

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

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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:

$$Y_t = \beta_0 + \beta_1 t + \beta_2 t^2, t = 1, 2, \dots, n \quad (1)$$

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:

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

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.

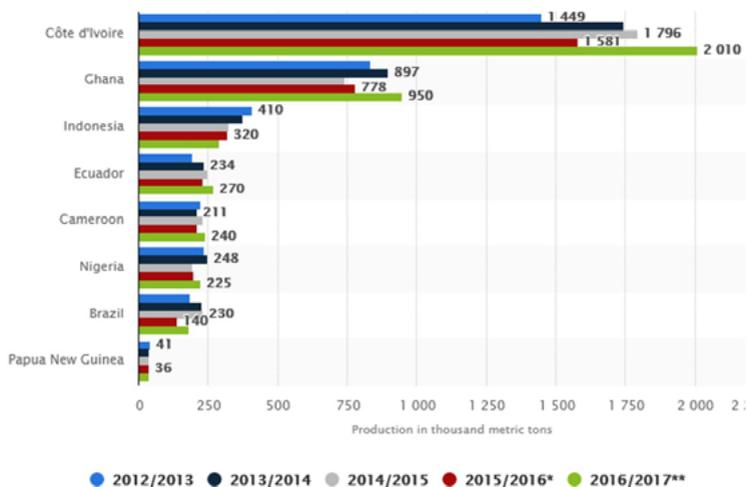
Production of cocoa in the world

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.

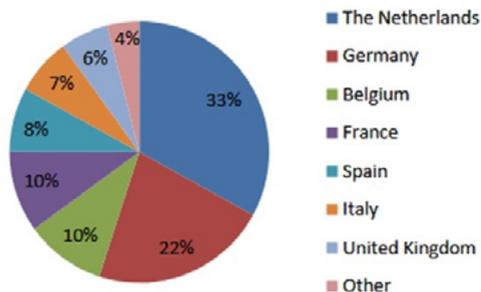
Africa is the largest producer of cocoa beans and accounted for 73% of global cocoa beans production where major production of cocoa beans comes from Ivory Coast and Ghana. Asia Pacific and Latin America are also plays an important role in the production of cocoa beans. Asia-Pacific accounts for 15% 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]

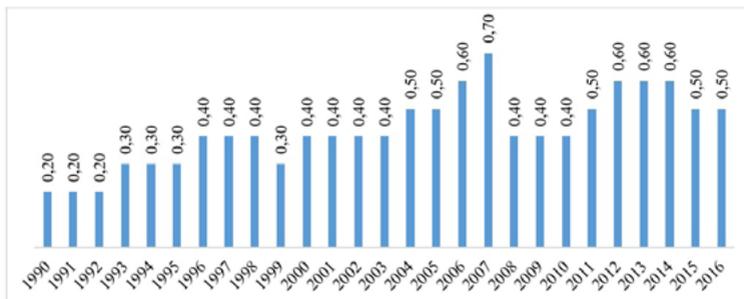
Graph 2 Grinding shares of European countries, 2016, in %



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 Trinitario¹ 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/inforesta/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: *The 13th 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/>.