https://doi.org/10.15414/isd2018.s3.02

DEVELOPMENT OF CONSUMER PRICES OF SELECTED TYPES OF MILK AND DAIRY PRODUCTS

Mária Farkašová[1], Norbert Kecskés[2]
Slovak University of Agriculture Nitra[1,2]
Faculty of Economics and Management, Department of Mathematics
Trieda A. Hlinku 2
Nitra, Slovak Republic
e-mail[1]: Maria.Farkasova@uniag.sk

Abstract

The paper analyzes mutual relationships between purchase, processing and consumer prices of milk and dairy products and also the main factors that may influence the current price development in the Slovak republic.

Keywords: *purchase price, processing price, consumer price, milk consumption*

JEL Classification: *G, E21, E30*

1 Introduction

Food consumption, both in the world and in our country, has undergone major changes in recent decades and this trend keeps going on. In food consumption there have been significant changes both in amount and structure. These changes have been affected by various factors. The most important factors influencing food consumption include the development of the income of population, development of consumer prices, development of the distribution network, advertising and also health education. Dairy industry belongs among the leading food industry in developed countries. Every developed country in the world is trying to attain self-sufficiency in production of basic foods and one of the most important are milk and dairy products. Throughout the recent years Slovakia has been in the role of a country dependent on imports. Production of milk has a great social significance not only as standard foodstuff but also in terms of livestock farming in agricultural primary production. It influences the livestock breeding

economy, rural employment and also the social and ecological program of agricultural products processing.

1.1 Situation in the dairy market

Throughout the last ten years the milk sector in Slovakia was hit by three dairy crises. The biggest fluctuation in milk purchase prices took place between 2008 and 2009 and we call it the major milk crisis. Further drop in purchase prices came in 2012. The last middle-class crisis occurred between 2015 and 2016 (Table 1). Until 2015 the market was regulated. In 2015, with the abolition of milk quotas, milk production increased and milk became overproduced. In addition, Russia has issued an embargo on European products and China has restricted imports of dairy products from the EU. Due to this crisis the milk sector has declined. "Over the past ten years, the number of dairy cows has fallen by 31 % (55,102), milk deliveries have fallen by 15 % (141 million kg), nearly 35 % of businesses (133) have finished milk production, but the number of milk processing plants remained unchanged " (Štefániková, 2017). After the abolition of milk quotas in 2015 the price of raw cow's milk began to fall below production costs. Milk purchase prices did not cover the average production costs. In 2010, the production cost of a liter of milk was 0.39 €. In the reference period 2010-2016 these values ranged from 0.38 € (2015) to 0.43 €. l^{-1} (2011). This is due to the presence of competing surplus milk on the EU market supplied by dominant European producers.

Table 1**Purchase prices of raw cows' milk in Slovakia (€.(100 kg)$^{-1}$)**

Year	Purchase price	Year on year change € (100kg)$^{-1}$ %	
2008	33.76	-	-
2009	20.82	-12.94	-38.33
2010	27.24	6.42	30.84
2011	31.62	4.38	16.08
2012	29.46	-2.16	-6.83
2013	32.65	3.19	10.83
2014	33.82	1.17	3.58
2015	27.95	-5.87	-17.36
2016	26.62	-1.33	-4.76

Source: http://www.vuepp.sk/dokumenty/komodity/2017/Mlieko06_17.pdf and author's computations.

2 Data and methodology

The selected methodological approach was applied in order to analyze the mutual price relationships between the purchase, selling and consumer prices of milk and dairy products during the period of 2010-2016. This goal was met by:

- collection of domestic and foreign data,
- analysis, synthesis and comparison of data processed in a tabular, graphical and textual form.

The analysis was based on the latest publications, databases, data from the SO SR, NPPC-VÚEPP (own analyses, databases, research tasks and situational and forward-looking statements) and PPASR. The analysis includes comparison of the development of milk consumption and selected dairy products and milk purchase prices in Slovakia in 2008-2016.

3 Results and discussion

In the reference period (2008-2016), the trend of milk and dairy products consumption per capita in the Slovak Republic was increasing, with the exception of the year 2011, but is not close to the Pan-European average ranging from 320 to 340 kg per capita. The recommended amount is 270 kg per capita per year. Consumption of selected dairy products corresponded to their current price development. Consumption of milk had a fluctuating trend (Table 2). During the reference period (2008-2016) it fell by 4.2% (from 47.7 kg to 45.7 kg. citizen^{-1}. year^{-1}). Since 1992, consumption of milk has fallen by 50.6% (from 92.5 kg. citizen^{-1}. year^{-1}), what is an annoying drop. From 2008 to 2016, consumption of dairy products grew by 15.56 % (from 153 kg. citizen^{-1}. year^{-1} to 176.8) and since 1992 it has declined by 7.43 %. The highest consumption of milk and dairy products was recorded in 2016. Despite this fact, this year showed historically the lowest consumption rate of milk.

Table 2 **Average yearly consumption of milk and selected dairy products in Slovakia (kg. citizen^{-1}. year^{-1})**

	Year								
	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Dairy products	153.0	153.3	162.8	156.9	158.6	158.5	166.8	167.6	178.8
Drinking milk	47.7	48.9	53.9	52.5	53.7	48.7	47.6	48.0	45.7
Butter	2.2	2.8	2.6	2.9	3.2	3	3.2	3.5	3.9
Cheese and curd	9.2	9.8	9.9	10.4	10.1	11.4	11.5	12.1	13.9

	Year								
	2008	2009	2010	2011	2012	2013	2014	2015	2016
Curd	1.9	2.0	2.1	2.0	2.1	2.2	2.4	2.5	2.6

Source: http://www.vuepp.sk/dokumenty/komodity/2017/Mlieko06_17.pdf.

Consumption of cheese and curd attained the record value in this year. Decline in milk consumption is mainly caused by the rise of consumer prices of drinking milk. We analyzed the course of the selling price of semi-skimmed milk.

From 2008 the consumer price of semi-skimmed milk increased by 19.72 % to 0.79 €. l^{-1} (2016). From 1992, when it was at the level of 0.23 €. l^{-1}, to 2016 the price rose by 243 %. There is an inverse proportion between milk consumption and consumer price and milk consumption declines as the consumer price increases.

In the reference period the purchase, selling and consumer prices of this product, excluding VAT, alternated - after each increase there was a decrease and vice versa (Table 3). In 2014, the selling price decreased by 0.02 €. l^{-1}, while the purchase price of milk increased by 0.01 €. l^{-1} and in 2016 the selling price increased by 0.03 €. l^{-1} and the purchase price decreased by 0,01 €. l^{-1}.

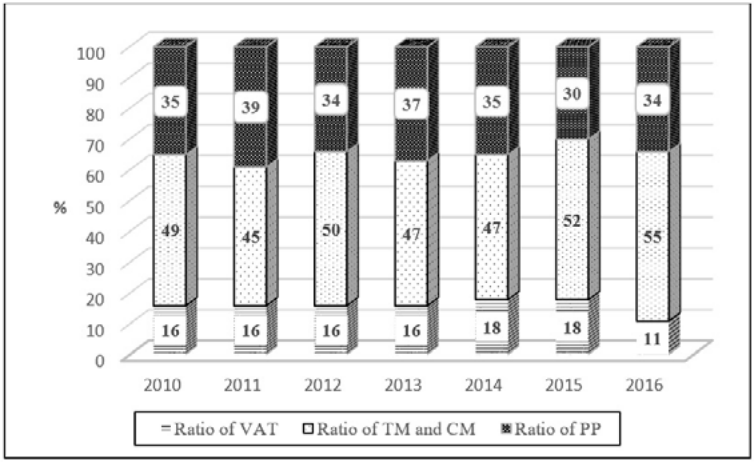
Table 3 **Selling prices distribution of semi-skimmed milk (€. l^{-1}).**

	Year						
Indicator	2010	2011	2012	2013	2014	2015	2016
Purchase price	0.27	0.32	0.30	0.33	0.34	0.28	0.27
Selling price	0.40	0.43	0.40	0.45	0.43	0.35	0.38
Consumer price without VAT	0.65	0.69	0.74	0.75	0.79	0.77	0.65
Consumer price with VAT	0.77	0.82	0.88	0.89	0.96	0.94	0.79
Disparity	0.38	0.37	0.44	0.42	0.45	0.49	0.38

Source: http://www.vuepp.sk/dokumenty/komodity/2017/Mlieko06_17.pdf and author's computations.

In the reference period the average prices of raw cow's milk ranged from 0.27 (2010) to 0.34 €. l^{-1} (2014). The abolition of milk quotas in 2015 launched problems. They caused overproduction of milk and a big drop in prices by 0.06 € per liter. In the next year milk producers responded to this situation by production limitations which led to higher prices. In 2015 and 2016, the communication campaign "Save Slovak Milk", together with petitions, was carried out to promote milk production.

Chart 1 **Structure of consumer prices of semi-skimmed milk in Slovakia in years 2010-2016**



Source: Author's computations, OM – trade margin, SM – consumer margin, NC – purchase price.

The analysis carried out by SZPM revealed different purchase prices among milk purchasers within Slovakia, but also in purchase prices paid by individual milk purchasers to their suppliers - primary milk producers. The difference between the highest and the lowest milk price reached 0.08 €. l^{-1}. Variation of milk prices in the European Union has been traditionally very high. It ranges from approximately 0.28 € to 0.55 € per kilogram of milk. On average, European purchase prices reached the level of more than 0.33 € and have a slightly increasing trend. Compared to these facts, Slovak primary producers receive for milk, on average, 0.03 € per kilogram less.

The disparity between the purchase and consumer prices of semi-skimmed milk grew year-on-year, except the years of milk crises, when prices dropped. This means that the share of cow's milk producer's price in the consumer price of semi-skimmed milk decreases.

Consumer price development was affected by the increase of VAT in 2010 to 19 %, in 2014 the VAT rate was 22 % and on 1.1.2016 it was reduced from 20 % to 10 %. In 2017, according to the data of the Statistical Office of the SR, the average consumer price of semi-skimmed milk increased by 7.4 % compared to 2016.

Fats and protein components of milk are evaluated in production of cheese, curd, butter and drinking milk. Price increase of these products has also been

recorded. Consumption of curd per capita in Slovakia in the reference period of 2010-2016 is about 2.2 kg per person per year.

Development of purchase prices of cow's milk necessary for production of 1 kg of curd, selling prices and consumer prices is shown in Table 4.

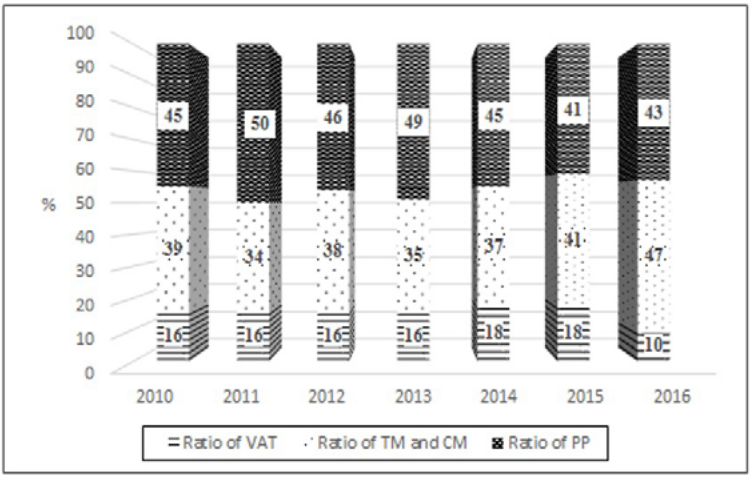
The disparity between the milk purchase prices and the consumer prices of curd increased year-on-year with the exception of 2011 and 2013, which indicates a reduction in shares of primary milk producers in consumer prices.

Table 4 **Selling prices distribution of curd (€. kg^{-1})**

Year							
Indicator	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Purchase price	1.84	2.19	2.05	2.25	2.13	1.91	1.84
Selling price	2.06	2.31	2.45	2.52	2.59	2.52	2.52
Consumer price without VAT	3.43	3.66	3.76	3.83	3.92	3.84	3.92
Consumer price with VAT	4.08	4.36	4.48	4.56	4.78	4.68	4.31
Disparity	1.59	1.47	1.71	1.58	1.79	1.93	2.08

Source: http://www.vuepp.sk/dokumenty/komodity/2017/Mlieko06_17.pdf and author's computations.

Chart 2 **Structure of consumer prices of curd in Slovakia in years 2010-2016**



Source: Author's computations, OM – trade margin, SM – consumer margin, NC – purchase price.

The most significant increase in price of dairy products was recorded in case of butter. From 2010 to 2016, the total butter consumption rose from 2.2 to 3.9 kg per capita per year, which is an increase by 77 %. This was caused by a gradual shift of consumers from vegetable fats towards traditional sources of fats (butter, hog lard).

The development of purchase prices of cow's milk necessary for production of 1 kg of butter, its selling and consumer prices is shown in Table 5. The development of consumer prices of butter without VAT in the reference period had a predominantly increasing trend, except of 2016, when there was the decrease by 0.33 €.kg^{-1} compared to 2015.

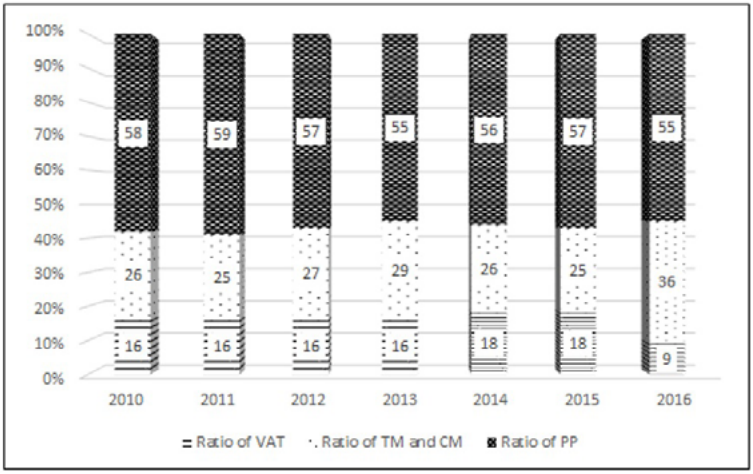
Table 5 **Selling prices distribution of butter (€. kg^{-1})**

	Year						
Indicator	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Purchase price	4.00	4.50	4.40	4.52	4.74	4.64	4.30
Selling price	4.13	4.66	4.32	4.49	4.58	4.05	4.14
Consumer price without VAT	5.78	6.45	6.52	6.86	6.95	6.62	7.12
Consumer price with VAT	6.88	7.68	7.76	8.16	8.48	8.08	7.84
Disparity	1.78	1.95	2.12	2.37	2.21	1.98	2.82

Source: http://www.vuepp.sk/dokumenty/komodity/2017/Mlieko06_17.pdf and author's computations

From 2010 to 2016, the consumer price increased by 12.3 % (1.34 €. kg^{-1}). The purchase price trend was copying the development of the selling price. During the reference period the purchase price of raw cow's milk necessary for production of 1 kg of butter reached the highest value in 2014 and the lowest in 2010, their difference was 0.74 € .kg^{-1}.

Chart 3 **Structure of consumer prices of butter in Slovakia in years 2010-2016**



Source: Author's computations, OM – trade margin, SM – consumer margin, NC – purchase price.

The disparity between the purchase price of milk and the consumer price of butter was increasing (until 2014). This shows that the share of cow's milk producer's price in the consumer price of milk had a decreasing trend and then increasing since 2014.

In the reference period, the milk vertical, i.e. primary production, processing and trade did not avoid the problems of unbalanced business relationships. Prices in shops do not copy the decrease in purchase prices of raw cows' milk. The trade and market develops a long-term pressure on selling prices, that is, the prices for which milk and dairy products are purchased from milk processors. Milk processors transfer this pressure on primary milk producers. Unfair business practices, especially uneven margin distribution, emerged. The smallest portion is received by primary producers and processors. The highest percentage is claimed by traders. In case of butter prices, some traders claimed a 100 % margin. The undesirable phenomenon is that traders apply higher margins on domestic dairy products than to foreign ones of the same category and this is reflected in consumer prices. In the end, the consumer price of milk and dairy products depends on market.

4 Conclusion

In the reference period consumption of milk and dairy products was rising, which was influenced by eating habits and also by the level of customer prices in relation to the average income of the population. At the same time, there was a demand for full-fat milk and dairy products which contain significantly more protein and fat. The total consumption of dairy products in Slovakia in 2016, after the average fat content had been adjusted, reached 7.35 kg per capita. Production of Slovak milk fat is 5.9 kg per capita. To achieve self-sufficiency in milk fat production, Slovakia lacked 35,000 dairy cows. If this rising trend in dairy products consumption is going to continue, the rate of our self-sufficiency in milk fat and protein will decrease. If adequate support measures are not taken, decrease in number of dairy cows in Slovakia will continue and we will be forced to import dairy products from abroad.

The priorities of the Slovak Republic include provisions of health and consumer protection in terms of food safety.

Milk purchase prices in the reference period in Slovakia constantly lagged behind the European Union average and we also have significantly less support than European farmers. That is why Slovak primary producers expect an increase in purchase prices of raw milk and government support to the extent of neighboring countries. This is the only way how to stabilize milk production in Slovakia.

References

1. MASÁR, I. (2016). Mlieko – situačná a výhľadová správa k 31.12.2015. Bratislava, NPPC –VÚEPP. (ISSN 1338-4848). Available at: http://www.vuepp.sk/dokumenty/komodity/2017/Mlieko06_17.pdf.
2. ŠTEFÁNIKOVÁ, M. (2017). Začarovaný mliečny kruh. Available at: http://www.agroporadenstvo.sk/ ekonomika-financie-trh-odborne-clanky?article=1001.
3. Správa o poľnohospodárstve a potravinárstve v slovenskej republike za rok 2015 (zelenáspráva). Available at: http://www.vuepp.sk/dokumenty/zelena/zelena2016.pdf.

COCOA MARKET IN THE WORLD AND IN SLOVAKIA: EXAMPLE OF SUPPLYING COCOA POWDER

Alexandra Filová[1], Veronika Hrdá[2]
Slovak University of Agriculture in Nitra[1, 2]
Department of management
Tr. A. Hlinku 2, 949 76
Nitra, Slovakia
e-mail[1,2]: alexandra.filova@uniag.sk,veronika.hrda@uniag.sk

Abstract

The paper analyses cocoa market. Specifically, production in the countries which belong to the biggest producers of cocoa in the world, consumption of this commodity in the European countries which, on the contrary, belong to the countries with the highest consumption of cocoa in the world. By statistical methods of trend equalization we analyse time series of consumption of cocoa powder in Slovakia from 1990 to 2016. In the last part we compute optimum amount of supply of cocoa powder from Mexico to Slovakia. It is a static model of supply with deterministic movement of demand after this commodity. The amount of supply is selected based on total expected costs which emerge within decision on the acquisition of the given supply. These costs must be minimal.

Keywords: *optimal order quantity, supplies, consumption, production, cocoa*

JEL Classification: *M2, C32, D2*

1 Introduction

The cocoa bean also referred to as cacao or simply cocoa, is the dried and fully fermented fatty seed of Theobroma cacao, from which cocoa solids and cocoa oil are extracted. The "beans" are the essential ingredient for chocolate and cacao products. Products received from cocoa beans are not only used in chocolates, but also in a wide range of food products.

Growing expansion of chocolate confectionary business is boosting the demand for cocoa beans across the globe. Every year nearly 4 million tones cocoa beans are produced and around 92% of total cocoa beans are utilized for chocolate

production. Rising popularity of cocoa-based products such as cocoa powder, cocoa butter, cocoa beverages and beauty products are driving the growth of global cocoa beans market.

Major production of cocoa is generated from emerging economies. Poor infrastructure and lack of communications in such regions are impacting the production of cocoa beans. Nearly 95% of total cocoa production comes from small farmers. In 2009, Indonesian government launched a program which will boost the production of cocoa beans in Indonesia up to 600,000 tons annually. In 2015, USD 100 million was invested to distribute new seedlings among Indonesian farmers. However, these initiatives have shown limited results which are hindering the growth of global cocoa beans market.

The global cocoa beans market is estimated to reach USD 16,7 billion by the end of 2024, growing at compound annual growth of 3,1% during the forecast period.

However, rapid increase in demand for chocolate flavoured products, cocoa powder and cake in China, Malaysia and India are encouraging the growth of cocoa beans market in Asia-Pacific region. China is the 9th largest importer of cocoa paste and cocoa powder.

Huge demand from chocolate industry is bolstering the cocoa beans market. In 2015, retail sales of chocolate are increased by 0,6% in the USA and sales of cocoa powder and cakes is also increased by 5% in China. Increasing demand of chocolate based products is expected to drive the growth of cocoa beans market in the near future. [1]

2 Data and methodology

In the paper we use data from various web portals dealing with statistics like: Eurostat, Statistical Office of the Slovak Republic, Statista. We also used information from International Cocoa Organization and so on.

Trend line of the time series

The main objective of the analysis of time lines is definition of basic tendency of its development, thus setting its trend. Trend is defined by methods which are generally called equalizing or smoothing time series, i. e. supplementing time series of empirical values $y_1, y_2, \dots y_n$ by series of values without periodical and random fluctuation. [5] In case of trend curves we searched for possibilities provided by software IBM SPSS, whereas the most suitable alternative according to criteria R^2 was a quadratic trend curve, general formula of which is as follows:

$$Y_t = \beta_O + \beta_1 t + \beta_2 t^2,\ t = 1,2,\dots n \quad (1)$$

Static model of supplies with probable deterministic movement of supplies

Palúch – Peško (2006) state that „within searching cost reserves we found out, that companies have them inadequately bonded in supplies." The authors as well state that „it was shown, that effective solution is provided by classic optimizing and statistical methods."

A supplying model which was used within solution of the given problem is known under the expression static model of supplies with probable deterministic movement of supplies. Sixta and Žižka (2009) say „demand in this case is described by probability."

Function of total assumed costs within decision on how to ensure supply in the amount x can be expressed by relation:

$$N_c(x) = \sum_{y=0}^{x-1} c_p(x-y)p(y) + \sum_{y=x+1} c_z(y-x)p(y) \quad (2)$$

where: x – amount of provided supply,
y – amount of demand which reaches discrete values,
$p(y)$ – probability that demand in the future will be in size y,
c_z – unit costs from insufficient supply,
c_p – unit costs from surplus supply.

Optimizing task is to set an amount of supply x, for which the total costs $N_c(x)$ will be minimum, whereas for optimum amount of supply both sides of the following formula must be approved:

$$p\ y \le x_{opt.} - 1 \ \le \frac{c_z}{c_p + c_z} \le p\ y \le x_{opt.} \quad (3)$$

3 Results and discussion

While cocoa originated in Central America over 5000 years ago, it's popularity and production has spread globally. Cocoa powder and chocolate are made from the dried seeds that are found in pods on the cacao tree. [2] Cocoa is produced in countries within 10° south and 10° north of the equator.

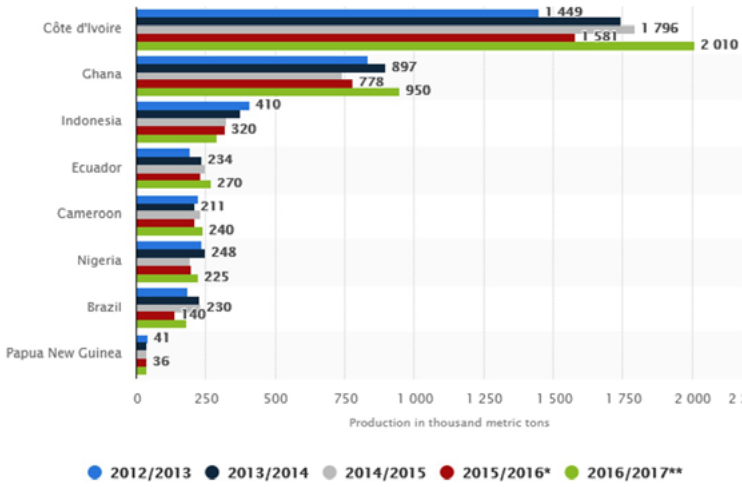
Production of cocoa in the world

Global production of cocoa beans amounted to more than 4,5 million tonnes in 2016, increasing by an average 2,2% per annum between 2009 and 2016. Production is mainly concentrated in West Africa (66%). Although West African countries showed an average growth in production of 2,7% per year, they are facing increased pressure to supply the world market and are dealing with complex

economic, social and environmental issues of their own. Asia, Latin America and the Caribbean are other cocoa producing regions. Especially Latin America and the Caribbean showed good growth between 2009 and 2016 (5,2% per year). Asia saw a small annual decline (1,4%). [4]

The largest cocoa producing countries are listed in the graph 1 below. The processing of cocoa beans is predominantly undertaken in Europe and North America with the Netherlands and the USA as the leading countries. However, there has been a steady increase in cacao processing in other countries. [3]

Graph 1 **World cocoa production by country from 2012/2013 to 2016/2017 (in 1,000 metric tons)**



Source: Statista.

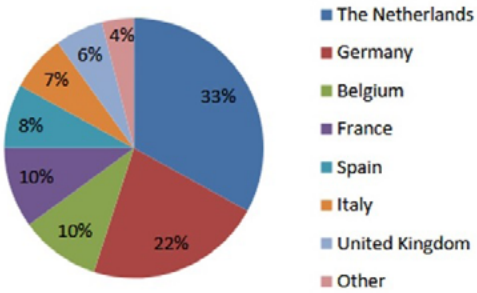
Africa is the largest producer of cocoa beans and accounted for 73% of global cocoa beans production where major production of cocoa beans comes from Ivory Coast and Ghana. Asia Pacific and Latin America are also plays an important role in the production of cocoa beans. Asia-Pacific accounts for 15% and Latin America accounts for 12% share of total cocoa beans produced in 2015. Major contribution of cocoa beans production comes from countries such as Indonesia, Malaysia and Singapore, which is likely to expand the business opportunities of cocoa beans in Asia-Pacific region. [1]

Consumption of cocoa in the EU and in Slovakia

Europe and America are the largest consumers of cocoa beans and cocoa-based products. Growing demand of cocoa beans in chocolate and food & beverage industry is fuelling the market growth in the regions. USA has the largest chocolate market and increasing demand for chocolate and chocolate flavoured products is increasing the demand for cocoa beans. Europe accounted for 42% revenue share of global cocoa beans market in 2015, owing to the high consumption of cocoa paste and cocoa butter in Germany, Belgium, The Netherlands and Russia. [1]

The European cocoa market offers good opportunities for developing countries. Europe is a dominant force in the cocoa sector, representing more than half of global cocoa bean imports. Furthermore, most beans are imported directly from developing countries, the Netherlands, Belgium and Germany being the largest importers. Europe comprises nearly 40% of the global cocoa-processing market. European cocoa grindings accounted for 1,3 million tonnes in 2016. European grindings decreased slightly, by an average of 0,8% per year, between 2010 and 2016. There was a significant drop in 2012, probably as a result of the economic crisis. The Netherlands and Germany are the two most important grinders in Europe. [4]

Graph 2 **Grinding shares of European countries, 2016, in %**



Source: Eurostat.

As we can see from the bar graph 3 consumption of cocoa powder in Slovakia has a rising tendency even though we have recorded a slight fall in the recent years. The highest value of consumption of the given commodity is recorded in 2007 with the value of 0,70 kg per inhabitant. The lowest value of consumption is recorded in the first years of the given period, specifically in 1990, 1991 and 1992, when the consumption of cocoa powder per inhabitant in Slovakia reached only 0,20 kg. As mentioned above, this rise can be explained by growing trend in production of chocolate products.

Graph 3 **Consumption of cocoa powder per inhabitant in Slovakia in kg**

Source: Statistical Office of the Slovak Republic, database of DATA CUBE, own elaboration.

From the table 1 it is clear, that the value of correlation coefficient $R = 0{,}836$ shows relatively high dependence between the given variables and time. Coefficient of determination $R^2 = 0{,}699$, i. e. model is explained by 69,9% of the total variability. Based on p-value, which is smaller than 0,05 , we can assume that selected model as a whole was right. Quadratic trend was assumed by equation $Y_t = 0{,}161 + 0{,}029t - 0{,}135t^2$. The selected trend has statistically significant assumptions of parameters on the level of significance 5%.

Table 1 **Trend equalization of time series of cocoa powder consumption in Slovakia using quadratic trend**

Model Summary			
R	R Square	Adjusted R Square	Std. Error of the Estimate
,836	**0,699**	0,673	0,075

ANOVA					
	Sum of Squares	df	Mean Square	F	Sig.
Regression	0,312	2	0,156	27,815	**0,000**
Residual	0,135	24	0,006		
Total	0,447	26			

Coefficients					
	Unstandardized Coefficients		**Standardized Coefficients**	**t**	**Sig.**
	B	**Std. Error**	**Beta**		
Case Sequence	0,029	0,008	1,747	3,756	**0,001**

Model Summary					
Case Sequence ** 2	-0,001	0,000	-0,973	-2,093	**0,047**
(Constant)	0,161	0,047		3,459	**0,002**

Source: Own elaboration.

Example of computing optimum amount of supply of cocoa powder

Let us briefly outline the situation that is discussed by the company's management dealing with retailing bio food products online in Slovakia. As the data is highly confidential, we are not allowed to name the company. After the research of the cocoa market the company has opportunity to import bio cocoa powder type Trinitario[1] from Mexico and therefore the management of the company wants to know what the amount of the supply of this kind should be, with expected costs which might emerge within decision to obtain a supply in the given amount. Total expected costs should, of course, be minimal.

There are specific limitations, as for transfer, storage, supplying and distribution of cocoa powder from Mexico. Within transfer it is possible to move only a product on palettes with the size of 800x1 200 cm, which are placed in cooled ship containers. Number of packages on one palette is 1 000 pieces, whereas one package contains 500 g of cocoa powder.

Acquisition price of one half – a – kilo package is 6,18 euro. Retailing price of one half – a – kilo package of cocoa powder is 10,50 euro. The company's management, taking into account the sale of similar products in the past, assumed probability of selling the analysed product which can be seen in the table 2. It is assumed that the highest probability is to sell approximately 9 800 pieces of cocoa powder packages.

Based on the given facts we computed optimum amount of the order of cocoa powder which should be 9 000 pieces. With this size of created supply the total expected costs will be minimum and their amount after rounding will be approximately 10 343 euro.

[1] Trinitario plants are not found in the wild as they are cultivated hybrids of the other two types. Trinitario cocoa trees are grown mainly in the Caribbean area but also in Cameroon and Papua New Guinea. The mostly hard pods are variable in colour and they contain 30 or more beans of variable colour but white beans are rare. [2]

Table 2 **Basic information about expected sale of cocoa powder**

Number of customers who would buy the product	Number of packages of the product on a palette	Probability of sale
5 442	5 000	0,01
5 728	6 000	0,03
6 402	7 000	0,11
7 256	8 000	0,21
8 372	9 000	0,22
9 894	10 000	0,23
12 093	13 000	0,13
15 548	16 000	0,04
21 768	22 000	0,01
36 279	37 000	0,01

Source: Own elaboration.

4 Conclusion

To sum up we can proclaim that production of cocoa in the world is growing. The biggest producers are African countries (especially Côte d'Ivoire, Ghana), countries of Latin America (especially Brazil, Ecuador, Mexico, Peru) and countries of Oceania (especially Indonesia, Papua New Guinea). On the other hand, the biggest consumers of cocoa are European countries (especially the Netherlands, Germany, Belgium). The growth of production and consumption of this commodity reflects the growth of chocolate production and production of chocolate products in the world.

In Slovakia we have recorded a rise of cocoa powder consumption by 0,30 kg per person since 1990. Recently, consumption has stagnated and we do not assume a rise in consumption in coming years.

Nowadays Slovakia imports cocoa especially from African countries and countries of Latin America. The quality of cocoa powder is different. A customer in Slovakia has a possibility to buy lower quality cocoa as well as bio cocoa with a high level of quality. The quality indicator has an influence on the price of the given commodity on the market. Cocoa in Slovakia is retailing from 5 Euro per kilo to approximately 23 Euro per kilo. Price of cocoa in Slovakia is influenced by the world trade as well. In the graph 4 we can see how the price of cocoa per kilo developed in euro on the world markets from 31.1.2017 to 30.1.2018.

Graph 4 **Development of cocoa price on the world markets in kg from 31.1.2017 to 30.1.2018**

Source: www.kurzy.cz.

References

1. [online]. [accessed 30. January 2018]. Available at: https://marketersmedia.com/global-cocoa-beans-market-2017-revenue-price-and-gross-margin-research-report-2024/251508.
2. [online]. [accessed 30. January 2018]. Available at: http://www.worldagroforestry.org/treesandmarkets/inaforesta/documents/cocoa%20and%20chocolate/cocoa%20and%20chocolate.pdf.
3. [online]. [accessed 30. January 2018]. Available at: http://www.cacaoweb.net/countries.html.
4. CBI Ministry of Foreign Affairs. (2016). CBI Trade Statistics: Cocoa in Europe. The Hague. Netherlands. 2016. [online]. [accessed 30. January 2018]. Available at: https://www.cbi.eu/sites/default/files/market_information/researches/trade-statistics-europe-cocoa-2016.pdf.
5. OSTERTAGOVA, E. Modelling time series. In. *The13th International Scientific Conference Trends and Innovative Approaches in Business Processes.* (2010). [online]. [accessed 30. January 2018]. Available at: https://www.sjf.tuke.sk/umpadi/taipvpp/2010/index.files/clanky%20PDF/OSTERTAGOVA.pdf.
6. PALÚCH, S., PEŠKO, Š. (2006). *Kvantitatívne metódy v logistike*. 1st edition. Žilina : EDIS žilinská univerzita (2006). 185 p. ISBN 80-8070-636-0

7. SIXTA, J., ŽIŽKA, M. (2009). *Logistika. Metody používané pro řešení logistických projektů*. 1st edition. Brno : Computer Press (2009). 238 p. ISBN 978-80-251-2563-2
8. Statistical Office of The Slovak Republic. (2018). DATA CUBE.[online]. [accessed 30. January 2018]. Available at: http://datacube.statistics.sk/.
9. EUROSTAT. (2018). [online]. [accessed 30. January 2018]. Available at: http://ec.europa.eu/eurostat/data/database.
10. STATISTA. (2018). [online]. [accessed 30. January 2018]. Available at: https://www.statista.com/topics/3211/cocoa-industry/.
11. KURZY. (2018). [online]. [accessed 30. January 2018]. Available at: https://www.kurzy.cz/komodity/kakao-graf-vyvoje-ceny/.