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CHANGES IN PERCEPTION OF COFFEE IN EU: LUXURY GOOD TURNED INFERIOR

Marek Vochozka
Institute of Technology and Business,
Ceske Budejovice, Czechia
E-mail: vochozka@mail.vstecb.cz
ORCID 0000-0001-9923-7814

Filip Petrách
Institute of Technology and Business,
Ceske Budejovice, Czechia
E-mail: 19651@mail.vstecb.cz
ORCID 0000-0002-0487-2397

Svatopluk Janek
Institute of Technology and Business,
Ceske Budejovice, Czechia
E-mail: 26597@mail.vstecb.cz
ORCID 0000-0003-4684-1078

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ABSTRACT. Coffee is a very popular commodity on a global scale. Its consumption is somewhat influenced by the fact that coffee is addictive and potentially harmful to health. Using price elasticity, income elasticity, and subsequent multiple regression, the demand function for coffee is formulated on a sample of the EU countries. Our findings confirm that in today´s Europe, coffee is considered an inferior good with almost perfect price inelasticity. This confirms the importance of coffee for everyday consumption, and at the same time, determines the awareness of potential health risks it possesses for consumers in the case of its excessive consumption. The obtained results could be applied in further analyses of coffee within the supply-demand chain, including new views on the heterogeneity of coffee as an economic asset.

Keywords: coffee, price elasticity, income elasticity, demand, EU

Introduction

Coffee is one of the most traded and valuable commodities in the world, as stated by Cerasa and Buscaglia (2017). The importance of coffee on the market is comparable to precious metals that preserve value, such as gold (Brabenec et al. 2020) or silver (Rowland et al. 2021). Its spread is now clearly visible – even on a global scale.

However, the beginnings of coffee in European culture were not easy. For example, in France, which is famous for its gastronomy, the first steps in coffee adoption were taken in the

17th century (the period between the years 1670 and 1730 can be considered a peak of this historical movement). The first and major problem of coffee adoption into French gastronomy was its significant association with the hostile Ottoman Empire. Moreover, its bitterness and already known health problems associated with the excessive consumption of coffee did not help it gain popularity in French society (Landweber, 2015). The 16th and 17th centuries are thus connected with the spread of coffee drinking in Europe (Zollner and Giebelmann, 2004). From the European perspective, the 18th century can be described as a key period in the rise of coffee as a commodity. Combrink (2021) mentions the increasing popularity of coffee in the inland areas of the European continent when clusters of mass consumption of coffee began to emerge mainly in large German cities around the Rhine. In the Netherlands, the share of coffee in the total trade grew from 1% to 9.5% during the 18th century. This confirms the gradual establishment of coffee on the European market due to its increasing consumption.

Currently, the leading producers of coffee are South America, Africa, and Southeast Asia. Specifically, we can mention Brazil and Vietnam, which rank among the absolute top producers (Amarasinghe et al. 2015; Ho et al. 2018). Europe as such is not a producer of coffee due to its climatic conditions. This means that Europe is completely dependent on the import of this valuable and in-demand commodity (Cerasa and Buscaglia, 2017, Novakova et al., 2022). At the same time, coffee supply can be influenced by a number of events that may threaten its production. These can be referred to as "force majeure" and typically include weather fluctuations (e.g., the alteration of El Nino and La Nina in South America) and pests, which include mainly coffee berry borer and coffee leaf rust (Bastianin et al. 2018; Toro-Zapata et al. 2018; Gichuru et al. 2021).

An important thing is the reaction of coffee demand in European, or EU countries. A lot of them form the Eurozone, an economic area with a common European currency within the third stage of the European Monetary System (Iša, 2000). These countries are net importers of coffee, as stated above. The popularity of coffee is very significant in this pan-region; therefore, the question arises of how consumers respond to changes in coffee prices. The issue of consumer demand for coffee is dealt with e.g. by Bonnet and Villas-Boaz (2016), who tried to model demand for coffee in France, which is limiting in terms of territorial market definition to a certain extent. Currently, demand for coffee is also influenced by new directions focused on environmental issues and support for coffee growers (the so-called Fair Trade), as mentioned e.g. by Takahaski (2021), Omidvar and Giannakas (2015), Hindsey et al. (2020), and others.

The objective of this paper is to determine the demand function for coffee when considering the price elasticity of demand in sample EU countries: Austria, Belgium, Bulgaria, Cyprus, Czechia, Denmark, Finland, France, Germany, Hungary, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain and Sweden.

In specific limited quality and quantity, coffee can be seen as a necessary good. However, it can also be seen as a luxury good. In the first case, coffee consumers prefer the effects of the beverage, especially the effects of caffeine, which reduces fatigue in the short term and can thus temporarily increase an individual´s performance. In the second case, in addition to caffeine, consumers also require a pleasant aroma, excellent taste, and other characteristics of the beverage. This leads to the first research question:

RQ1: What is the price elasticity of the demand?

Price elasticity of demand explains consumer behaviour with regard to coffee price as one of the parameters of the demand function. This will be examined on the aforementioned sample of countries in order to get an objective opinion and an interesting potential market for potential users of the research output. Following the detailed evaluation of the price elasticity of demand, the second research question is formulated:

RQ2: What is the demand function for coffee in the given sample of countries?

Based on the results obtained, it will be possible to describe the existing consumer behaviour as well as the future trend of demand for coffee in the territory under review.

1. Literature review

The coffee demand-supply chain is characterised by a significant imbalance of purchasing power. The degree of this imbalance is more noticeable in the case of emerging markets, where smaller coffee growers sell their produce to intermediaries, who sell it to exporters – mostly multinational companies. Also, an economically strong exporter has the potential to benefit producers and improve the well-being of the producer country (Bjorvatn et al. 2015). This consequence is important due to the growing interest in well-being ensuring (Kwarciński & Ulman, 2020; Tvaronavičienė et al., 2021; Rajnoha et al., 2021). In some cases, the support to growers is through well-thought-out PR. At this point, Starbucks can be mentioned, which launched a campaign in the spring of 2016 in the Democratic Republic of Congo with the help of a famous personality, Ben Affleck. Obviously, the purpose was to stimulate consumer demand for coffee within the value chain. The actual benefit for farmers is uncertain. The results indicate rather a support for farmers´ customers and media support from celebrities (Richey and Ponte, 2021). Recently, ecological programs have been targeted at consumer demand. On the other hand, the discrete choice model refutes the effect of this policy on demand on a larger scale (Friberg and Sanctuary, 2018). Consumers´ willingness to pay more for organic coffee is rather given by their cultural worldviews (Hindsley et al. 2020). This was confirmed e.g. by Yang et al. (2014) on a sample of 564 respondents in a survey conducted in the Chinese town of Hubei.

The construction of the demand in the final supply-demand chain is naturally conditioned by the coffee supply. Some models work with this fact – for example, the supply-driven Ghosh model (Manresa and Sancho, 2013). The supply of coffee as an agricultural commodity is largely unstable and subject to fluctuation. In the years 1998 – 2002, there was even global coffee crisis (Fridell, 2015). Coffee supply was mainly in the past influenced also by the participation of countries exporting and importing coffee. These were organizations such as ICA (International Coffee Agreement), SPREAD (Society for Promoting Rural Education and Development) etc. Their purpose was to strengthen the coffee value chain, and in many cases, this led to price coffee growth, as stated by Moss et al. (2017) and Igami (2015). A similar effect on supply can be seen also in the case of cooperatives, which encourage their members to certify coffee supply (Snider et al. 2017).

Net demand function is defined using the Leontief model of final demand. Aggregate demand in the Slovak economy at the beginning of the financial crisis that started in 2008 is analysed by Labaj (2013) using the Leontief open static model and structural decomposition analysis. From a design point of view, it shall be noted that the main pillar of the Leontief model is a set of elasticities, as in the case of the Cobb-Douglas model (Kim et al. 2017). Cho (2017) states that the traditional Leontief model shows certain shortcomings, which can be seen mainly in the overestimated economic impact (this is even more pronounced if it is the demand in the multiregional context). Koesler and Schymura (2015) made even stricter conclusions, as they do not see practical benefits in the application of both models.

The demand models of the applied economy are thus based on the set of demand formulas, which are characterised by using income elasticities combined with the matrix of own-price and cross-price elasticities. This approach is used e.g. in CGE (Computable General Equilibrium) models and the measurement of the deadweight loss of the monopoly in distortion in consumption (Clements and Gao, 2015). Elasticities are dealt with also by Toner et al. (2020) based on the analysis of rail demand in Great Britain. They concluded that generating own-

elasticities and subsequent deducing of cross-elasticities for individual ticket types. This provides a more relevant picture of demand than in the case of the conventional single equation approach. The network monopoly generally requires a very sensitive approach to estimating demand. Mainly in the case of energy services, the principle of derived energy demand is often neglected. It is not energy itself that people want, but energy services it ensures, such as heating, machinery, lighting, etc. If this fact is not considered, the estimates of price elasticities are erroneous as well as the wrong establishment of the energy demand function (Hunt and Ryan, 2015).

Multiple regression is one of the essential quantitative statistical tools applicable across all scientific disciplines (Ucal & Kaplan, 2020). Its measure is classical linear regression (Andrejiová and Marasová, 2013). Least squares method based on multiple regression is suitable for reversal analysis and dynamical processes (Petráš a Bednářová, 2010; Chlebisz and Mierzejewski, 2020). The successful use of multiple regression allowed defining core factors of demand and supply in different markets (Beck, 2020; Roshchyk et al., 2022), including analysis and forecast in international trade (Nikensari et al., 2021). In macroeconomics, it can be effectively used to analyse the relationship of the response of market interest rates to discount rate changes of central banks (Bai, 1997). Valášková et al. (2018) use multiple regression to identify statistically significant determinants that significantly affect the future financial development of a company. Gomes and Ferreira (2022) verify through multiple regression the impact of entrepreneurial activity on the economic growth of 21 European countries. The effectiveness of multiple linear regression (MLR) model is compared with the generalized additive modelling (GAM) by Dhulipala and Patil (2020) when examining freight transport in the Indian agricultural sector (the role of primary production in India is crucial for the national economy). Their conclusions confirm the applicability of both models. The authors also add that the predictive ability of the GAM model outperforms the MLR model. This is given by the GAM model ability of non-linear modelling. Furthermore, multiple regression can be combined with the model of focused information criterion (FIS). In the context of portfolio creation, the combination enables obtaining better estimates (Klimenka and Wolter, 2019).

Multiple regression can be applied in studying interconnectedness, or observing information flows between various commodity exchanges. The performed analysis of four indexes with wheat futures markets on four continents shows the need for more supportive policies to incentivise higher wheat production in South Africa (Motengwe and Parde, 2016). The MLR has also been effectively used for the identification of sugar price differences in the turbulent period of the Great Depression of 2008 and others, and also identified the correlation between oil and sugar prices (Babirath et al. 2021). Guido et al. (2020) used regression methods to analyse coffee producers in Jamaica, while Bacon et al. (2014) examined small Nicaraguan coffee and corn producers using the method of least squares.

Some authors, such as Vrbka et al. (2020) or Krulický et al. (2020) use more progressive artificial neural networks on larger datasets. However, the set objective of this paper is specified using multiple regression, which appears to be the optimal tool with regard to given sources. .

2. Methodological approach

2.1. Data

The data will be obtained from the Eurostat database and the websites of the International Coffee Organization. The selection of countries is based on the intersection of data, where the selected countries are members of the European Union (with some countries

being part of the Eurozone). Based on the selection, indicators of 22 countries in total have been monitored since 1999. In the case of the net income median, the Eurostat database lacks the data for the year 2022. Indicators expressed in monetary units are in EUR. In the case of the input data in USD, the values are converted according to the average USD/EUR exchange rate based on the ECB data.

Specifically, the data available are for the years 1999 – 2019 for the following countries: Austria, Belgium, Bulgaria, Cyprus, Czechia, Denmark, Finland, France, Germany, Hungary, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, and Sweden.

The dataset will include the information on the country´s net income per capita, price level change, when 100 % is determined in the year 2015, retail coffee price in EUR per pound (which will be converted to EUR per kg), consumption of coffee (in thousands of 60-kilogram packages), and the population of the country.

2.2. Methods

To be able to deduct the behaviour of a product in the market, it is necessary to calculate the relationship between price and consumption, or between income and consumption. This way it is possible to determine demand price elasticity and demand income elasticity.

Price elasticity of demand determines how the demand size changes in the price changes by one unit. In such a case, it will be calculated as follows:

$$E_{(p)} = \frac{\Delta Q/Q}{\Delta P/P}, \tag{1}$$

where $E_{(p)}$ is demand price elasticity,
Q volume of coffee consumption,
ΔQ change in coffee consumption volume,
P coffee price,
ΔP change in coffee price.

The result is evaluated in the interval presented in Table 1.

Table 1. Intervals for determining coffee price elasticity

Elasticity	Calculated result
Perfectly elastic demand	+∞
Price elasticity of demand	(1;+∞)
Unit elastic demand	1
Price inelastic demand	(0;1)
Perfectly inelastic demand	(-1;0)

Source: *Author*

Income elasticity of demand measures the number of units by which demand increases if income increases by one unit. It is calculated as follows:

$$E_{ID} = \frac{\frac{Q_2 - Q_1}{Q_1 + Q_2}}{\frac{I_2 - I_1}{I_1 + I_2}}, \tag{2}$$

where E_{ID} is price elasticity,
I income of consumer.

The results of the calculation are arranged in Table 2.

Table 2. Interpretation of results of coffee income elasticity

Results	Interval
Luxury goods	(1; +∞)
Normal goods	(0;1)
Inferior goods	(-∞;0)

Source: *Author*

Another variable to be examined is the income per capita of individual countries in the research sample and the average in the research sample (hereinafter referred to as the EU). This is followed by the analysis of coffee consumption for individual countries of the research sample and the EU. The measurement unit of coffee consumption is a kilogram per year per 1000 inhabitants. This statistical measure is used because of more precise calculations it implies due to higher values compared to more common measure per capita. We want to know whether the consumption grows or not. To be able to determine the demand curve, it is necessary to know the behaviour of coffee prices. By default, its growth over time can be expected in line with the growth of prices in the individual countries and in the EU. Therefore, it will be examined in nominal and real prices converted to the price levels in 2015.
Subsequently, the relation of price and the volume of coffee consumption will be calculated using the Pearson correlation coefficient:

$$r = \frac{\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum_{i=1}^{n}(X_i - \bar{X})^2}\sqrt{\sum_{i=1}^{n}(Y_i - \bar{Y})^2}}, \quad (3)$$

where $\bar{X}$ is the arithmetic mean of independent variable,
$\bar{Y}$ is arithmetic mean of dependent variable,
X consumption of coffee,
Y coffee price.

The parameters of the demand curve in individual countries are determined using linear regression:

$$y = ax + b\,, \quad (4)$$

where x consumption of coffee,
y coffee price,
a variable parameter of regression curve,
b constant.

Weights are determined from the formulas below:

$$a = \frac{n\sum x_i y_i - \sum x_i \sum y_i}{n\sum x_i^2 - (\sum x_i)^2}, \quad (5)$$

$$b = \frac{\sum x_i^2 \sum y_i - \sum x_i \sum x_i y_i}{n\sum x_i^2 - (\sum x_i)^2}, \quad (6)$$

The results are then graphically illustrated in time and quantity. The basic assumption of the calculation is the fact that the demand was satisfied by the market and no excess was generated in the monitored period.

3. Conducting research and results

3.1. Price elasticity of demand

The price elasticity of coffee for each country is calculated and presented in Table 3. It is calculated in nominal prices (see column NV) and real prices (RV).

Table 3. Price elasticity of coffee demand in EU

	Elasticity NV	Elasticity RV	Elasticity NV	Elasticity RV
Austria	0.15	-0.10	Price inelasticity of demand	Perfectly inelastic demand
Belgium	0.07	0.27	Price inelasticity of demand	Price inelasticity of demand
Bulgaria	0.35	0.06	Price inelasticity of demand	Price inelasticity of demand
Cyprus	0.15	-0.25	Price inelasticity of demand	Perfectly inelastic demand
Czechia	0.20	0.30	Price inelasticity of demand	Price inelasticity of demand
Denmark	0.05	0.25	Price inelasticity of demand	Price inelasticity of demand
Finland	-0.40	-0.05	Perfectly inelastic demand	Perfectly inelastic demand
France	0.40	0.55	Price inelasticity of demand	Price inelasticity of demand
Germany	0.20	0.15	Price inelasticity of demand	Perfectly inelastic demand
Hungary	0.00	-0.20	Perfectly inelastic demand	Perfectly inelastic demand
Italy	0.25	-0.15	Price inelasticity of demand	Perfectly inelastic demand
Latvia	-0.05	0.15	Perfectly inelastic demand	Price inelasticity of demand
Lithuania	0.00	-0.40	Price inelasticity of demand	Perfectly inelastic demand
Luxembourg	-0.26	-0.32	Perfectly inelastic demand	Perfectly inelastic demand
Malta	0.20	0.00	Price inelasticity of demand	Perfectly inelastic demand
Netherlands	0.55	0.35	Price inelasticity of demand	Price inelasticity of demand
Poland	0.20	0.00	Price inelasticity of demand	Perfectly inelastic demand
Portugal	0.15	0.00	Price inelasticity of demand	Perfectly inelastic demand
Slovakia	-0.15	-0.30	Perfectly inelastic demand	Perfectly inelastic demand
Slovenia	-0.45	-0.20	Perfectly inelastic demand	Perfectly inelastic demand
Spain	0.40	0.45	Price inelasticity of demand	Price inelasticity of demand
Sweden	0.05	0.10	Price inelasticity of demand	Price inelasticity of demand
EU	-0.70	-0.45	Perfectly inelastic demand	Perfectly inelastic demand

Source: *Author*

It follows from the table that the calculated results using both nominal and real values correspond to perfectly inelastic demand. However, in several countries, coffee demand showed price inelasticity.

3.2. Income elasticity of demand

The results of income elasticity of coffee demand are presented in Table 4.

Table 4. Income elasticity of coffee demand in EU

	Elasticity NV	Elasticity RV	Elasticity NV	Elasticity RV
Austria	-0.25	-0.10	Inferior goods	Inferior goods
Belgium	0.00	0.20	Normal goods	Normal goods
Bulgaria	-0.29	-0.24	Inferior goods	Inferior goods
Cyprus	-0.05	-0.15	Inferior goods	Inferior goods
Czechia	-0.05	-0.05	Inferior goods	Inferior goods
Denmark	-0.15	0.05	Inferior goods	Normal goods
Finland	-0.15	-0.20	Inferior goods	Inferior goods
France	-0.15	-0.70	Inferior goods	Inferior goods
Germany	-0.40	-0.55	Inferior goods	Inferior goods
Hungary	-0.10	-0.15	Inferior goods	Inferior goods
Italy	0.05	-0.25	Inferior goods	Inferior goods
Latvia	-0.45	-0.50	Inferior goods	Inferior goods
Lithuania	-0.15	-0.10	Inferior goods	Inferior goods
Luxembourg	-0.05	-0.05	Inferior goods	Inferior goods
Malta	0.30	0.20	Normal goods	Normal goods
Netherlands	0.10	-0.20	Inferior goods	Inferior goods
Poland	-0.30	-0.30	Inferior goods	Inferior goods
Portugal	-0.15	-0.25	Inferior goods	Inferior goods
Slovakia	-0.30	-0.40	Inferior goods	Inferior goods
Slovenia	-0.25	0.05	Inferior goods	Inferior goods
Spain	-0.40	-0.25	Inferior goods	Inferior goods
Sweden	-0.35	0.00	Inferior goods	Normal goods
EU	-0.15	-0.10	Inferior goods	Inferior goods

Source: *Author*

The results show that in the EU, coffee is an inferior good, both based on income elasticity of demand in nominal and real prices. Only in some countries it is perceived as a normal good (e.g. Belgium, Denmark, or Malta).

3.3. Demand function

In order for the economic analysis of the coffee market to make sense, the income of the countries needs to be examined first. Figure 1 below shows an overview of income per capita in the research sample.

The graph in Figure 1 shows the trend of net income per capita in EUR in comparison with other EU countries. Net income per capita is represented by curves that are distinguished by colours. The Y axis shows net annual income, while the X axis shows the individual years (1999-2019). The graph shows that the highest net income was recorded in Luxembourg, which in the period from 1999 to 2019 also recorded the largest growth of all countries presented in the graph. In 2017, Luxembourg achieved the highest value of EUR 36,315. Denmark shows a similar upward trend, where the highest value (in 2019) achieved EUR 30,717. Other countries can be divided into three groups: countries with the highest income - Sweden, Germany, Belgium, Austria, Finland, France, and the Netherlands, where the value ranges from EUR 12,782 (the Netherlands, 1999) to EUR 25,838 (Sweden, 2014). The second group includes Italy, Spain, Cyprus, and Slovenia, with the value ranging from EUR 4,883 (Cyprus, 1999) to EUR 16,990 (Cyprus, 2011). The last group includes the Czech Republic, Hungary, Slovakia, Poland, Lithuania, Latvia, and Portugal, which was included in the second group until 2010 but due to the stagnation in recent years, it falls under the lowest-income countries. The net income of the third group ranges from EUR 562 (Slovakia, 1999) to EUR 10,023 (Portugal, 2019). Figure 2 shows the net income in EUR per capita in the EU.

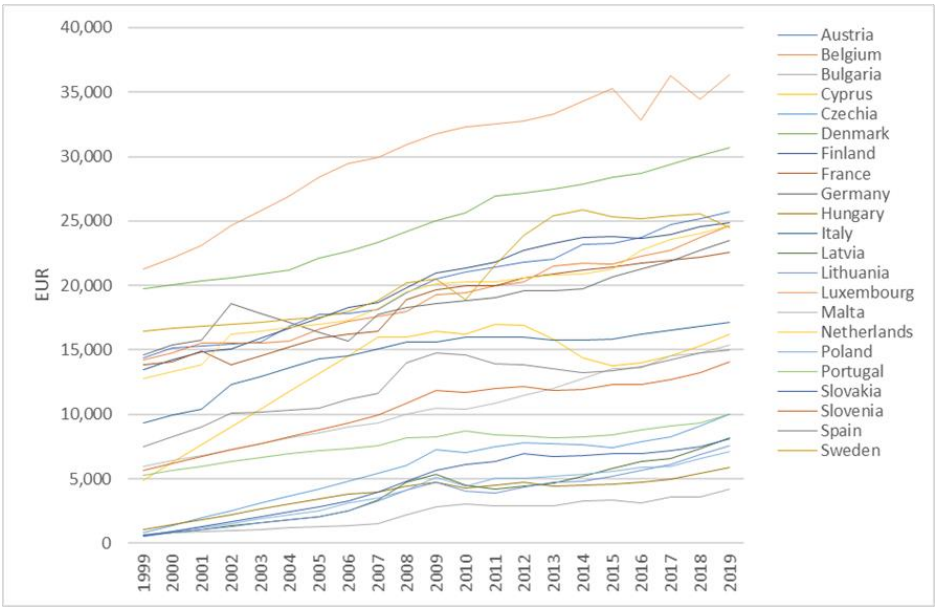

Figure 1. Net income per capita in EUR – individual countries
Note: Germany: until 1990, former territory of the FRG (applies in the whole paper).
Source: Author based on data from europa.eu/eurostat.

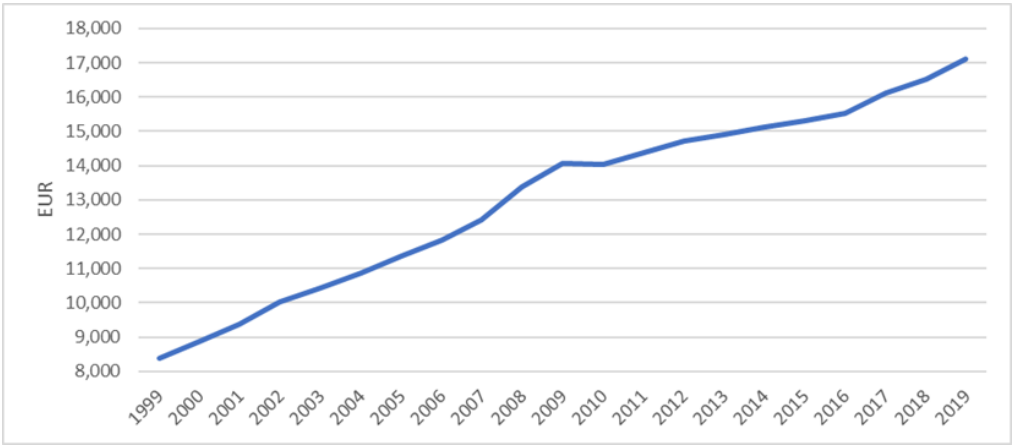

Figure 2. Net income per capita in EUR – EU average
Source: Author based on data from europa.eu/Eurostat.

The curve in the graph in Figure 2 representing the average net income of EU citizens shows a stable upward trend. Between 1999 and 2019, the average value in the EU more than doubled, and the slight stagnation in the years 2009-2010 did not stop its constant growth. The Y axis shows the net annual income, the X axis represents the period from 1999 to 2019. The curve also shows that the first decade (1999 - 2009) showed more than twice as fast growth of income as the second decade – see the years 1999 (EUR 8,372), 2009 (EUR 14,073), and the year 2019 (EUR 17,108).

Next, coffee consumption in individual EU countries is analysed (see Figure 3).

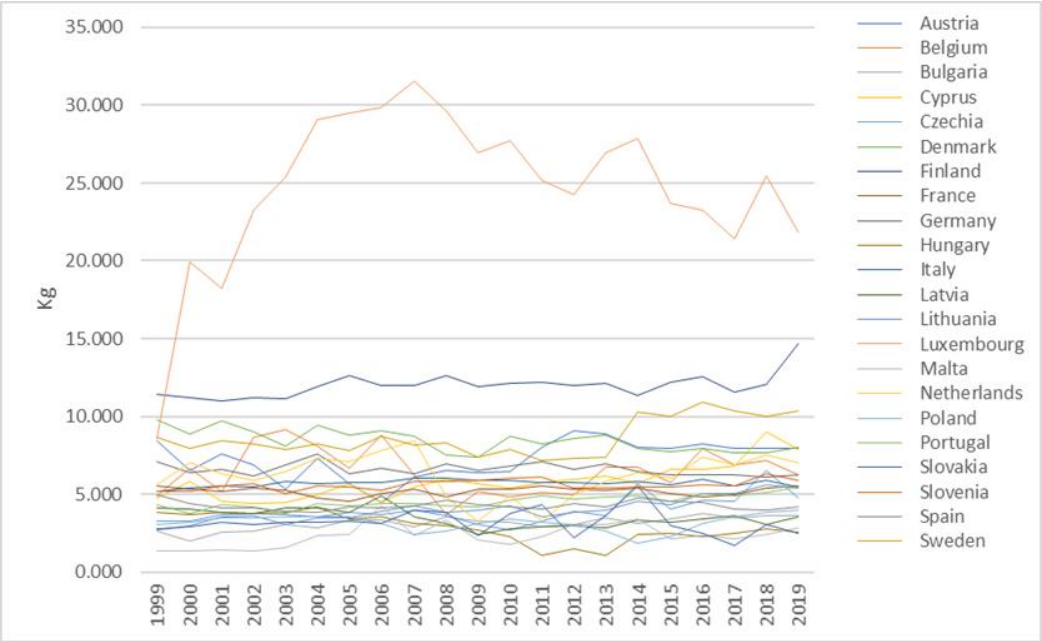

Figure 3. Coffee consumption in kg per 1000 inhabitants – individual countries
Source: Author based on data from ico.org.

The figure shows the coffee consumption per 1000 inhabitants in individual EU countries. The vertical axis of the graph shows the consumption of coffee in kilograms; the horizontal axis shows the individual years (1999-2019). The consumption in different countries is represented by curves of different colours. The highest difference is seen in the case of Luxembourg, whose average coffee consumption is more than twice as high as when compared to other countries. The second highest consumption can be seen in Finland, where the curve does not show any major fluctuations in the years 1999-2018. The consumption in other countries ranges from 1070 kg (Hungary, 2013) to 10 953 kg (Sweden, 2016). The most interesting trend is seen in Sweden, where the consumption increased nearly by 3000 kg between 2013 and 2014; thanks to this increase, Sweden can be ranked among the biggest consumers of coffee per 1000 inhabitants in the EU. The lowest consumption is alternatively recorded in Hungary and Malta when Malta´s coffee consumption was very low in the years 1999-2005, and Hungary experienced a significant drop in the years 2011-2013. The resulting values for the whole EU can be seen in Figure 4.

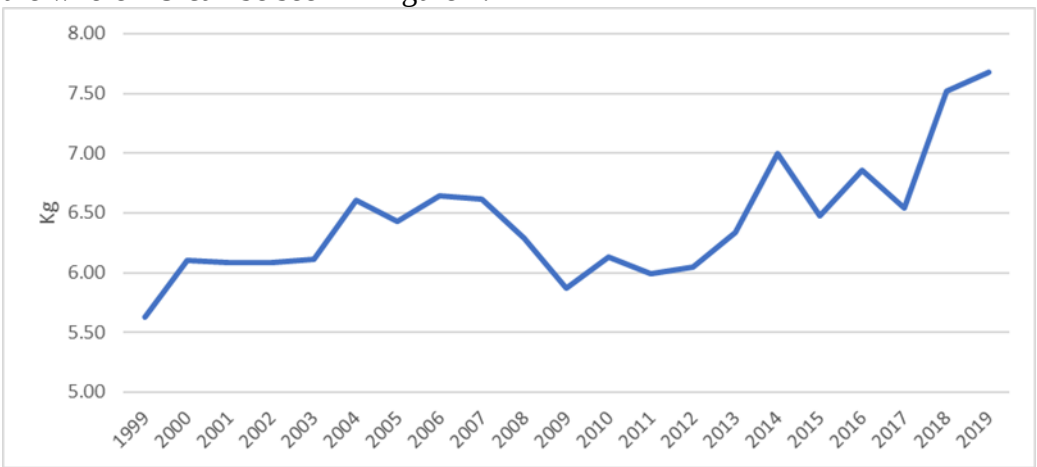

Figure 4. Coffee consumption in kg per 1000 inhabitants – EU average
Source: Author based on data from ico.org.

The curve in the graph shows the average coffee consumption in kg per 1000 inhabitants in the EU. The vertical axis shows the individual kilograms (5-8), the horizontal axis shows the individual years (1999-2019). The curve changed significantly over the years, with the consumption first growing by nearly 1 kg between 1999 and 2000, then stagnating in the years 2001, 2002, and 2003 and subsequently increasing to the value of 6.64 kg (2006). Coffee consumption then started to decrease, first slowly, then very sharply to the value of 5.87 kg (2009). From this point, it started to grow until reaching the value of 7 kg (2014), but in the years 2015–2017, it fluctuated. Since the year 2017, the curve started to increase sharply until reaching its maximum in 2019 (7.68 kg of average coffee consumption per 1000 inhabitants in the EU).

The price of coffee was analysed in accordance with the methodology. Figure 5 shows an overview of coffee price per kg in individual countries of the research sample.

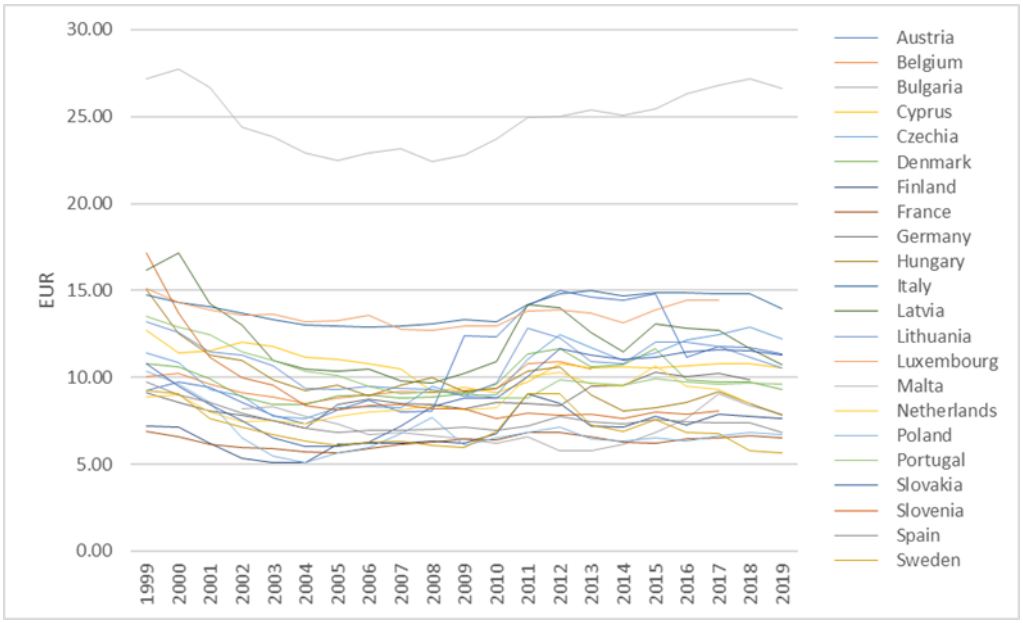

Figure 5. Price of coffee per kg – individual countries (constant prices as of 2015)
Source: Author based on data from ico.org.

The graph shows the price of 1 kg coffee in the EU countries (constant prices as of 2015). The Y axis shows the price in EUR; the X axis shows individual years (1999-2019). The prices of 1 kg coffee in individual countries are represented by curves of different colours. The highest price was recorded in Malta, where the coffee price ranges between 22.42 and 27.72 EUR per kilogram. The second and third highest price on average in the years 1999-2019 is in Italy and Luxembourg, whose curves are very constant. An interesting trend can be seen in the case of Latvia and Slovenia, as the most significant price drop was recorded there. In Latvia, there was a drop in price between 2000 and 2008 from EUR 17.17 to 9.69. In Slovenia, the price of coffee decreased from the year 1999 (EUR 17.16) to 2010 (EUR 7.64). The price in other countries ranges from EUR 5.10 (Poland, 2004) to 15.09 (Hungary, 1999). The price of coffee in the EU can be seen in Figure 6.

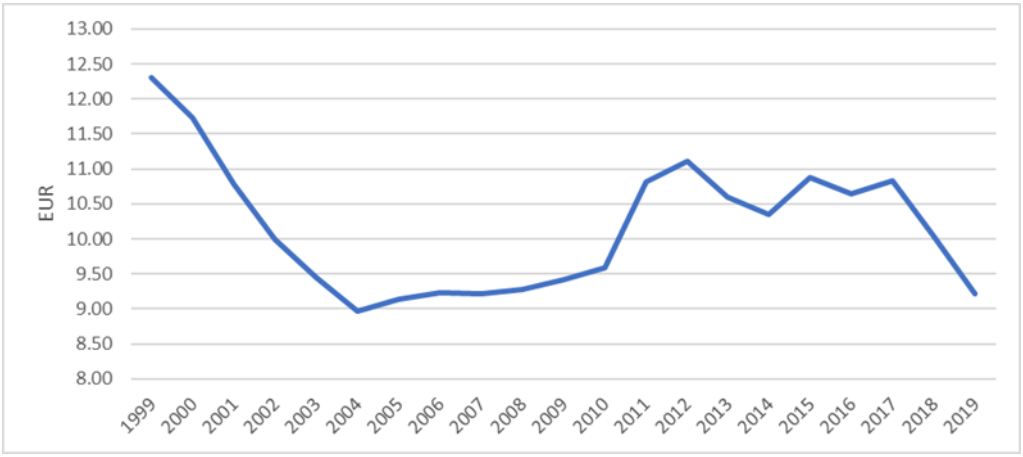

Figure 6. Price of coffee per 1 kg – EU average (in constant prices as of 2015)
Source: Author based on data from ico.org.

The curve of the graph represents the average price of 1 kg coffee in the EU countries. The vertical axis shows the price in EUR, while the horizontal axis represents the individual years (1999-2019). The curve changed significantly over the years; first, there was a drop between 1999 and 2004 (from EUR 12.31/kg to EUR 8.97/kg). In the next years, it increased slowly until reaching the value of EUR 9.59 EUR/kg (2010). In 2011 and 2012, the value rocketed to the value of 11.11. From this point, the value decreased to the value of 10.35 (2014), from which it started to increase, reaching EUR 10.88/kg in 2015 and EUR 10.83/kg in 2017. However, in the next 3 years, the price of coffee dropped to EUR 9.22/kg (2019). For the result, it is necessary to compare nominal and real prices (Figure 7).

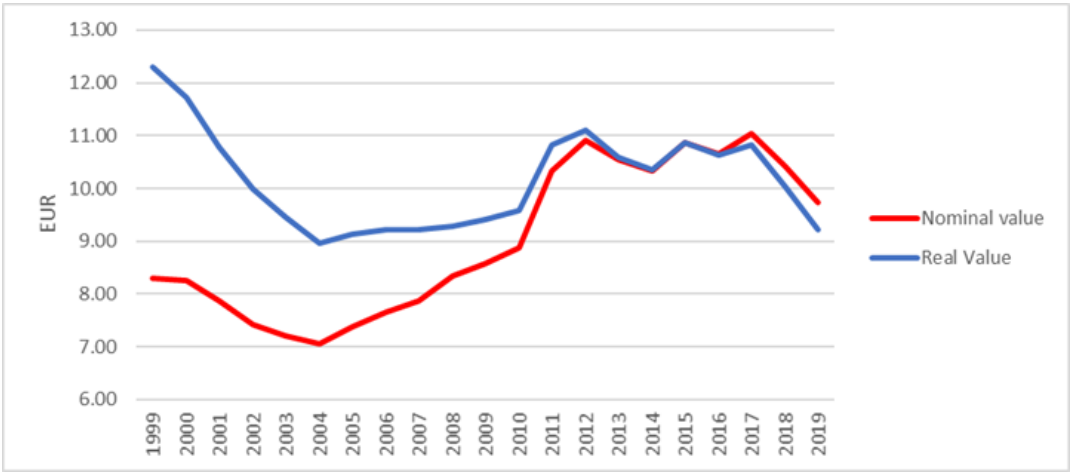

Figure 7. Price of coffee per 1 kg – EU average
Source: Author based on data from ico.org.

The graph shows the average price of 1 kg coffee in the EU countries. The price is represented by two curves of different colours. The red curve shows the nominal value, while the blue curve represents the real value. The vertical axis represents the coffee price in EUR, while the horizontal axis shows the individual years (1999-2019). The biggest difference between the two curves is seen in the year 1999 when the real value was EUR 12.31 and the nominal value was EUR 8.30. Then the curves started to converge, achieving jointly the maximum in the year 2004, with the real value curve achieving the value of EUR 8.97 and the nominal value of EUR 7.05. Subsequently, especially the nominal value started to get closer to

the real value, and in 2013, the curves intersected at the value of EUR 10.60. Despite slight fluctuations, this lasted until the year 2016 (with a value of EUR 10.64). From this year, the curves split again, where the nominal curve exceeded the real value curve, achieving its maximum in 2017 (11.04). In the years 2018 and 2019, both curves started to decrease, with the nominal value curve still exceeding the real value curve. As already known, coffee price is based on trades on commodity exchanges, i.e. on the demand function.

In the following step, the parameters of the demand curve for each monitored country and the whole EU are calculated (Table 5).

Table 5. Parameters of demand curves for individual countries

Country	Correlation coefficient	Standard error of estimate	F-test	F-Value	b	a
Austria	0.70823	1.935274	18.11484	0.000475	-0.25295	1.566108302
Belgium	0.426636	0.729218	2.670248	0.128183	10.74922	-0.19344337
Bulgaria	0.289909	0.943538	1.376386	0.259011	3.867638	0.97656678
Cyprus	0.250735	0.783479	1.207542	0.286301	11.64603	-0.17124969
Czechia	0.555899	1.529312	8.050086	0.010927	5.750553	1.115156905
Denmark	0.1230322	1.0479665	0.2766522	0.6053244	11.334986	-0.18832423
Finland	0.307972	1.05928	1.886133	0.186505	1.778689	0.421202266
France	0.566556	0.294725	8.509015	0.009201	2.435814	0.745749958
Germany	0.5635	0.782203	7.909589	0.011988	17.60055	-1.34459286
Hungary	0.287673	1.142822	1.624003	0.218742	8.498229	0.37115005
Italy	0.303913	0.770084	1.831717	0.192678	21.54072	-1.32788446
Latvia	0.0110301	1.9604863	0.0021902	0.9631881	11.902254	0.036242929
Lithuania	0.0546106	1.2779529	0.0538423	0.819125	10.413058	0.092129955
Luxembourg	0.799734	0.339492	28.39189	6.79E-05	16.62805	-0.11912939
Malta	0.294821	1.679959	1.713481	0.207	26.36785	-0.66132416
Netherlands	0.28064	1.005988	1.45337	0.244501	9.942828	-0.20109551
Poland	0.0555308	1.0389661	0.0556777	0.8161268	7.0106951	-0.10277379
Portugal	0.519476	0.988148	6.652661	0.018904	16.12401	-1.34652721
Slovakia	0.166383	2.119009	0.512487	0.483249	10.56498	-0.41793592
Slovenia	0.378767	1.471548	2.6799	0.121137	20.42883	-2.10739691
Spain	0.1341301	0.5674924	0.3297689	0.5729024	6.0894045	0.312916741
Sweden	0.351352	1.019434	2.535006	0.128755	9.622534	-0.30800474
EU	0.24099	0.816642	1.109824	0.306057	12.66783	-0.40235743

Source: Author

The table shows the parameters of demand curves of individual countries. The first column shows the correlation coefficient, the second one the standard deviation of estimates, the third column the values of the F-test. The fourth column presents the values of b – a constant, and the last column a, which indicates the weight of the volume of the consumption. The red values are inconclusive due to the difference between the F-test and F-Value. The lowest value of the correlation coefficient is in the case of Lithuania (0.01103), while the lowest one is in Luxembourg (0.79973). The EU achieves the value of 0.24099. The standard error of the estimate is the lowest in the case of France (0.29472), the highest in Slovakia (2.119). The value for the EU is 0.81664. The lowest value of the F-test can be seen in the case of Latvia (0.00219), the highest value in Luxembourg (28.3918); the value for the EU is 1.10982. In the case of F-value, the lowest value is in Luxembourg (6.79E-05), the highest in Latvia (0.9631881). The value for the EU is 0.30605. The b constant is lowest in the case of Austria (-0.25295), the highest in Malta (26.,36785); for the EU, the value is 12.6678. The value of the weight of the

consumption volume is the lowest in Slovenia (-2.1073969) and the highest in Austria (1.566108). The value for the EU is -0.40235743.

The demand curve for the monitored period is shown in Figure 8.

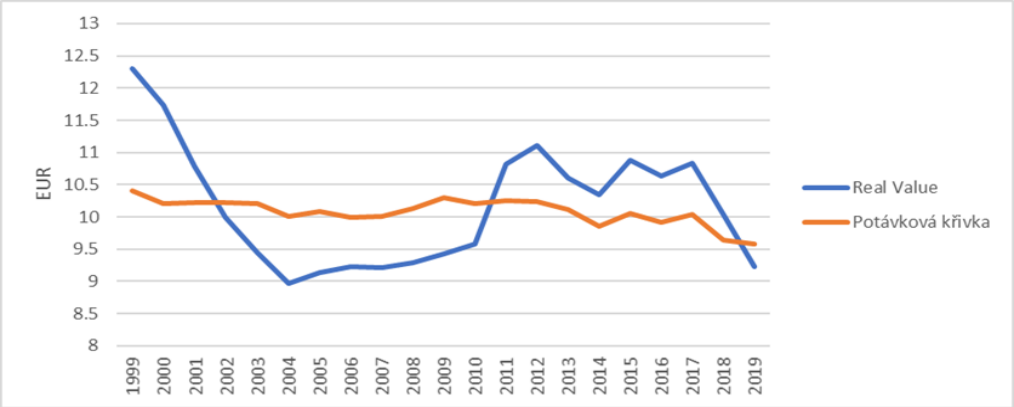

Figure 8. Demand function over time in EU in 1999-2019
Source: *Author*

The figure shows the demand function over time in the period 1999-2019 in the EU. The demand function is represented by two curves of different colours. The orange colour represents the demand curve; the blue colour the real value. The vertical axis shows the value in EUR, while the horizontal axis shows the given years (1999-2019). The real value of coffee between 1999 and 2004 decreased sharply from EUR 12.305 to EUR 8.968. After that, the real value increased slowly to EUR 9.586 until the year 2010 and then rocketed to EUR 11.704 in the years 2011 and 2012. In the next period, the price fluctuates, with the value falling to EUR 9.224 in the year 2019. Compared to the value of the real curve, the demand curve is relatively stable, fluctuating between EUR 10.402 in 1999 and EUR 9.577 in 2019. However, the important thing is that the demand curve in the figure reflects the fluctuations in coffee consumption. It is assumed that the consumption is equal to the demand. At first glance, the demand curve shows a slightly downward trend and the decrease in the real value of price between the years 2002 and 2011 has only a slight impact on the increase in the demand over the years. The actual relationship between the volume of coffee consumed and the price, i.e. the demand curve, can be seen in Figure 9.

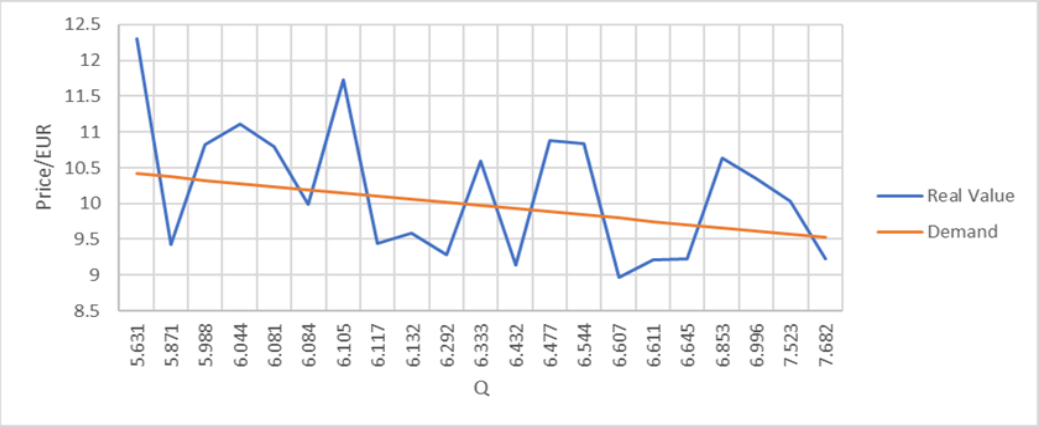

Figure 9. Relationship between the volume of coffee consumed and the price
Source: *Author*

The figure shows the coffee demand function according to the volume of consumption. The demand function is represented by two curves of different colours. The orange colour represents the demand curve, while the blue colour is for real value. The vertical axis shows the value in EUR, in the horizontal axis, there can be seen the volume of coffee consumed. It can be seen that the demand curve is perfectly evenly declining from 5.631 to 7.682, and only at the points 6.083 and 6.132 it intersects the curve of real value at the point of EUR 10.281 and 9.927. The values of the real curve are fluctuating, achieving a maximum of EUR 12.305 at the point 5.631, and a minimum of EUR 8.968 at the point 6.606. At the following points, the price rose to EUR 11.107 at the point 6.044, which was followed by a drop to EUR 11.107 at the point 7.681.

Discussion

The objective of the paper was to formulate the demand for coffee in EU member countries. Due to insufficient data exposure, not all states of the EU were included. Despite this, the sample showed sufficient informative properties. To fully achieve the objective set, two research questions had to be formulated and answered. Moreover, it shall be stated that the issue of resulting elasticities is the same in the case of nominal and real coffee prices.

RQ1: What is the price elasticity of the demand?

The concept of elasticity was first formulated by the leading personality of Cambridge School, Alfred Marshall. Until now, the importance of elasticities is crucial in creating demand. In this context, there can be mentioned mainly Bonnet and Villas-Boas (2016), who used price elasticity to obtain valuable information on coffee demand in France. The results showed the dominance of perfectly inelastic demand for coffee in most of the countries under review. The income elasticity even evaluates coffee as an inferior good in most of the countries in the research sample, with the exception of the following states – Denmark, Belgium, and Malta. In the context of the EU, the price elasticity of demand can be described as perfectly inelastic, while the income elasticity classified coffee as inferior good, which is statistically natural in view of the above.

RQ2: What is the demand function for coffee in the given sample of countries?

To determine the demand function for coffee, it was a priori important to determine the net annual income per capita for individual years, then the average consumption of coffee in kg per 1000 inhabitants, and finally the price of 1 kg coffee in individual countries. Based on the data on these three economic variables, multiple regression can be carried out. The demand curve at the level of the EU over time was constantly between EUR 10,402 in 1999 and 9,577 in 2019. The results show that in this case, the consumption equals the demand. The final demand in terms of the price for quantity at the level of the EU was almost perfectly decreasing from the point 5.631 to 7.682.

The majority of papers dealing with commodities in general focus rather on the demand side. For the purposes of this paper, the most relevant one is the aforementioned study by Bonnet and Villas-Boas (2016), who analyzed the impact of the demand of households on the price in the context of cost shock. The authors stated that the response of French households to price changes is more pronounced in the case of price increases than to price decreases. According to the results presented in this paper, in terms of price elasticity, the demand in France is classified as inelastic, which means that price changes do not have any significant impact on consumption. The findings of Bonnet and Villas-Boas (2016) are thus inconsistent with the findings presented in this paper.

According to our findings, coffee is classified as an inferior good, which is contradictory to the premise in the introduction. Based on an empirical test, it can be concluded that the

consumption of coffee decreases with increasing income. Here, the assumption is made that coffee is a substitute. With increasing income, a more expensive and thus luxurious product is assumed to satisfy the demand (e.g. through "fair trade" and organic coffee). This is in line with the statement by Yang et al. (2014), who examined the willingness of consumers to pay more for a more expensive product in the Chinese market. The willingness to pay more for coffee is mentioned also by Hindsley et al. (2020). Slightly different results are presented by Friberg and Sanctuary (2018). According to them, the attractiveness of a more expensive organic coffee is more typical for households slightly interested in ecology.

The findings may bring valuable information to the theoretical background. There can also be overlap in practice, since the formulation of demand for coffee may be beneficial for the whole supply-demand chain, even in the context of formulating price and income elasticities as design intermediary steps in the final construction of the demand function. The sample of European countries can be considered a limitation since the selected sample did not contain all the EU countries due to its incompleteness.

Further research aimed at determining coffee demand should focus on other markets and compare the findings. Interesting results were recorded in the case of Luxembourg, which, due to its small number of inhabitants showed high coffee consumption; however, despite this, coffee was classified as an inferior good. There is also room for further perspectives and comparisons. Also, given the results, it is appropriate to focus on the potential identification of coffee substitutes.

In terms of the economic theory, there are certain assumptions about the development of coffee as an economic good. At the time of its launch in the European market, coffee was logically considered a luxurious good. With the growing demand, the supply grew as well due to the growing number of coffee plantations. As already mentioned, our findings classified coffee as inferior good. From the microeconomic point of view, consumption of coffee decreases with increasing income. As already stated, coffee can be considered a drug due to its stimulating effects. In the case of the EU, the price elasticity of demand was perfectly inelastic. In spite of this, the findings are surprising. One of the prerequisites is the health aspect if consumers do not exceed a certain limit of daily consumption (Gavurova & Megyesiova, 2022; Soltes & Gavurova, 2015). With a higher income, consumers do not consume more coffee. Moreover, it can be assumed that there will be demand for more luxurious brands of coffee and vice versa.

Conclusion

The objective of the contribution is to determine coffee demand using a sample of selected EU countries, namely: Austria, Belgium, Bulgaria, Cyprus, Czechia, Denmark, Finland, France, Germany, Hungary, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain and Sweden.

In the alternative, to achieve this objective, it will be necessary to determine elasticities for individual states in the research sample, specifically price and income elasticity. Thanks to this, it was possible to gain an overview of the behaviour of coffee in the market. Finally, in constructing the demand, it was also necessary to monitor the consumption of coffee, its price, and the income in individual EU countries. In the EU, coffee was classified as an inferior good, which is rather surprising. With increasing quantity, coffee demand in the EU had a declining shape, which was almost perfectly linear. We assume that the findings will contribute to the theoretical basis, and at the practical level, the findings will be beneficial for the whole supply-demand chain of coffee. The set objective can thus be considered achieved.

Our view of the demand for coffee has brought interesting findings. From a microeconomic point of view, it can be determined from a sample of the EU countries that coffee as economic good shows perfect price inelasticity. This way it gets to the level of constant consumption as the price moves both up and down. This is typical e.g. for drugs or medicines, whose permanent use is important for health. Coffee as an inferior economic good illustrates the reluctance of demand to acquire more coffee in the case of increasing income. We believe that this fact indicates and confirms that the demand is aware of health risks related to the excessive consumption of coffee.

A significant limitation is in certain incompleteness of the data, which results in the fact that the research sample does not include all EU member countries. Despite this, the results achieved can be considered relevant, and in further contributions, they can be interpreted in the context of other markets. Moreover, due to the classification of coffee as an inferior good, it is recommendable to identify its potential substitute or deal with the demand for a diversified coffee product at a retail price that would scale coffee for demand according to the degree of luxury.

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