Žamberský; Taušer, 2003)

In the figure no. 7 we can see development of selected variable. The US dollar exchange rate has grown significantly between 1997 and 2001, so the US dollar has boosted by almost 8% y / y. After 2001, the US dollar exchange rate declined substantially by 9.6% per annum until 2008, when the USD exchange rate started to grow slightly. Since 2008, the year-on-year increase is no longer significant, with an average increase of 5.7% per year. Reliability of 52.3% can be expected to decrease the US dollar in the coming years.

Figure 7: Development of foreing exchange rate USD/CZK



Source: own elaboration

4.2 Linear regression model

Econometric models may contain one or more equations depending on the purpose of the survey. Based on this, we distinguish between single-equation and simultaneous models. In our case, we will examine a single-equation model that examines the links between the import of coffee into the Czech Republic and selected variations.

The creation of an econometric model can be divided into seven steps:

- economic theory;
- economic model;
- econometric model;
- dataset;
- estimation of the econometric model;
- verification of the econometric model;
- application of the econometric model.

The linear regression model (LRM) is the most widely used model in econometric analysis. However LRM must fulfill certain assumption, to achieve the expected properties of estimated parameters. It is therefore necessary to achieve the model that is the best, unbiased and consistent. The key prerequisites according to (Čechura, 2014) include:

Specification assumptions

There are specification of assumptions listed bellow:

- not to miss a substantial explanatory variable;
- removing insignificant explanatory variables;
- choosing the right functional form of the model;
- stable estimated parameters, time invariance;
- absence of simultaneous relationships between variables.

Assumptions of random components

- the random component should have a zero average (approaching zero);
- homoskedasticity of the model (homogeneity), refutation heteroskedasticity;
- absence of autocorrelation of residues;
- the lack of perfect multi-collinearity;
- the random component has a normal distribution.

4.2.1 Economic model

First, the economic model is described verbatim, then, if possible, the model is mathematically transformed. When formulating an economic model, it is necessary:

- define the aim of the research (in the model captured in the form of the explanatory variable);
- select appropriate variables (explanatory variables);
- define the appropriate form of the model.

Our economic model based on our dataset has following form:

$$\boldsymbol{y = f(x1, x2, x3, x4, x5) + u}$$

Where:

y…….. Import of the coffee to the Czech Republic (in value)
u…….. Random variable
x1…….Price of the coffee
x2…….Consumption of the coffee
x3…….Income
x4…….Foreign exchange rate USD/CZK

Economic model must also fulfill the specification assumptions, including the inclusion of important variables in the model, non-inclusion of irrelevant variables, the choice of the right

functional form, and the assumption that there is no simultaneous relationship between the endogenous and an exogenous variable, or between exogenous variables. The defined economic model serves to confront economic theory with reality. (Čechura, 2014)

The basic assumption of the economic model is the dependence of coffee import to the Czech Republic on selected variables.

Based on the economic theory, the relationships between the variables are assumed:

- If the income increases, then value of imported of coffee should increase;
- if the price of coffee increase, then value of imported of coffee should increase;
- if the consumption of coffee increases, then value of imported of coffee should increase;
- if the rate CZK/USD increases, then value of imported of coffee should increase.

4.2.3 Econometric model

Our basic one-dimensional econometric model will contain one endogenous variable at time t, four exogenous variables of the current period and one random component. Variables have already been declared in the formulation of the economic model. The functional shape of the single-rate econometric model will be linear.

The resulting one-dimensional econometric model takes the form of:

$$\mathbf{y_t = \gamma_1 x_{1t} + \gamma_2 x_{2t} + \gamma_3 x_{3t} + \gamma_4 x_{4t} + \gamma_5 x_{5t} + u_t}$$

Where:

Endogenous variable:

y_{1t} = Value of imported coffee to the Czech Republic in bill. CZK

Exogenous variables:

x_{1t} = Unit vector

x_{2t} = Coffee price

x_{3t} = Income

x_{4t} = Coffee consumption per capita

x_{5t} = Foreign exchange rate USD/CZK

Stochastic variable:

u_{1t} = Residual value

The one-line linear regression model was designed for a total of four variables that are captured in a time series of 21 observations in the years 1997-2017. The data was obtained from the database of the Czech Statistical Office, the WTO and the ICO. The basic descriptive statistics - mean, median, minimum, maximum, and standard deviation have been used to validate the data. The resulting values of all variables are shown in the following table.

Table 6: Statistical descriptive of selected variables

Variable	Mean	Min	Max	st. Deviation	Median
Coffee Import	3,28	0,96	12,63	2,88	2,44
Coffee price	260,65	192,51	362,11	55,90	256,05
Income	20,25	10,80	29,50	5,72	20,96
Coffee consum	3,44	2,69	4,07	0,43	3,47
Rate USD/CZK	25,43	17,04	38,59	6,74	23,95

Source: Own calculation and elaboration.

4.2.4 Parameters estimation by OLS

If all the linear regression model assumptions are met, you can begin to estimate the parameters in the linear regression model using the least squares (OLS) method. The method of ordinary least squares is attributed to Carl Friedrich Gauss, a German mathematician. The method of least squares has some very attractive statistical properties that have made it one of the most powerful and popular methods of regression analysis (Gurajati, Porter, 2009).

The parameter estimation refers to the data usage process for estimating the parameters of the selected distribution. Various methods of parameter estimation are available. In the linear regression model, the most common OLS (ordinary least square) method is used to determine parameters by minimizing the sum of squared error data. From the Gretl output (see Appendix 1) the resulting estimated parameters are summarized in our dataset (Table 4).

Table 7: Estimated parameters of selected variables

Variable	Parameter	P-Value
γ1 - Unit vector	-13,1439	0,0042
γ2 - Coffee price	0,00994722	0,0625
γ3 - Income	0,342601	0,0001
γ4 - Coffee consumption	0,921282	0,0251
γ5 - Rate USD/CZK	0,133683	0,0764

Source: Own calculation and elaboration.

Based on econometric theory, we will follow the basic rule by omitting irrelevant changes that may negatively affect our model. In our case, this is a change in the consumer price of coffee, which is statistically significant for us, because its P-value reaches 0.0625 which means the first degree of significance, but the parameter reaches very negligible values of 0.00994722 which does not affect our model.

The next step will be to estimate the parameters for our model after omitting the consumer coffee price variable for its insignificance and adding the so-called ¨dummy variable¨ due to the very high variance of our explained variable in 2015 more precisely by 110 % which was caused by increas of foreign rate of USD/CZK and significant increas of imported quantity to the Czech Republic wchich was based on data from ICO by over 30 % of increas.

Dummy variable is one of the method how to dynamize econometrical model. Dummy var. is a variable that takes on the value 0 or 1in order to indicate our unexpected phenomenon. It is artificialy created variable in order to eliminate seasonal shock or one-way shock. " *A dummy variable that takes the value one only for one observation has the effect of deleting that observation from computation of the least squares slopes and variance estimator (but not R-squared)."* (Greene, 2002)

Our new model will have following form:

$$\mathbf{y_t = \gamma_1 x_{1t} + \gamma_2 x_{2t} + \gamma_3 x_{3t} + \gamma_4 x_{4t} + \gamma_5 x_{5t} + u_t}$$

Where:

Endogenous variable:

y_{1t} = Value of imported coffee to the Czech Republic in bill. CZK

Exogenous variables:

x_{1t} = Unit vector

x_{2t} = Income

x_{3t} = Coffee consumption per capita

x_{4t} = Foreign exchange rate USD/CZK

x_{5t} = Dummy variable

Stochastic variable:

u_{1t} = Residual value

Estimating parameters of our new model by using OLS:

Table 8: Estimated parameters of selected variables

Variable	Parameter	P-Value
γ1 - Unit vector	-17,0128	0,0003
γ2 - Income	0,401097	>0,001
γ3 - Coffee consumption	1,76978	0,0232
γ4 - Rate USD/CZK	0,226526	0,0012
γ5 - Dummy variable	6,80795	>0,001

Source: own elaboration

The final equation of the econometric model can be compiled as follows:

$$y_{1t} = -17{,}0128 + 0{,}401097x_{2t} + 1{,}76978x_{3t} + 0{,}226526x_{4t} + 6{,}80795x_{5t} + u_{1t}$$

4.2.5 Correlation matrix

Correlation matrices are pairs of correlation coefficients of variables. In regression modeling, coefficients are used to determine the presence of multicollinearity. Multicoliniarity shows a moderate or high dependence between exogenous variables. Multicoliniarity occurs when the magnitude of the correlation coefficients is greater than or equal to 0.8 in absolute value. If multicollinearity is detected, this may result in misleading results and significantly affect research findings. The table below shows the calculated coefficients.

Table 9: Correlation coefficients of selected variables

Import of coffee	Income	Coffee consumption	Rate USD/CZK	Dummy variable	
1,00	0,69	0,50	-0,29	0,74	**Import of coffee**
	1,00	0,66	-0,79	0,25	**Income**
		1,00	-0,69	0,15	**Coffee consumption**
			1,00	-0,03	**Rate USD/CZK**
				1,00	**Dummy variable**

Source: own elaboration

It is evident from the correlation matrix that there is no high multicolinearity between the exogenous variables, since the pair correlation coefficients do not exceed the values of 0.8. Therefore, it was not necessary to modify the underlying data. Estimating the model using a common least squares method was done using the Gretl software. The estimation output is given in the appendix.

4.2.6 Economic verification

In the context of economic verification, the direction and intensity of the explanatory variables' effect on the variable explained. Furthermore, it compares the results of the parameter estimation with the economic theory defined in the formulation of the economic model. From the above estimated model, under the ceteris paribus conditions, it is assumed that:

- **Constant**

  When other influences are zero, the import of coffee would be -17.0128 bill. CZK.

- **Income**

  If the income increases by 1 thous. CZK, then import of coffee increases by 0.401097 bill. CZK, ceteris paribus.

  Agrees with assumptions.

- **Consumption of the coffee**

  If consumption of coffee increases by 1 kg/year/capita, then import of coffee increases by 0.0308898 bill. CZK, ceteris paribus.

  Agrees with assumptions.

- **Rate CZK/USD**

  If rate CZK/USD increases by 1 CZK, then import of coffee increases by 0.226526 bill. CZK, ceteris paribus.

  Agrees with assumptions.

- **Dummy variable**

  If the dummy schock happens, then import of coffee increases by 6.80795 bill. CZK, ceteris paribus.

  Agrees with assumptions.

All these assumptions are in line with the assumptions of economic theory above.

4.2.7 Statistical verification

As part of the statistical verification, the conformity of the model with the data and the statistical significance of the estimated parameters are assessed.

Model Fitness with Data

The value of the determination coefficient R^2 is 0.911542 (shown in appandex no. 1), meaning that the changes in the explanatory variable are 91.16 % dependent on changes in the explanatory variables. The value of the corrected determinant is slightly lower, precisely 0.889427 and therefore the change of the dependent variable from 88.94% is explained by changes in the independent variables.

Statistical significance of estimated parameters

The statistical significance of the estimated parameters is determined by the t-test. Outputs from Gretl software provide p-values for individual parameters that inform about the significance level on which the zero hypothesis is rejected. The null hypothesis states that the parameter is not statistically significant at the chosen materiality level. If the calculated p-value is less than the significance level selected, the null hypothesis is rejected. The calculated values from SW Gretl are shown in the following table.

Table 10: P-values of selected variables

Variable	P-Value	Level of sig.
γ2 - Income	<0.0001	***
γ3 - Coffee consumption	0.0232	**
γ4 - Rate USD/CZK	0.0012	***
γ5 - Dummy variable	<0.0001	***

Source: Own elaboration

At the significance level α = 0.01, are the variables Income, Rate of USD/CZU and Dummy variable. The variable Coffee consumption is statistically significant at the level α =0.1 level. It means that the relationships between the variables are caused by something else than random chance.

4.2.8 Econometric verification

In the part of econometric verification,we will process tests of autocorrelation, heteroskedasticity and normality test to verify the conditions necessary for the subsequent application of the econometric model.

Autocorrelation

Autocorrelation occurs when the errors are correlated. In the econometric verification, the Durbin-Watson statistic test is used to detect the presence of autocorrelation. The value is always between 0 and 4. Based on Gretl output of our model Durbin-Watson value is 1.6069

(shown in appendex 1). Depending on the number of degrees of freedom, the lower table limit is 1.8 and the upper limit is 2.2. The p-value according to the test is 0.6768. The null hypothesis says there is no autocorrelation in the model. The calculated p-value is higher than the significance level $\alpha = 0.05$, it means that the null hypothesis is not rejected. The autocorrelation is not present in the model.

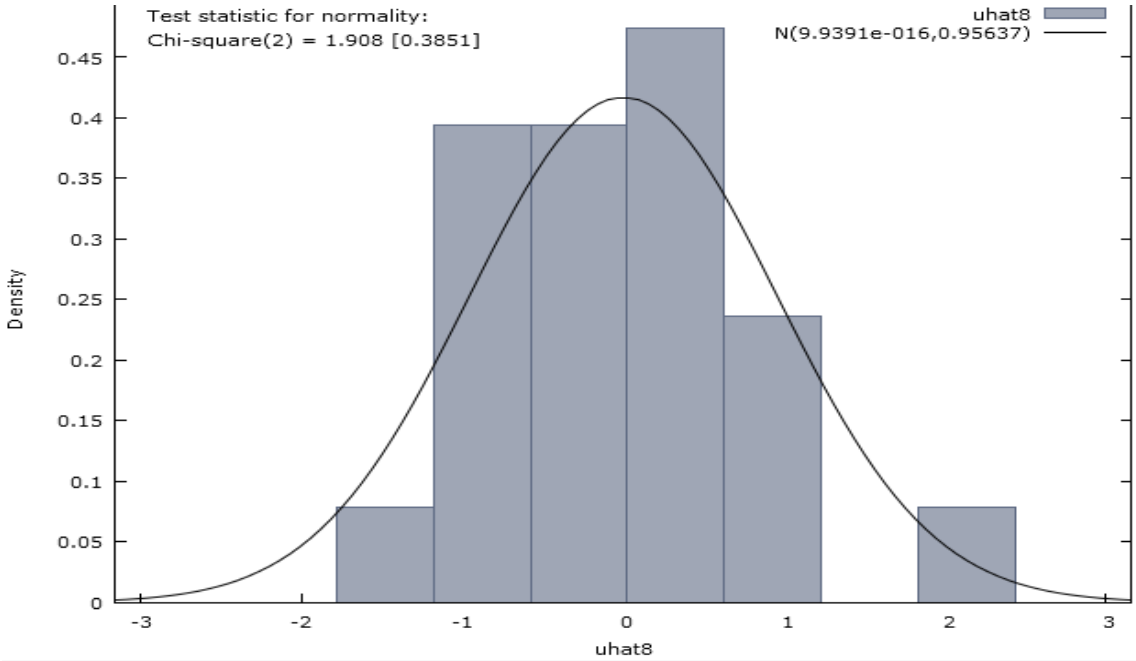
Heteroscedasticity

A White test was used to determine the occurrence of heteroskedasticity. The zero hypothesis says that residues have a constant scatter, so it is homoskedasticite. According to White's test, a p-value at 0.054436 is calculated (shown in appendex). The P-value is higher than the significance level of 0.05 and therefore the null hypothesis can not be rejected at the chosen materiality level. This confirms the heteroskedasticity of the model.

Test of Normality

One of the hypotheses for linear regression analysis is the normal distribution of the residuals. Otherwise it is not possible to trust the results because they are not reliable. That's why examining residuals is a key part of all statistical modeling. The Jarque-Bera test has been used to verify the normality. The test describes how well it fits the set of observations. The null hypothesis states that the residuals are normally distributed. The calculated p-value equals to 0.38512, this is greater than the significance level of $\alpha = 0.05$. Thus, the null hypothesis can not be rejected, it means that there is the normal distribution of the residuals. This is also evident from the figure below.

Figure 8: Graph of the normal distribution of the residuals



Source : software GRETL

4.2.9 Model application

In the part of application of the one equation econometric model, there are computed elasticities of individual exogenous variables. In addition, there are derived prognoses of the endogenous variables and all exogenous variables for the year 2018, 2019 and 2020.

Elasticities

The following Table shows us the data set for the computation of elasticities.

Table 11: Data set for calculation of elasticities

Variable	Value of parametr	Mean value	Elasticities
Income	0,401097	20,25	2,476 %
Coffee consumption	1,76978	3,44	1,856 %
Rate USD/CZK	0,226526	25,43	1,756 %

Source: own elaboration

Interpretation of the individual elasticities is as follows:

- **Income**

  If the Income increas by 1%, the value of Coffee import increases by 2.476 %. per year.

- **Coffee consumption**

  If the Coffee consumption increases bv 1 %, the value of Thai rice export increases by 1.856 % per year.

- **Foreign exchange rate USD/CZK**

  If the Foreign exchange rate increases by 1%, the value Coffee import increases by 1.756 % per year.

Prognosis

In order to obtain the prognosis of the endogenous variable, the future values of the explanatory variables need to be put into the econometric model. To predict the Coffee Import for the next three years (2018, 2019, 2020), the estimated linear regression model is used. The first phase will be estimated forecasts of all predefined variables. The second phase will be these values are added to the estimated one-year model and the prognosis will be derived explaining variables.

Firstly there are processed prognoses for all exogenous variables for chosen years in Gretl using the ARIMA model. The Gretl output is summarized in the Table 12 below.

Table 12: Trend function of exogenous variables

Variable	Function	R^2
Income	$x_{2t} = 10.181 + 0.9153t$	0.9865
Coffee cunsumption	$x_{3t} = 2.9437 + 0.0451t$	0.4153
Rate USD/CZK	$x_{4t} = 41.517 - 2.7102t + 0.087t^2$	0.7243

Source: Own elaboration

Under the condition of the dummy variable shock is not expected.

Table 13: Prognosis of explanatory variables

Date	Unit vector	Income	Coffee consumtion	Rate USD/CZK
2018	1	30.32	3.94	24.01
2019	1	31.23	3.98	25.22
2020	1	32.15	4.03	26.6

Source: own elaboration

After the computation of prognoses of individual exogenous variables, the prognoses for the endogenous variable is obtained through the substitution of calculated prognoses in the following model:

$$\mathbf{y_{1t} = -17{,}0128 + 0{,}401097x_{2t} + 1{,}76978x_{3t} + 0{,}226526x_{4t} + 6{,}80795x_{5t} + u_{1t}}$$

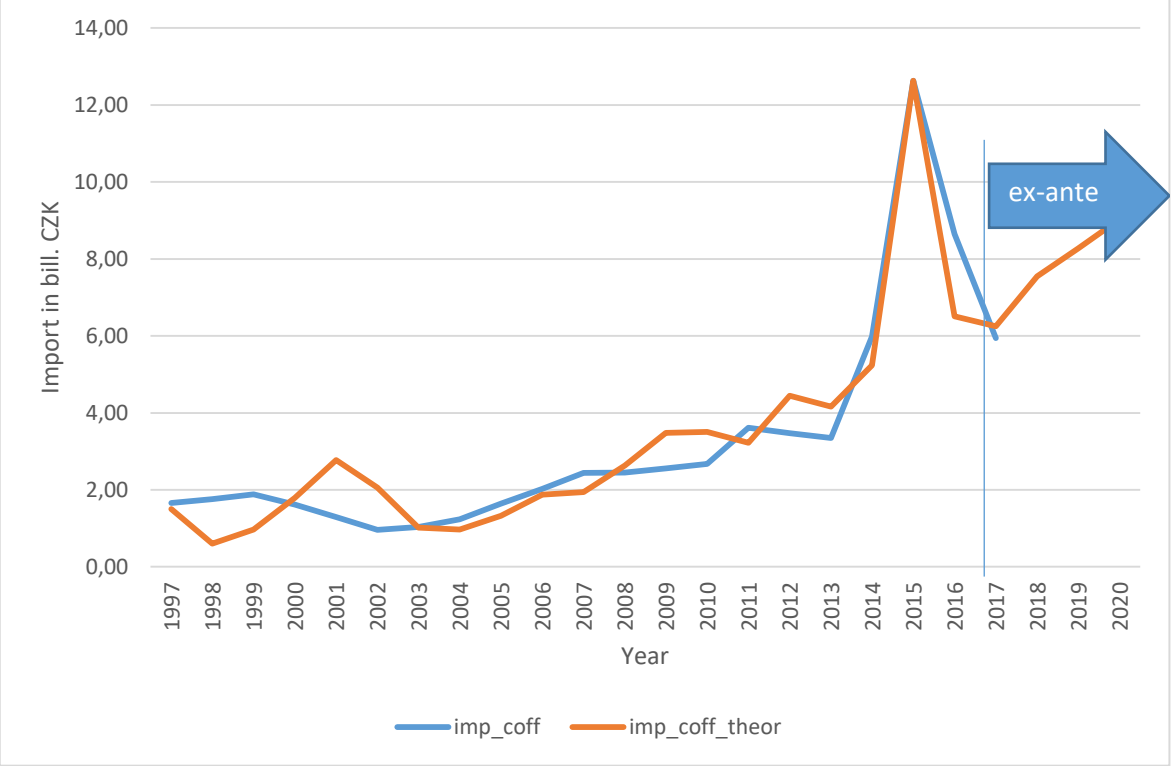
Table 14: Prognosis of explained variable

Date	Coffee consumption
2018	7.551
2019	8.272
2020	9.031

Source: own calculation and elaboration

The calculated numbers are in line with previous years. There are no extreme values. The overall development of Coffee Import to the Czech Republic including the forecast for the years 2018, 2019 and 2020 is graphically shown in figure below. Based on the previous progression, the prognosis may be evaluated as probable.

Figure 9: Forecast of coffee import (in billions CZK)



Source: own calculation and elaboration

As might be seen from the table and graph above, it is predicted that Coffee Import will slightly increase to 7.5 bill. CZK in 2018. A year on, the export is projected to increase to the value of 8.2 bill. CZK . In 2020 the value of Coffee Import is expected to be on the level of 9.1 bill. We can see that development of Coffee Import is constantly increasing and it will be probably increasing until it reaches the level of saturation.

5 Discussion and Conclusion

Coffee has gone through many years of development since its discovery. For some countries, it is an essential part of culture and its drinking is associated with many rituals and traditions. The cultivation of this commodity is heavily dependent on the climate, and therefore the region located between the 23rd and 25th southern parallel, also known as the coffee belt, appears to be the best area. The most represented species are Arabica and Robusta, while Arabica is considered the best variety ever. Compared to Robusta, however, it is more susceptible to various illnesses and more demanding to climate conditions. In particular, South America is focused on growing Arabica, while Vietnam is the largest producer of Robusta.

Both the primary and secondary processing of the coffee plant differ due to the country in which it is grown. Currently, efforts are being made to modernize the entire process mainly due to the negative impact on the environment. Some global organizations contribute to this. A typical example is FairTrade, which in one of the conditions for mutual cooperation, forces farmers to use chemical and other measures only to control pests, not as a method of preventive protection. In return, they offer them the possibility of certain earnings and life stability.

Another important organization closely related to coffee is the International Coffee Organization (ICO). It seeks to bring together all producer and consumer countries of the world. Its main objective is to find and stabilize the coffee market balance and to ensure sustainable development, and to maintain a 2002 quality support program that sets standards for exporters such as the number of defects per sample size or moisture content percent.

Coffee trade is most often done on local markets through local traffickers. They are usually the only ones in the locality to have storage spaces and trucks that are needed to transport coffee bags. Intermediaries thus often use their positions and buy coffee from growers at lower prices than the stock exchange currently states. This is the second coffee trade option, but only about 25 % of the total trade in this commodity is realized.

The world's largest coffee producer is Brazil, which has been a leader since the early 1990s. In 2015, it produced an incredible 2 594 100 000 kg of coffee. World no. 2 is Vietnam, whose production has grown rapidly since the 1990s. The biggest coffee importers are the USA and Germany, which is a significant part of the imported coffee used to re-export. Germany is the biggest coffee importer in the Czech Republic. Roughly 60% of instant coffee from total imports to the Czech Republic is imported from Germany and then about 35 % of roasted coffee from total import is also imported from Germany. Brazil is a major trading partner for green coffee imports. It represents about 32% of total green coffee imports to the Czech Republic.

At the beginning of 2001, there was a coffee crisis that lasted until 2004. This period, especially for developing countries that are economically dependent on coffee, has had considerable consequences, not only in economic or social terms but also in environmental terms. At the moment, the coffee market is already stabilized and the ever-increasing demand for this commodity, which growers hardly satisfy by their production, is the biggest problem.

In the practical part of this thesis, the single linear model was build, which explains the behavior of coffee import to the Czech Republic using selected variables, which are the average monthly consumer income, the dollar exchange rate to Czech crowns and finally the consumption of coffee per capita. In the original model, the consumption price of coffee was included, however, this variable was very insignificant for our model from the econometric point of view and therefore I decided to exclude it based on econometric theory. Model with chosen explanatory variables is explained by (R^2) 91.15 %. This implies that significant variables were included in the model, both in terms of statistics and econometrics. On the basis of the calculated flexibility, it can be said that the average intake of 2.476 % and then its consumption of 1.856 % have the greatest influence on the consumption of coffee beans. Estimated assumptions correspond to economic assumptions about the dependence of explanatory variables on the explained variable.

In the last chapter of the practical part of this diploma thesis a prognosis for the next three observation periods was made, which confirmed the increasing linear trend of the value of coffee import to the Czech Republic. Based on our forecast, which is derived from our

model, we can observe the estimated growth of coffee imports from 2017 when the import value of coffee was 6.25 bill. CZK to 2020 from the value we expect 9 bill. CZK.

List of references

Bibliography

[1] AUGUSTÍN, Jozef. *U kávy o kávě a kávovinách*. Brno: Jota, 2016. ISBN 978-80-7462-850-4.

[2] BUSH, S. B. (2012). Derivatives and Developement. *A Political Economy of Global*
Finance, Faming and Poverty.

[3] ČECHURA, Lukáš. Cvičení z ekonometrie. V Praze: Česká zemědělská univerzita, Provozně ekonomická fakulta, 2014. ISBN 978-80-213-2405-3.

[4] DAVIRON, Benoît. a Stefano. PONTE. The coffee paradox: global markets, commodity trade, and the elusive promise of development. New York: Distributed in the USA by Palgrave Macmillan, 2005. ISBN 978-1-84277-456-4.
Greene, W. H. (2002). Econometric Analysis. *Fifth edition*, 117.

[5] GUJARATI, Damodar N. a Dawn C. PORTER. *Basic econometrics*. 5th ed. Boston: McGraw-Hill Irwin, c2009. ISBN 978-0-07-337577-9.

[6] INTERNATIONAL TRADE CENTRE. *The Coffee exporter's guide* [online]. Third edition.
Geneva: International Trade Centre, 2011 [cit. 2017-02-03]. ISBN 978-929-1373-949.

[7] MASTRONARDI, Giovanni. *Quality of coffee: effects of origin and roasting process on the aromatic and sensorial composition of coffee*. Saarbrücken: Edizioni Accademische Italiane, 2014. ISBN 978-3-639-85778-8.

[8] NICHOLLS, Alex. Fair trade: Towards an economics of virtue. *Journal of business ethics*, 2010, 92: 241-255.

[9] ŽAMBERSKÝ, Pavel a Josef TAUŠER. Ekonomie měnového kurzu I. Vyd. 1. V Praze:
Vysoká škola ekonomická, Nakladatelství Oeconomica, 2003. 60 s. ISBN 80-245-0637-8.

[10] SMEKALOVÁ, Barbora. *Káva.* 1. vyd. Praha: OTTOVO NAKLADATELSTVÍ, 2006. 64 s.
ISBN 80-7360-395-0.

[11] ŽAMBERSKÝ, Pavel a Josef TAUŠER. Ekonomie měnového kurzu I. Vyd. 1. V Praze:
Vysoká škola ekonomická, Nakladatelství Oeconomica, 2003. 60 s. ISBN 80-245-0637-8.

[12] VESELÁ, Petra. *Kniha o kávě: Průvodce světem kávy s recepty na její přípravu*. Praha: Smart
Press, 2010. ISBN 978-80-87049-34-1.

Internet resources:

[1] ICO. The Story Of Coffee [online]. ©2014. Dostupné z: http://www.ico.org/coffee_story.asp/

[2] KÁVOVÉ LISTY. Arabica vs. Robusta: Najdete 15 rozdílů? [online]. 2013 Dostupné z: http://www.kavovelisty.cz/arabika-vs-robusta-najdete-15-rozdilu/

[3] NCA. What is coffee? [online]. ©2014. Dostupné z: http://www.ncausa.org/i4a/pages/index.cfm?pageid=68/

[4] SVĚT KÁVY. Kávovník [online]. ©2014. Dostupné z: http://www.svetkavy.cz/info_kavovnik.php/

[5] KÁVOVÉ LISTY. Arabica vs. Robusta: Najdete 15 rozdílů? [online]. 2013 Dostupné z: http://www.kavovelisty.cz/arabika-vs-robusta-najdete-15-rozdilu/

[6] NCA. Ten Steps to Coffee [online]. ©2014. Dostupné z: http:// http://www.ncausa.org/i4a/pages/index.cfm?pageid=69

[7] HANDLOOM COFFEE ANF TEA.From Bean to Cup – How Coffee is Harvested and Processed [online]. 17.7.2014 . Dostupné z: http://www.handloom.co.uk/blog/from-bean-to-cup-how-coffee-is-harvested-processed/

[8] 10 Steps from Seed to Cup. National Coffee Association [online]. Copyright © National Coffee Association of U.S.A., Inc. [cit. 08.03.2019]. Dostupné z: http://www.ncausa.org/about-coffee/10-steps-from-seed-to-cup
[online]. Dostupné z: (http://www.ncausa.org/about-coffee/10-steps-from-seed-to-cup)

[9] Co je FairTrade. bio-info.cz [online]. [cit. 2011-07-09]. Dostpné z:http://www.bio-info.cz/zpravy/co-to-je-fair-trade)

[10] KÁVA zkušený matador na burze. Kávové listy [online]. 2017 [cit. 2017-10-27]. Dostupné z: http://www.kavovelisty.cz/kava-zkuseny-matador-na-burze/

1.2.5-World coffee trade-World production by type: arabica and robusta. ITC [online]. Dostupné z: http://www.intracen.org/coffee-guide/world-coffee-trade/world-production-by-type-arabica-and-robusta/

[11] Price Volatility in the Coffee Market | tutor2u Economics. tutor2u | The Exam Performance Specialists [online]. Copyright ©2019 tutor2u. [cit. 08.03.2019]. Dostupné z: https://www.tutor2u.net/economics/reference/price-volatility-in-the-coffee-market

[12] The Top Factors that Move the Price of Coffee. Futures knowledge [online]. 2017 [cit. 2017-10-28]. Dostupné z: http://www.futuresknowledge.com/news-and-analysis/softs/the-top-factors-that-move-the-price-of-coffee/

[13] Mapped: The countries that drink the most coffee. The Telegraph - Telegraph Online, Daily Telegraph, Sunday Telegraph - Telegraph [online]. Copyright © Telegraph Media Group Limited 2019 [cit. 08.03.2019]. Dostupné z: https://www.telegraph.co.uk/travel/maps-and-graphics/countries-that-drink-the-most-coffee/

[14] Euromonitor International [online]. 2018 [cit. 2018-03-14]. Dostupné z: http://www.euromonitor.com/

[15] Ze světa komoditní kávy: Kdo ovládá trh?. Kávové listy.cz [online]. 2013 [cit. 2014-11-03]. Dostupné z: http://www.kavovelisty.cz/ze-sveta-komoditni-kavy-kdo-ovlada-trh/.

[16] V českých domácnostech se nakupuje více kávy neţ čaje. GfK [online]. 2013 [cit. 2014-10-31]. Dostupné z: http://www.gfk.com/cz/news-and-events/News/Stranky/v-ceskych-domacnostech-se-nakupuje-vice-kavy-nez-caje.aspx.

[17] Umíme pít kávu?. BENDLOVÁ, Kateřina. Svět potravin [online]. 2014 [cit. 2014-11-03]. Dostupné z: http://www.svet-potravin.cz/clanek.aspx?id=4217.

[18] Ze světa komoditní kávy: Kdo ovládá trh?. Kávové listy.cz [online]. 2013 [cit. 2014-11-03]. Dostupné z: http://www.kavovelisty.cz/ze-sveta-komoditni-kavy-kdo-ovlada-trh/.

[19] WTO | What is the WTO? - Who we are. World Trade Organization - Home page - Global trade [online]. Dostupné z: https://www.wto.org/english/thewto_e/whatis_e/who_we_are_e.htm

[20] Oxfam America | The power of people against poverty | Oxfam [online]. Copyright ©nl [cit. 25.03.2019]. Dostupné z: https://www.oxfamamerica.org/static/media/files/mugged-full-report.pdf

[21] International Coffee Organization - What's New. International Coffee Organization - What's New [online]. Dostupné z: http://www.ico.org/

[22] World Trade Organization - Home page - Global trade. World Trade Organization - Home page - Global trade [online]. Dostupné z: https://www.wto.org/

[23] Home | CZSO. Český statistický úřad | ČSÚ [online]. Dostupné z: https://www.czso.cz/csu/czso/home

Appendices

Gretl output: Estimation of parameters for the original model

Model 3: OLS, using observations 1997-2017 (T = 21)
Dependent variable: imp_coff

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	−13.1439	3.89451	−3.375	0.0042	***
income	0.342601	0.0677421	5.057	0.0001	***
cons_coff	0.921282	0.771540	1.194	0.2510	
RateUSDCZK	0.133683	0.0702354	1.903	0.0764	*
Dummyvar	6.84442	0.973771	7.029	<0.0001	***
pric_coff	0.00994722	0.00494304	2.012	0.0625	*

Mean dependent var	3.279967	S.D. dependent var	2.876080
Sum squared resid	11.52327	S.E. of regression	0.876480
R-squared	0.930346	Adjusted R-squared	0.907129
F(5, 15)	40.07027	P-value(F)	3.71e-08
Log-likelihood	−23.49609	Akaike criterion	58.99218
Schwarz criterion	65.25932	Hannan-Quinn	60.35231
rho	0.017177	Durbin-Watson	1.919559

Gretl output: Estimation of parameters for the second model

Model 2: OLS, using observations 1997-2017 (T = 21)
Dependent variable: imp_coff

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	−17.0128	3.69558	−4.604	0.0003	***
income	0.401097	0.0667658	6.008	<0.0001	***
cons_coff	1.76978	0.705032	2.510	0.0232	**
RateUSDCZK	0.226526	0.0577840	3.920	0.0012	***
Dummyvar	6.80795	1.06234	6.408	<0.0001	***

Mean dependent var	3.279967	S.D. dependent var	2.876080
Sum squared resid	14.63427	S.E. of regression	0.956369
R-squared	0.911542	Adjusted R-squared	0.889427
F(4, 16)	41.21901	P-value(F)	3.11e-08
Log-likelihood	−26.00557	Akaike criterion	62.01113
Schwarz criterion	67.23374	Hannan-Quinn	63.14457
rho	0.193732	Durbin-Watson	1.606900

Gretl output: White test

```
White's test for heteroskedasticity
OLS, using observations 1997-2017 (T = 21)
Dependent variable: uhat^2
Omitted due to exact collinearity: X2_X5 X3_X5 X4_X5

                  coefficient    std. error   t-ratio   p-value
  ---------------------------------------------------------------
  const           109.387        54.9206       1.992    0.0744   *
  income           -4.27678       1.55668     -2.747    0.0206   **
  cons_coff       -12.7227       17.0476      -0.7463   0.4727
  RateUSDCZK       -3.95544       1.55858     -2.538    0.0295   **
  Dummyvar         -2.60543       0.672902    -3.872    0.0031   ***
  sq_income         0.00729309    0.0148821    0.4901   0.6347
  X2_X3             0.848377      0.197692     4.291    0.0016   ***
  X2_X4             0.0409576     0.0280028    1.463    0.1743
  sq_cons_coff     -2.31246       1.42489     -1.623    0.1357
  X3_X4             0.560487      0.260603     2.151    0.0570   *
  sq_RateUSDCZK     0.0270613     0.0129520    2.089    0.0632   *

  Unadjusted R-squared = 0.858640

Test statistic: TR^2 = 18.031445,
with p-value = P(Chi-square(10) > 18.031445) = 0.054436
```