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COMPARISON OF COST IN MINING COMPANIES IN SLOVAKIA

Katarína TEPLICKÁ

Abstract

Costs constitute the basic economic indicator that affects the business activities of mining companies. In this paper we analyze costs of mining companies in Slovakia. Cost optimization is a key factor of business in the mining company and the goal to successful growth and profit formation. The costs of the mining company are high and costs affect negatively corporate profit. The goal of this paper is to find out the development costs in the mining companies in Slovakia relative to the size of the business. We will use economic cost analysis in the mining companies through a chain index. The results of this economic analysis present a decreasing development of costs in the small and medium mining companies and increasing development of costs in large mining companies.

Keywords:

costs, profit, efficiency, trend, economic analysis

Introduction

The company which wants to be successful is focused on effectivity and flexibility of own activities and processes and their optimization (Serina, 2013). Cost management activities become part of the management tools that mining companies use to achieve economic efficiency and profit. The main idea of the cost management in companies is to direction, to evaluation and to improve of all processes. Costs create basic economic category. Costs are instrument of barriers to business, leading to bankruptcy or liquidation of business. Financial accounting is a system for evidence all costs of business. The main body of evidence is to prepare very effective system. Mann, Modrak, Grabara (2011) point out that the marginal costs are very important indicator for efficiency of production. Marginal costs are intimately connected with productivity optimum which is determined by the level of activity of the company where production achievement is done at the lowest medium cost, and both mathematical calculus and economic reasoning show that this optimum appears when medium cost is identical with marginal cost. It is very important mathematical formula for financial situation in companies.

Literature review

The new innovative method for accounting named targeting lean process improvement (Darlington, Francis, Found, Thomas, 2015). Cost management in many companies is not systematic and that is why the question of the introduction of cost controls as a tool for effective decision making, planning and cost management is very important and necessary (Šatanová, Potkány, 2004). Prosperity of the firms depends in present time mainly from the timely and proper

decision of management about way for obtaining of financial, raw material, material, technical and human sources, decision about work efficiency achieving for individual working places and employees in the production, about efficiency of firm's fixed capital using, about optimal management of stocking and sales, about localization of clients and transport, about environment of the firm (Šatanová, Závadský et.al., 2014). Cost management in the mining company and their impact on profit represents a measure of financial success business (Kassay, 2001). Process approach in cost management is the key of efficiency and productivity in business today. Very important method for managerial decision is activity based costing and using of this method is possible in cost management (Floreková, Teplická, 2001). Łęgowik - Świącik (2015) applied decision making process for chemical company with aim to present information flow in production by analysis of linear correlation and comparative analysis of cost information in production process. Kaizen cost management technique is very important instrument how to reduce and to control operational costs. Olabisi and col. studied relationship between Kaizen cost management technique and profitability of SMEs and the result of statistical test of hypothesis showed that there is a significant relationship between Kaizen cost management and profitability. (Olabisi Jayeola, A.O. Sokefun, B.O. Oginni, 2012). The other new instrument for cost reduction is method Activity Based Costing (ABC) that to support the business processes and to use accounting information - costs to optimise costs in the firm (Noerlina and A. Kharin , 2015).

Material and Methods

Monitoring of the costs can be made on the basis of different approaches. For evaluation of economic and statistical indicators we can use arithmetic mean and economical chain index (Petřík, 2005). Development of costs we follow through graphical methods. Arithmetic mean indicates the average value of expenses in the period in relation to the size of the mining companies. The average value of costs is monitored in relation to the size of the business to be able to see the difference in the cost of small, medium and large mining companies. Individual chain index informs of changes in the cost of two consecutive periods. Individual index follows the development of economic indicators and suggest ways to optimize costs in the mining company. Cost optimization is important in terms of generating profits and achieving efficiency in the mining company.

We implemented statistical indicators of costs in mining companies in Slovak republic. We classify companies - small, medium, large mining companies and cost management used in this companies, because costs are very important economical index for the competitiveness of the companies. We obtained information about costs in mining companies from statistical database SLOVSTAT and accounts register in Slovak republic.

Results and Discussion

We analyzed costs according to this classification. We summarized the costs for three years and we express arithmetic mean. We solved statistical indicators of costs in mining companies. Economic analysis in mining companies points out decrease and increase of costs. We used mathematical, statistical indicator – arithmetic mean for specification of cost changes in the mining companies for three years. Results of this economic analysis shows to decreasing of costs in small and medium mining companies but in large mining companies was recorded soft increasing of costs (tab.1). Decreasing of costs for mining companies is positive indicator for profit creation.

Table 1 Economic indicator in mining companies

Arithmetic mean	2012	2013	2014
small mining	2 059 119	1 882 716	1 808 618
medium mining	8 620 761	8 534 399	8 010 235
large mining	120164732	130505770	130554878

Source: SLOVSTAT

Continual decreasing of costs in mining companies is base in cost management. Monitoring and evaluation costs create one part of cost controlling and this part of cost controlling affords information for managerial decision. Costs are element of all activities in company and every process in company generates costs. Bain & Company has identified several factors that differentiate successful businesses from unsuccessful businesses in cost management. One of them is the respect of external market conditions when setting cost targets (Teplická, 2004). An international consulting firm Bain & Company based on its own survey identified four success factors that companies must comply with if they are to achieve sustainable is a necessity to take into account external market environment to define cost objectives - the actions of competitors, the price elasticity of the market, technological innovation.

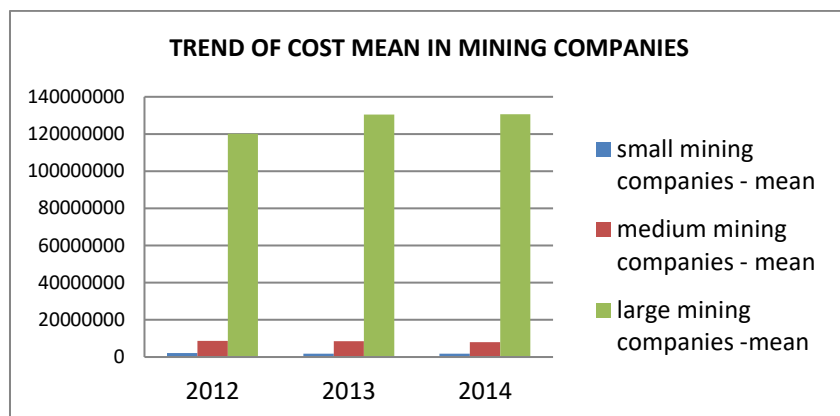


Figure 1 Trend of costs in mining companies

Source: SLOVSTAT

We analyzed chain index in economic analysis. Chain index under value 1 means cost decreasing and chain index over value 1 means cost increasing (tab.2, 3,4). In small mining companies is situation various. Some of mining companies minimalize chain index for example IKRA s.r.o., ŠTRKOPIESKY s.r.o. Batizovce. In those companies was expressive decreasing. In some companies chain index was increasing it means negative trend for costs. We have seen a reduction of difference between chain indexes in company for example DELTA STONE s.r.o., Sehring s.r.o. Bratislava. This trend is positive for cost management.

Table 2 Economic indicators- chain index in small companies

Company / costs(€)	I_{N(13/12)}	I_{N(14/13)}
Agro Matúškovo s.r.o.	0.91	1.19
Agro Rátka s. r. o.	0.94	0.96
Delta Stone s. r. o.	1.18	1.06
Gazda Slovakia s. r. o.	1.19	0.75
Chyžbet SK s. r. o.	0.69	1.20
Ikra s. r. o.	0.87	0.49
Is - Lom s. r. o.	0.75	1.32
Kabe s. r. o.	0.92	1.10
Kam-Bet s. r. o.	0.91	0.83
Kamenivo Slovakia a.s.	0.81	1.70
Company / costs(€)	I_{N(13/12)}	I_{N(14/13)}
K.L.K. s. r. o.	1.14	0.92
Lesostav Sever s. r. o.	0.99	0.78
Mhrč s. r. o.	0.58	0.89
Rekos s. r.o.	0.66	1.01
Sehring Bratislava s.r.o.	1.62	1.36
Stemp - M & G s. r. o.	0.90	0.80
Štrkopiesky Batizovce s.r.o.	0.83	0.48
Štrkopiesky Hrubá Borša s.r.o.	0.73	0.98
Vestkam s. r. o.	0.79	1.35
Zempra s.r.o.	0.72	0.75
Zemplínska Plavebná	1.27	0,70

Source: own

In medium mining companies is situation various. Some of mining companies expressive minimalize chain index for example Cestné stavby Žilina s.r.o., PREFA Sučany S.K. a.s., Mestský podnik Spišská Belá s.r.o.

Table 3 Economic indicators- chain index in medium companies

Company / COSTS (€)	I_{n(13/12)}	I_{n(14/13)}
Agrocoop Imeľ a.s.	1.02	1.05
Agrorent a. s.	0.97	1.05
Cestné stavby Žilina s.r.o.	1.08	0.43
D.a.L. s.r.o.	1.42	1.17
Intocast Slovakia a. s.	0.91	0.97
Mestský podnik Spišská Belá s.r.o.	1.00	0.58
PK Doprastav a.s.	0.86	0.99
Prefa-Stav s.r.o.	0.92	1.04
Company / COSTS (€)	I_{n(13/12)}	I_{n(14/13)}
Prefa Sučany a. s.	1.19	0.69
Vod-Eko a.s.	0.50	1.49
Zapa Beton s.r.o.	1.19	0.97

Source: own

In one large mining company Holcim a.s. chain index was increasing (1,43 – 1,00) it means negative trend for costs but reduction of difference between chain indexes was expressive and it means positive situation of cost management in this mining company.

Table 4 Economic indicators- chain index in large companies

Company / costs (€)	I_{n(13/12)}	I_{n(14/13)}
Holcim a. s.	1.43	1.00
Lesy SR š. p.	1.03	1.01
Vion a. s.	0.60	0.96

Source: own.

We obtained information that some of mining companies increased chain index very expressive in medium mining company VOD-EKO a.s. (0,5-1,49), in small mining company CHYŽBET SK s.r.o., (0,69-1,20), IS LOM s.r.o. (0,75-1,32), KAMENIVO SLOVAKIA a.s. (0,81-1,70), VESTKAM s.r.o. (0,79-1,35). Significant changes in costs may negatively affect for profit formation and for business activities in mining companies.

Key results

In conclusion we can say that the development of costs in the mining companies in relation to size of companies is positive, what may appear to the profit of mining companies and preparing cost budgeting for individual costs of companies for the future strategy. Cost budget can deliver cost reduction and saving of resource. Reducing of costs is one of the main ways to get a competitive advantage in the market. 40% of companies that are among the best in the

industry, cost leadership is considered a pillar of its competitive strategy. Bain & Company research shows that companies that have set measurable goals based on performance indicators achieved good results in cost reduction. Condition of performance indicators was to respect the competitive situation.

Table 5 Economic indicators – profit in mining companies

Mean of costs (€)	2012	2013	2014
small	2 059 119	1 882 716	1 808 618
medium	8 620 761	8 534 399	8 010 235
large	120 164 732	130 505 770	130 554 878
Mean of revenues (€)	2012	2013	2014
small	3 560 780	3 563 450	3 852 230
medium	9 653 785	9 763 652	9 156 456
large	350 620 456	265 236 254	258 654 320
Formation of profit (€)	2012	2013	2014
small	1 501 661	1 680 734	2 043 612
medium	1 033 024	1 229 253	1 146 221
large	230 455 724	134 730 484	128 099 442

Source: own

Influence on profit formation: The results of this economic analysis present a decreasing development of costs in the small and medium mining companies and increasing development of costs in large mining companies. We obtain influence of cost optimization to profit formation.

Profit (Fig.2) in small mining companies is increasing because costs in mining companies in period 2012-2014 are decreasing and it is positive progress. Profit in medium mining companies is increasing and in year 2014 is soft decreasing but results of economic situation is positive because mining companies to achieve profit. This influence to profit creates decreasing of revenues but costs are decreasing.

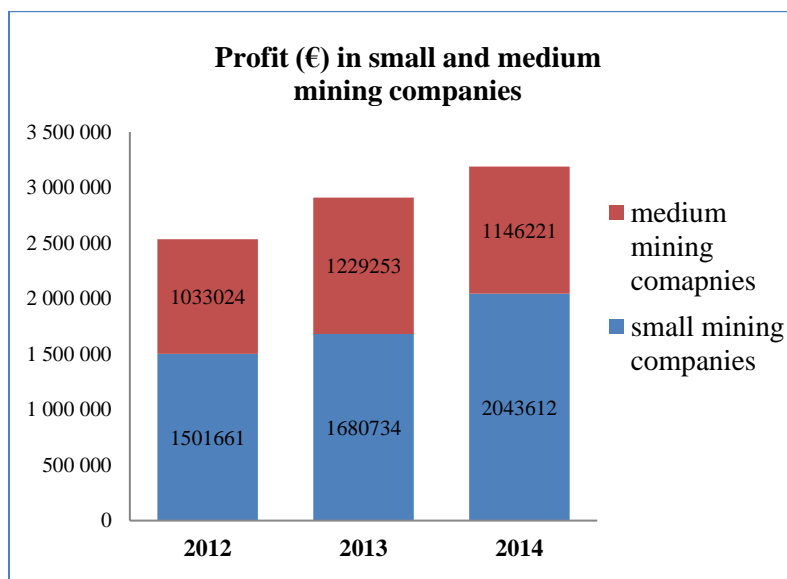


Figure 2 Trend of profit in small, medium mining companies

Source: own.

Profit (Fig.3) in large companies is decreasing. This influence to profit creates decreasing of revenues and increasing of costs. This financial situation is not acceptable for large mining companies. This situation decreases competitiveness.

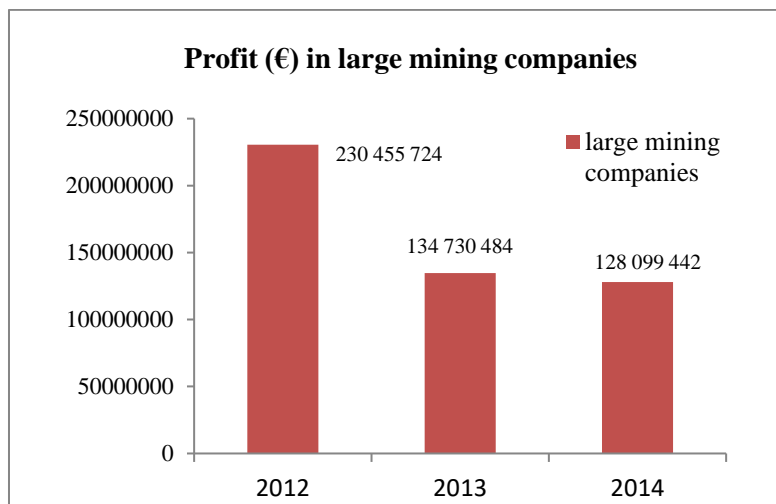


Figure 3 Trend of profit in large mining companies

Source: own

Conclusion

Continual improvement is one part of management. Improvement of business processes create base for costs decreasing. Awkward set up processes of more expensive products and lower corporate profits (Wagner, 2009). The current goal of mining companies is cost reduction. Traditional methods for costs reducing

such as saving material, energy, the reduction of the workforce, inventory is limited. It needs to look for a new methods and tools for reducing costs. One such method is to optimize the costs of the processes (Kassay, 2001).

Processes and activities that show significant inefficiencies must be optimized. Economical –mathematical model create base for cost optimization. The highest costs are incurred in production processes. These processes are priority in optimization and optimization solutions to deliver profitable growth. In mining companies are very important to use new methods of process optimization. Process optimization is connected with cost reduction in mining companies.

Cost controlling is a tool for the effective management of costs in mining companies. An important part of the data basis. Information on the costs needs to be linked with information from the financial accounting (Potkány, Hitka, 2015). Through controlling can successfully manage critical business processes and enable the enterprise as a whole to build a concept of permanent continuous improvement in the direction of reducing costs. Reduce costs in the future has to bring enterprise positive to eliminate the risk and prioritize economic effect.

A very important change in cost is the cost of innovation. Enterprises to innovate are reserved approach because innovations are very demanding on resources. Mistakes are part of upgraded and it is very important to reduce and eliminate errors which reduces the cost. Open innovation represent expense management a new approach for mining companies.

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ANALYSIS AND EVALUATION OF AIR POLLUTION LEVEL IN CZESTOCHOWA IN THE YEARS 2012-2015

Marcin ZAWADA – Marek SZAJT

Abstract

One of the key elements of environmental protection is taking care of air quality. This is a difficult task as the quality of air is influenced by numerous factors connected with man activity. Usually more developed economies have a stronger influence on the environment - including the level of pollution, at the same time they have at their disposal a number of tools that make it possible to stop emission of harmful substances. An important aspect in the struggle with air pollution in a given area is constant monitoring of its quality. In the paper the author present basic law regulations (both at the level of the EU as well as the national one) that regulate the system for evaluating and managing air quality. The system of air control in Poland has been characterized in it as well as the state of air pollution in the area of Czestochowa. The author has also conducted a statistical and econometric analysis of basic parameters of air pollution in this city, which has been done with the use of calculations of basic descriptive statistics and estimating the fluctuation model parameters in time.

Keywords:

air pollution, environment monitoring, city of Czestochowa, time series analysis, descriptive statistics

Introduction

Analysis and Evaluation of Air Pollution Level in Czestochowa in the years 2012-2015

In the course of the previous century tremendous changes occurred in the economy, and what follows in the natural environment. Basically, a few dozen years have been enough for human beings to cause that the world ecosystem has been deregulated. Greenhouse effect, ozone hole, acid rains, deforestation, electromagnetic smog, these are only a part of contemporary environmental threats that result from the man's manufacturing activity. Growing level of atmosphere pollution caused by development of industry, transport, fossil fuels mining and concentration of human dwelling places on small urban areas have a negative impact on natural environment, people and objects (Mesjasz 2014).

According to the 2015 report of the European Environment Agency (Air 2015), Poland belongs to the group of countries where the air is most polluted. The biggest share in the air pollution has low emission, in this toxic dusts in particular. Although air quality in Poland has improved systematically, some serious problems still occur: in the summer - too high concentration of tropospheric ozone, and in the winter - exceeding the norm concentration of PM 10 particulate matter and benzo(a)pyrene. Unfortunately the prognosis for Poland is very pessimistic. It shows that Poland is going to remain one of the most polluted countries of the EU, if we do not start actively fight this problem.

Air quality management and evaluation systems at the EU level are regulated by:

The Directive of the European Parliament and the Council 2004/107/WE of 15 December 2004 on arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in the air (O. J. EU L 23 of 26.01.2005, p. 3);

The Directive of the European Parliament and the Council 2008/50/WE of 21 May 2008 on air quality and cleaner air for Europe (O. J. EU L 152 of 11.06.2008, p. 1) (so called CAFE directive);

The Council Implementing Decision 2011/850/WE of 12 December 2011 setting the rules for the use of directives 2004/107/WE i 2008/50/WE of the European Parliament and the Council with regard to a system of information and reports exchange on the air quality (O. J. L 335 of 17.12.2011, p. 86 - 106).

The abovementioned regulations of the EU law were transposed to the national law by the provisions of the law of 27 April 2001 - Environmental Protection Law (Journal of Laws of 2013, pos. 1232, with future amendments), and the law of 3 October 2008 on making available information on the environment and its protection, participation of the society in environment protection and evaluations of environmental impact (Journal of Laws of 2013, pos. 1235 with future amendments).

Apart from the regulations of statutory ranking, issues of air pollution are regulated by the regulations of the Minister of the Environment:

of 24 August 2012 on levels of certain substances in the air (Journal of Laws of 2012, pos. 1031);

of 13 September 2012 on conducting evaluations of levels of substances in the air (Journal of Laws of 2012, pos. 1032);

of 2 August 2012 on zones where air quality evaluation is conducted (Journal of Laws of 2012, pos. 914);

of 11 September 2012 on programmes of air protection and short-term actions plans (Journal of Laws of 2012, pos. 1028);

of 10 September 2012 on the scope and way of transferring information concerning air pollution (Journal of Laws of 2012, pos. 1034);

of 14 August 2012 on national goal of exposure reduction (Journal of Laws of 2012, pos. 1030);

of 13 September 2013 on the way the indexes of average exposure are calculated and how to evaluate if the exposure concentration ceiling is maintained (Journal of Laws of 2012, pos. 1029).

In Poland, similarly to other member states of the EU a system of air quality control and evaluation is present. It is based on measurements conducted within the national monitoring network.

Air pollution control system in Poland

Considering the structure of national sources of gas and dust substances emission into the atmosphere, when preparing collective reports of air quality evaluation in Poland, as a rule the division of pollutants into the following groups is applied:

- basic pollutants: sulphur dioxide, nitrogen dioxide and dust, are created mainly at fuel combustion processes of energy production and occur commonly in the territory of the whole country;
- specific pollutants, come from various technological processes used in industrial plants;
- pollutants emitted from mobile sources, mainly motor vehicles;
- secondary pollutants, frequently created far from the emission sources as an effect of reactions and changes taking place in the polluted atmosphere, e.g. oxidants (photochemical oxidants), such as ozone, or the ones that contribute to acidification of the environment, such as sulphates and nitrates.

Basic pollutants emission sources are mainly emitters of industrial and utility power plants (so called high emission), but also the municipal and household sector" local boiler rooms, service providers and households (so called low emission). Research conducted in the territory of Poland show that concentrations of main air pollutants: sulphur dioxide, nitrogen dioxide and dust in recent years have been systematically decreasing.

Social and economic changes that have been occurring in Poland in the recent years have been accompanied by equally dynamic growth of number of vehicles on the roads of our country. However, such a rapid development of automotive industry is not accompanied by equally fast development of road networks and equally efficient and anticipating actions that make traffic organization more effective. The growing concentration of traffic, particularly visible in large agglomerations more and more often causes traffic jams and as a result an increase in emission of transport pollutants (mainly coal oxide, nitrogen oxides, hydrocarbons, lead compounds and soot). Increased concentration of air pollutants (e.g. nitrogen oxides) is recorded particularly on arterial roads, in particular in places where local conditions of street architecture do not allow the pollution to spread quickly, e.g. in the regions of compact built-up structure.

Photochemical oxidants are a group of pollutants that are created as a result of chemical reactions that take place under the influence of sun radiation in the air polluted with nitrogen oxides and hydrocarbons. The main compound of this group is ozone. The results of previous research justify the statement that the air in Poland is polluted with ozone precursors at the such a high level that if meteorological conditions are favourable then in large areas of the country the concentrations of ozone are high, exceeding the maximum valid ones in Poland and so called health and plants protection thresholds specified in the EU law (*Zanieczyszczenie powietrza w Polsce*).

Conducting annual evaluation of air quality in the zones is a duty resulting from the law - Environment Protection Law of 27 April 2001 with future amendments, Journal of Laws 2001 nr 62 pos. 627 (Prawo). According to art. 89 of this law regional inspector for environment protection each year conducts an evaluation of substance levels in the air in the given zone for the previous year, and then classifies zones, separately for each substance, in accordance with defined criteria. Results of evaluation for each voivodship are delivered to the management of the voivodship and the Chief Inspector for Environmental protection, who on this basis conducts a collective evaluation of air quality in the country and then passes it in the form of a report to the European Commission.

In the air quality evaluation conducted with regard to compliance with criteria specified in order to protect human health there are 12 substances distinguished (Ocena jakości):

- sulphur dioxide SO₂,
- nitrogen dioxide NO₂,
- carbon oxide CO,
- benzene C₆H₆,
- ozone O₃,
- dust PM₁₀,
- lead Pb in PM₁₀,
- arsenic As in PM₁₀,
- cadmium Cd in PM₁₀,
- nickel Ni in PM₁₀,
- benzo(a)pyrene B(a)P in dust PM₁₀,
- dust PM_{2,5}.

Annual evaluations of air quality comprise territorially the area of the zone. In accordance with art. 87 of the law - The Law on Environmental Protection, currently for pollutants included in the evaluations a zone in Poland constitute:

- an agglomeration with the population of over 250 thousand,
- a city with the population of over 100 thousand,
- a city (not being an agglomeration) with the population of over 100 thousand,
- the rest of the voivodship, not being a part of an agglomeration and cities with the population of over 100 thousand.

In accordance with the valid division, in Poland there are currently 46 zones (Table 1). For sulphur dioxide (SO₂), nitrogen dioxide (NO₂), carbon oxide (CO), benzene (C₆H₆), dust PM₁₀, dust PM_{2,5} and lead (Pb) in dust PM₁₀ maximum levels have been specified understood as air quality standards. Table 2 includes information on maximum level of air pollution with regard to human health protection.

Table 1 Number of zones in particular voivodships in Poland in 2014, for which the annual evaluation of air quality is conducted with regard to the criteria established in order to protect health.

Voivodship	Total number of zones in the voivodship	Number of zones in agglomeration	Number of zones - cities with the population of over 100 thousand.
dolnośląskie	4	1	2
kujawsko-pomorskie	4	1	2
lubelskie	2	1	0
lubuskie	3	0	2
łódzkie	2	1	0
małopolskie	3	1	1
mazowieckie	4	1	2
opolskie	2	0	1
podkarpackie	2	0	1
podlaskie	2	1	0
pomorskie	2	1	0
śląskie	5	2	2
świętokrzyskie	2	0	1
warmińsko-mazurskie	3	0	2
wielkopolskie	3	1	1
zachodniopomorskie	3	1	1
Total	46	12	18

Source: Ocena jakości, p. 13

According to the report Air quality evaluation the maximum level of PM₁₀ was exceeded in 42 out of 46 zones in the country, and in 22 zones maximum level enlarged by the tolerance margin of PM_{2,5} dust was exceeded,. Moreover, lack of compliance with the maximum level of nitrogen dioxide in 4 zones was recorded.

Table 2 Maximum pollution levels in the air with regard to human health protection.

Substance name	Period of measurement results	Maximum level µg/m ³
Nitrogen dioxide (NO₂)	1 hour	200
	calendar year	40
Sulphur dioxide (SO₂)	1 hour	350
	24 hours	125
Carbon oxide (CO)	8 hours	10 000
Benzene (C₆H₆)	calendar year	5
Dust PM₁₀	24 hours	50
	calendar year	40
Dust PM_{2,5}	calendar year	25
Lead (Pb)	calendar year	0,5

Source: own elaboration on the basis of Air quality evaluation

Characteristics of Czestochowa

The city of Czestochowa is situated in southern Poland, in the northern part of Śląskie Voivodship between 19°01'02'' – 19°14'16'' eastern longitude and 50°44'08'' – 50°53'11'' northern latitude, neighbouring with the Czestochowa District. The zone of Czestochowa city with the area of about 160 km², is dwelled by 245 thousand people. The city is compact and has a regular shape with a centrally located downtown district of high intensity of development. It borders two municipalities: Blachownia and Kłobuck and seven rural communes: Mykanów, Rędziny, Mstów, Olsztyn, Poczesna, Konopiska and Wręczyca Wielka.

The average population density is 1506 citizens per km². This is the 12th city in Poland with regard to occupied area and 15th with regard to population size. Third largest river in Poland - Warta - flows through the city.

A number of national roads lead through Czestochowa, which enables good car communication with largest Polish cities. These roads include:

1E75 Gdańsk – Toruń – Łódź – Piotrków Trybunalski – Częstochowa – Dąbrowa Górnicza – Tychy – Bielsko-Biała

43 Częstochowa – Kłobuck - Krzepice – Wieluń

46 Szczekociny – Częstochowa – Lubliniec – Opole – Nysa – Kłodzko

91 Częstochowa – Radomsko – Piotrków Trybunalski

The network complements provincial roads:

483 Częstochowa – Łask

491 Częstochowa – Działoszyn – (Wieluń)

494 Częstochowa – Olesno – DK45

786 Częstochowa – Kielce

908 Częstochowa – Bytom

In the future A1 motorway will lead through the northern and western outskirts of the city. It will create the western motorway ring road of Czestochowa. Czestochowa, like the whole of Poland, is situated in a moderate climatic zone. Sunshine here is relatively low. On average it amounts 4 hours of direct solar radiation per day. In the annual run the largest sunshine can be observed in June, due to the length of the day. In Czestochowa in this month it is 212 hours, that is on average about 7 hours per day. The lowest daily sums of sunshine can be observed in December, when days are shortest. It amounts less than 1 hour (about 50 minutes) per day. In connection with general atmospheric circulation there are few windless days in Czestochowa. The periods of calm in a yearly perspective constitute on average 9.2%. Western winds are dominant here - 18% and south-west ones – 18.2%. They also reach highest speeds – 2.2 m/s. The rarest ones are northern winds – 7.7% and north-east ones – 7.4%. With regard to the location of industrial sources of air pollution winds which are favorable to the city include the ones from the west and north-west. Average annual air temperatures in Czestochowa are about 8.1°C (Program).

Air pollution condition in the city of Czestochowa

Since 2004 the delegation of the Voivodship Inspectorate for Environmental Protection in Czestochowa has conducted monitoring of atmospheric air in two automatic measurement stations. One of them is situated at the crossroads of Armii Krajowej Avenue and Jana Pawła II Avenue, and the second one in "Północ" district in Baczyńskiego Street. The measurement programme is compliant with valid in this respect directives of the EU. The stations measure continuously the level of such substances as: PM₁₀ particulate dust (since 2014), sulphur dioxide, nitrogen oxides, carbon oxide. Measurement results are available on the Internet on the website of the Voivodship Inspectorate for Environmental Protection in Katowice, and since 2004 the measurements from the first station are additionally displayed on the board located near the Inspectorate.

Measurements from the years 2012-2015 (monthly data) for the station *Armii Krajowej Avenue 3* are presented in Figure 1, basic descriptive statistics have been included in Table 3. In the analyzed period only nitrogen dioxide exceeded the norm established at 40 µg/m³ (in March and April 2012). The analyzed measurement station is located at the intersection of main transit roads, which explains high concentration of this compound.

The highest levels of pollution (in absolute terms expressed in µg/m³) can be observed in case of CO, the lowest ones in case of SO₂ measurements. SO₂ is characterized by the highest differentiation of measurements, and NO₂ by the lowest.

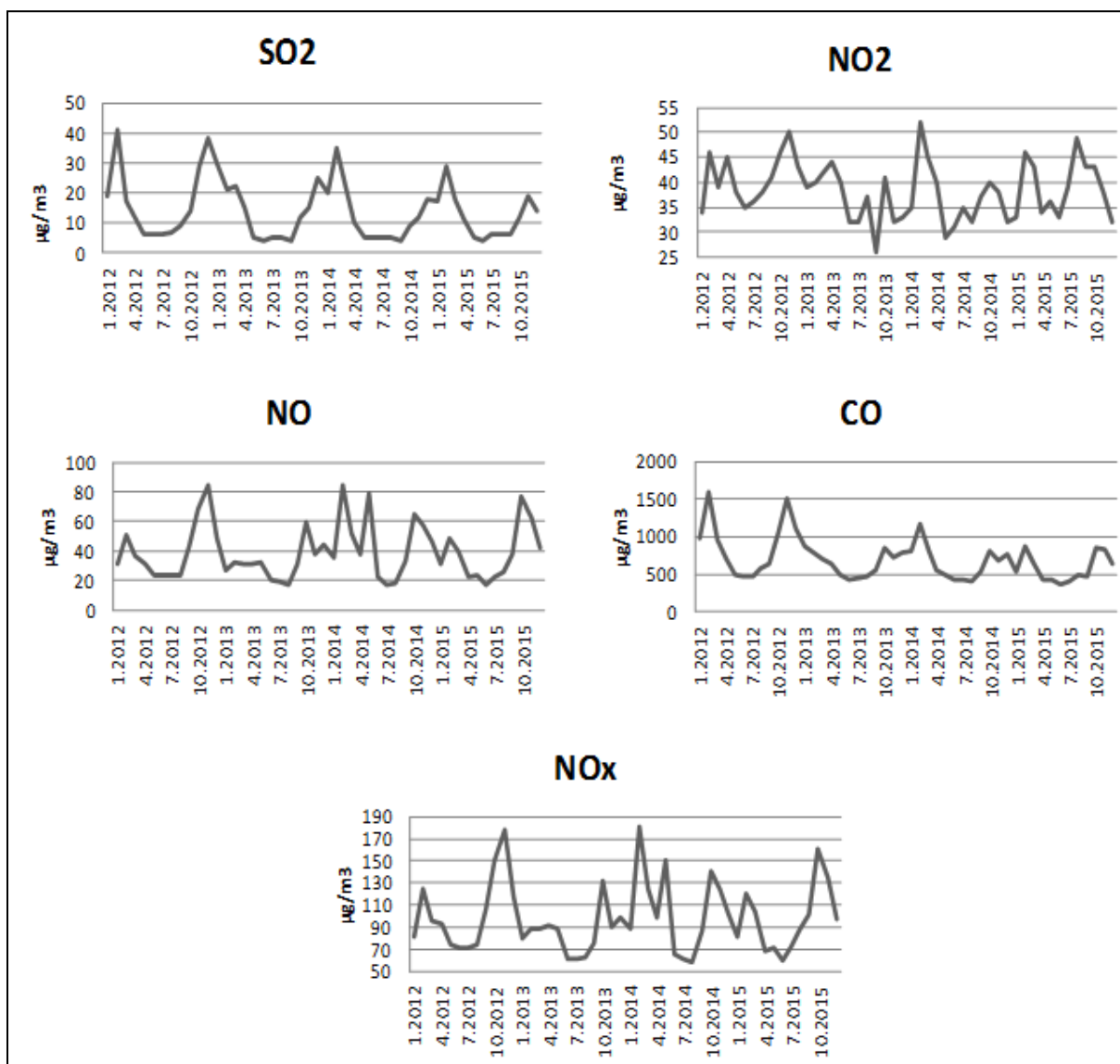


Figure 1 Air pollution level in the years 2012-2015 for the station Armii Krajowej Avenue 3 located in Czestochowa.

Source:

Table 3 Basic descriptive statistics of air pollution in the years 2012-2015 (monthly data) for the city of Czestochowa

Variables	Min	Max	Average	Median	Standard deviation	coefficient of variation	skewness	kurtosis
SO ₂	4.00	41.00	13.83	12.00	9.739	0.704	1.061	0.389
NO	17.00	84.00	38.917	32.50	18.478	0.475	0.971	0.087
NO ₂	26.00	52.00	38.417	38.00	5.772	0.150	0.25	-0.456
CO	363.00	1600.0	688.77	635.00	274.82	0.399	1.376	2.067
NO _x	58.00	181.00	97.958	89.50	31.291	0.319	0.949	0.233

Source: own calculations on the basis of <http://monitoring.katowice.wios.gov.pl/>

Distribution of each of the variables is characterized by right skewness, that means that records lower than the average value are dominant. The largest skewness occurs in case of CO, the smallest in case of NO₂. Kurtosis coefficient values - apart from NO₂ - prove concentration of the measurements around the average.

The SO₂ and CO concentration in the air in the analyzed period systematically drops, cyclicity connected with the season of the year (seasonality) can be clearly observed. In the winter period, particularly in the coldest months of the year, a significant growth of sulphur dioxide takes place. Its average concentration in the winter period (from October till March) are even 5 times higher than in the summer period (from April to September). Particularly big differences can be observed in the years when winters are severe. Such big growths of pollutant concentrations in the heating period, particularly in the area of housing development, indicate a strong influence of so called low emission from the municipal and household sector. Nitrogen dioxide concentrations show smaller seasonal differences. In the winter season its concentration is on average higher by 40-70% than in the warm period. The increase in the emission of nitrogen oxides which are created while burning fuels for heating purposes is probably eliminated by lower emission from mobile sources (smaller volume of traffic in the winter period). The social and economic changes in Poland in the recent years have been accompanied by equally dynamic growth in the number of cars on our roads. However, such a rapid development of automotive industry is not accompanied by equally dynamic development of the road network as well as effective and anticipating actions that make traffic organization more efficient. Constant growth of traffic volume particularly visible in big agglomerations (including Czystochowa), causes the situation when more and more often traffic jams occur and as a result the emission of transport pollution grows. It should be stressed that pollution emitted by vehicles not only directly worsen the quality of air in the areas where traffic is intense, but it also participate in photochemical reactions that take place in the atmosphere and have an influence on the growth of ozone concentration in the tropospheric layer.

Econometric analysis

Strong dependencies can be observed among substances that pollute the air, which is often indicated in scientific papers (e.g. Yoo 2014, Sabetghadam 2014, Xie 2015). The values of Pearson correlation coefficients among the analyzed figures are presented in Table 4. All the values turned out to be statistically relevant (critical value 0.2845). Majority of measurements are moderately correlated. A strong dependence occurs between CO and SO₂, a very strong dependence occurs between NO_x and NO.

Table 4 Correlation coefficients among different pollutants

	SO ₂	NO	NO ₂	CO	NO _x
SO ₂		.477	.501	.849	.519
NO			.457	.674	.986
NO ₂				.564	.594
CO					.710
NO _x					

Source: own calculations

The levels of pollutant concentration in the air result directly from the volume of pollution emission to the atmosphere, but they also depend on meteorological conditions: temperature, wind speed, humidity (e.g. Ocak 2008, De Sario 2013). Because of access to information only on the air temperature in Czesochowa for the analyzed period of 2012-2015, measurement results of pollutant concentration have been standardized by dividing real readings by the average temperature value for the given month. The values of temperature measurements have been increased by 10 °C due to negative values occurrence. The level and differentiation of pollutant concentrations after the standardization have been presented in Figure 2.

The values of correlation coefficients calculated among particular analyzed variables have also changed after the standardization (Table 5). A strong dependence can be observed among all standardized variables.

Table 5 Correlation coefficients among different pollutants after considering standardization in relation to temperature

	SO ₂	NO	NO ₂	CO	NO _x
SO ₂		.892	.981	.975	.945
NO			.898	.910	.988
NO ₂				.964	.956
CO					.952
NO _x					

Source: own calculations

A lot of phenomena, the changes of which can be observed in time, are characterized by seasonability, that is regularly repeated deviations from the general direction of development. Seasonal fluctuations that are the results of nature-based influences can be observed easily. It is equally easy to observe regular deviations with shorter cycles, monthly, weekly or daily ones, which result from economic, social and organizational reasons. The possibility of observing and measuring the changes occurring in time makes it possible, on the one hand to indicate the reasons that shape a given phenomenon and measure their impact, on the other hand to use this information to forecast future values of this phenomenon. Very often such a situation happens while analyzing air pollution levels (e.g. Kim 2010, Tchepel 2010).

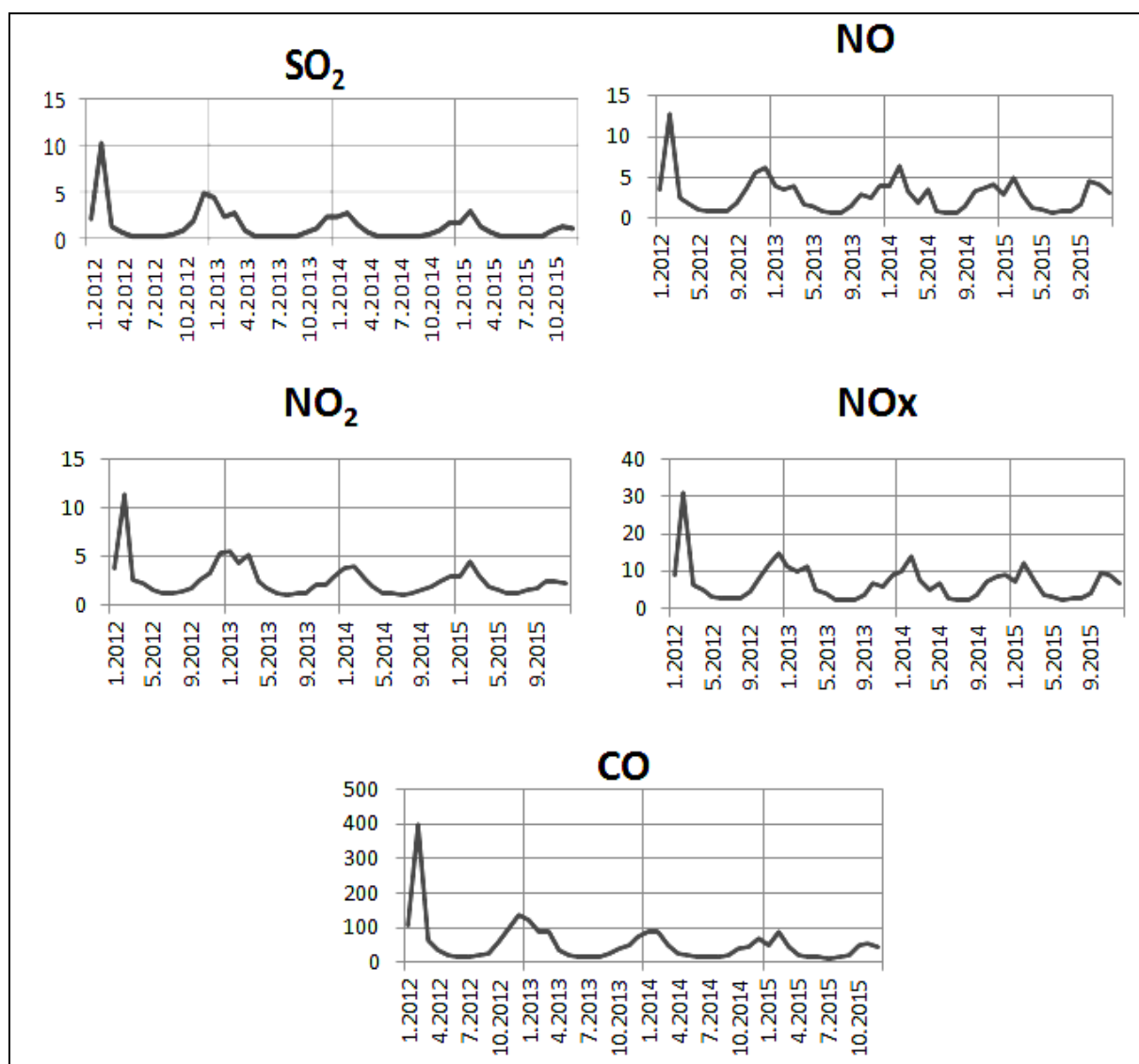


Figure 2 Air pollution level in the years 2012-2015 for the station Armii Krajowej Avenue 3 located in Czestochowa after considering standardization in relation to temperature

Source:

While analyzing the graphic presentation of the air pollution level in the years 2012-2015 (*Figure 2.*) after considering standardization in relation to temperature one can clearly observe the occurrence of seasonal fluctuations and the downward trend. In order to confirm these observations parameters of the following econometric model have been estimated with the classic method of smallest squares considering the trend and seasonal fluctuations for other five types of pollutants (Kufel 2016):

$$\hat{Y} = \alpha_0 + \alpha_1 t + \sum_{i=1}^{m-1} d_i Q_{it} + \varepsilon_t$$

where:

Y – analyzed variable (SO₂, CO, NO, NO₂, NO_x)

α_0 – free word

α_1 – parameter present at the time variable

t - time variable considering downward tendency (trend)

d_i – parameters present at seasonal fluctuations

Q_{it} – seasonal variable

ε_t – random component

m – number of sub-periods in the cycle, for monthly data =12

Estimation results (Table 6) confirm the relevance of the parameters present at the time variable, and the occurrence of a downward trend. Seasonal fluctuation evaluations have also proved relevant, confirming their occurrence in the level of all analyzed air pollutants.

Table 6 Dynamic models estimations considering seasonal fluctuations for basic air pollution sources in Czestochowa in the years 2012-2015

Parameter	SO ₂		NO		NO ₂		CO		NO _x	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
α_0	3.291	0.000	4.993	0.000	4.199	0.000	3.291	0.000	4.993	0.000
α_1	-0.029	0.031	-0.022	0.133	-0.027	0.039	-0.029	0.031	-0.022	0.133
d1	-0.195	0.823	-1.041	0.287	0.371	0.659	-0.195	0.823	-1.041	0.287
d2	1.837	0.041	2.367	0.019	2.475	0.005	1.837	0.041	2.367	0.019
d3	-1.042	0.235	-1.415	0.149	-0.201	0.810	-1.042	0.235	-1.415	0.149
d4	2.004	0.026	-2.886	0.005	-1.432	0.093	2.004	0.026	-2.886	0.005
d5	-2.396	0.009	-2.786	0.006	-2.059	0.018	-2.396	0.009	-2.786	0.006
d6	-2.409	0.008	-3.669	0.000	-2.306	0.009	-2.409	0.008	-3.669	0.000
d7	-2.374	0.009	-3.742	0.000	-2.324	0.008	-2.374	0.009	-3.742	0.000
d8	-2.331	0.010	-3.679	0.000	-2.151	0.013	-2.331	0.010	-3.679	0.000
d9	-2.256	0.012	-2.836	0.005	-1.903	0.027	-2.256	0.012	-2.836	0.005
d10	-1.839	0.039	-0.744	0.439	-1.163	0.167	-1.839	0.039	-0.744	0.439
d11	-1.194	0.171	-0.316	0.742	-0.786	0.347	-1.194	0.171	-0.316	0.742
Adjusted R ²	0.506		0.619		0.572		0.447		0.614	
DW	2.27		2.09		2.28		2.02		2.23	
ρ_1	-0.157		-0.055		-0.153		-0.011		-0.125	
AIC	165.301		175.421		161.725		512.472		255.634	

Source: own calculations

Conclusions

On the basis of the conducted in the present paper analysis and the evaluation of the air pollution condition in Czestochowa in the years 2012-2015 as well as the characteristics of the air control system in Poland the following conclusions can be formulated:

- Poland has become included into the group of countries where air is most polluted,
- in Poland, similarly to other member states of the EU, there is a functioning system for air quality evaluation and control based on measurements carried out within the national monitoring network,
- in the air quality evaluation conducted in relation to compliance with the criteria determined so as to protect human health twelve substances are distinguished:

sulphur dioxide SO₂, nitrogen dioxide NO₂, carbon oxide CO, benzene C₆H₆, ozone O₃, dust PM₁₀, lead Pb in PM₁₀, arsenic As in PM₁₀, cadmium Cd in PM₁₀, nickel Ni in PM₁₀, benzo(a)pyrene B(a)P in dust PM₁₀, dust PM_{2,5}.

- the largest share in air pollution belongs to low emission, in this toxic dusts in particular,

- the city of Czestochowa located in the south of Poland, in the north of Śląskie Voivodship carries out atmospheric air monitoring in its territory in two automatic stations considering SO₂, CO, NO, NO₂, NO_x and since 2014 PM₁₀,

- The highest levels of pollution (in absolute terms expressed in µg/m³) can be observed in case of CO, the lowest ones in case of SO₂ measurements. SO₂ is characterized by the highest differentiation of measurements, and NO₂ by the lowest,

- concentrations of all analyzed air pollutants systematically decrease and do not exceed maximum norms,

- a moderate or strong interdependence occurs among analyzed amounts of pollutants,

- concentration levels of pollutants in the air result directly from the emission size of pollutants into the atmosphere, but also meteorological conditions,

- after standardization of analyzed amounts in relation to the air temperature a downward tendency in their levels has been distinguished as well as clear (statistically significant) seasonal fluctuations,

- in case of PM₁₀ due to small number of observations the substance of this type has not been included into the analysis. Values of this factor are particularly worrying for officials and citizens of cities, due to obtained high concentrations and vital impact on human health and life.

The conducted analyses and obtained results should be used to create a forecast of pollution emission considering the division into the summer and winter season and including weather factors in this forecast. Such a forecast will make it possible to develop a proper strategy of city development and take actions to limit the level of air pollutants emission, particularly the ones emitted by vehicles.

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FOREX PREDICTION USING NEURAL NETWORKS

Michal TKÁČ – Pavel BLAŠČÁK

Abstract

Due to enormous changes over the last decades within the financial markets, traditional financial market theory has evolved. This work examines artificial neural networks as a method suitable for financial forecasting. Neural networks emulate the behavior of human brain. They are sets of interconnected input and output units where every link has an associated weight. The network learns by adjusting the weights to be able to accurately predict the output target of a given variety of input samples, such as exchange rates.

This paper focuses on neural networks, regarding their ability to discover nonlinear relationships in chaotic systems, as a potential method to overcome traditional financial analyses and predictions. It examines how neural networks work, emphasizes differences between various types of neural networks and applies neural network to predict exchange rates. Our results indicate that neural networks are able to estimate future movements of EUR/USD rate and they have potential for further analysis.

Keywords:

exchange rates, forex, neural networks, prediction

Introduction

Since the Efficient Markets Hypothesis was introduced, there have occurred many opinions disputing it or at least its assumptions. According to EMH there is no possibility of predicting the market moves and the best strategy is to “buy and hold”. The debate about strict validity of EHM still persists and some researchers tried to examine neural networks to support their statements. Neural networks are used to forecast prices, because these researchers claim that markets exhibit chaos as “nonlinear deterministic process which only appears random because it can not be easily expressed” (Lawrence 1997).

Haykin (2004) describes neural network as “a massively parallel distributed processor that has a natural propensity for storing experiential knowledge and making it available for use”. Before the evolution of computers science, people traded and dealt with uncertainty relying on intuition. With the growing level of transactions and investments, there had to be found some new methods that could raise their profits and at the same diminish the risk. One of the often used contemporary tools is called Artificial Neural Networks (ANN). ANNs are computational structures with learning and generalization capacity. They employ a distributive technique to store knowledge acquired by learning with known samples and are used for pattern classification, prediction and analysis (Shapiro 2003). In fact, they are software programs imitating biological operations of the human brain.

Research on ANNs has been done on the global level. Since late 1980's Japanese corporations have been developing products based on ANNs, such as Sharp Corporation's optical character reading of printed Japanese program or

Nippon Steel's casting breakthrough prediction program (Shandle 1993). According to Tan (1999), the four distinct areas of research in ANNs are:

- Modeling biological networks in order to gain understanding of the human brain and its functions. This is area of interest to researchers in neurology;
- Using ANN as an educational tool to gain understanding on how to solve complex tasks that traditional Artificial Intelligence methodologies and computer algorithms have had difficulty solving. This is area of interest to computer scientist and engineers;
- Solving real world-types of problems in various commercial applications. There are many of ANN software packages that are user-friendly enough for new users to start using them without any in depth knowledge of the ANN algorithms;
- Improving ANN algorithms. Researchers in this area construct better ANN algorithms that can learn quicker or model more efficiently.

Zahedi (1993) argues that, Artificial Neural Networks offer qualitative methods for business and economic systems that traditional quantitative tool in statistics and econometrics cannot quantify due to the complexity in translating the systems into precise mathematical functions.

Potential financial applications that could be improved with the adaptation to ANN technology were stated by Hsieh (1993):

- Financial Simulation
- Predicting Investor's Behavior
- Evaluation
- Credit Approval
- Security and/or Asset Portfolio Management
- Pricing Initial Public Offerings
- Determining Optimal Capital Structure

In the area of market predictions Chiang et. al. (1996) used a feed-forward neural network with back propagation to forecast net asset values of mutual funds. Comparing results with those obtained with traditional econometric techniques, they showed that when limited data is available, neural networks considerably overrun regression models. Kamruzzmann et al. (2006) claim that among main applications of neural networks in finance belong bankruptcy prediction, portfolio optimization and exchange rate forecasting. Yao & Tan (2000) developed a neural network model using six simple indicators in order to predict the exchange rate of six different currencies against the U.S. dollar. Their network significantly outperformed the ARIMA-based benchmark. To predict forex Kamruzzaman and Sarker (2003) applied three different network learning algorithms and observed that all of them performed better than conventional techniques.

Methodology

Artificial Neural Network models were inspired by biological sciences studying how anatomy of living animals flow into solving problems. But due to enormous complexity of biological networks, the similarity is limited to some borrowed ideas from biological networks, mostly for their architecture. Existing computers process information in a serial manner while ANNs and human brain in parallel. That is why despite the fact that the human brain operates much about million times slower than computer logic, a human brain can still perform pattern recognition task much faster and much more efficiently than the fastest computers. Basic structure of an ANN consists of artificial neurons, which are similar to biological.

Individual artificial neuron receives input from other sources or output signal of other units and produces an output as shown in Figure 1. The input signals x_j are multiplied with weights w_{ji} of connection strength between the sending unit i and receiving unit j . The sum of weighted inputs is passed through an activation function. The output might be used as an input to the neighboring units or units at the next layer. The net input to the unit j is given by:

$$net_j = \sum_n w_{jn}x_n + w_{j0}$$

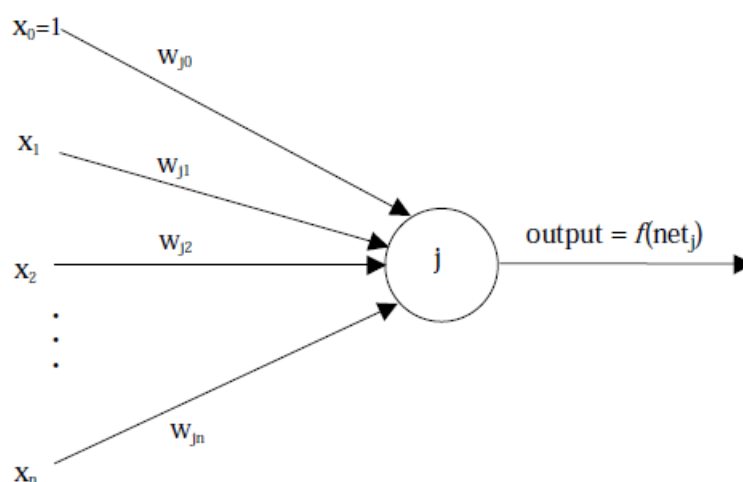


Figure 1 An Artificial Neuron

Source: Own processing.

The computed weighted sum of inputs is transformed into an output value by applying an activation function. In majority of cases, the activation function maps the net input between -1 and 1 or 0 and 1. The most common transfer functions used in present ANN models are due to ease of computing their derivative sigmoid functions, i.e. continuous, real-valued function whose domain is the reals, whose derivative is always positive, and whose range is bounded (Masters 1993).

Neural network architecture represents a configuration indicating how the units are grouped together as well as the interconnections among them. There are many various architecture types to be found in the literature, but majority of them can be divided into two main categories: feedforward and feedback. These architecture types are shown in Figure 2.

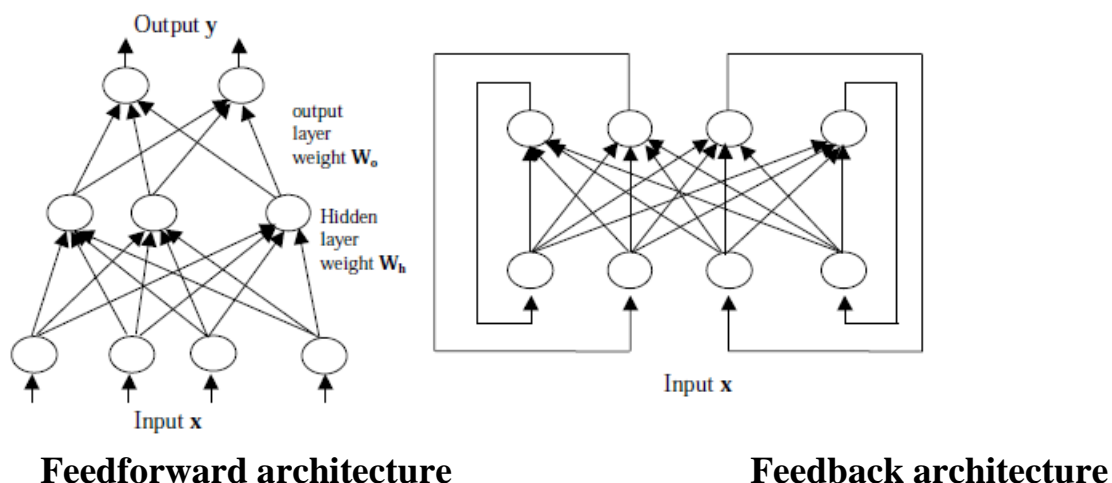


Figure 2 Architecture types

Source: Own processing.

In feed-forward architecture, the signal of information proceeds towards the forward direction while in feedback architecture the final outputs are again fed back at the input layer. The first layer is called input layer, the last one as output layer, and any intermediate layer as hidden layer. The number of units at the input and output layer is set by the particular issue. However, the numbers of hidden layers and the units in each layer might vary. There is no general rule for designing the configuration of a neural network, but a network with fewer than the required number of hidden units will be unable to learn the input-output mapping, whereas too many hidden units poorly of any unseen data (Kamruzzmann et al. 2006).

Supervised learning is the most common type of ANNs learning. Network Attempts to compute desired output from the set of given inputs of each sample by minimizing the error of the model output to the demanded output. It tries to do this by continuously adjusting the weights of its connection through an iterative learning process called training (Tan 1999). On the other hand unsupervised learning does not require any explicit output values for training. Each of the sample inputs to the network is assumed to belong to a distinct class. Hence, the process of training consists of letting the network uncover these classes. The purpose of the network is to emulate the understanding of how the brain uses spatial mappings to model complex data structures. One of the most common unsupervised neural networks is the Kohonen network (1988). In Kohonen network each iteration begins by randomizing the training sample, which is composed of P patterns (e.g. market indexes) each of which is represented by a numerical vector. Until the number of patterns used p exceeds the number

available, patterns are presented to the units, each of which is assigned the Euclidean distance between its connecting weight to the input unit and the value of the input. The unit that best matches to the pattern is the winning unit and it is used to adjust the weights of the units in its neighborhood.

In creating an ANN to deal with a specific problem, special care needs to be devoted to stating the evaluation criteria. This should be done by detail analysis of the problem, the major objective of the whole process and the ANN part in the process.

Results

Our work aims at the most liquid currency pair EUR/USD. Our time series consists of 2000 closing price observations between 18.1.2010 and 1.8.2016. Data was acquired from Reuters Financial Services database. Regarding the type of neural network, we applied nonlinear autoregressive neural network with one hidden layer containing 10 hidden neurons and 2 delays as input nodes. We have to emphasize that in this type of supervised learning, the data sample is divided into three separate sets. While training set (usually 70% of the sample) is used for calculating the error signal and for modification of connection weights, on the validation set (usually 15% of the sample) network monitors the error during the learning. When the learning algorithms starts to overfit the training sample, validation error immediately increases. That is how supervised network preserve their generalization ability. Stored optimal connection weights and biases are subsequently evaluated on the testing set (usually 15% of the sample). Out of sample character of testing set results determine the overall performance of the model. Figure 3 presents the learning process of proposed nonlinear autoregressive network. Learning process stopped at 12th epoch after 6 validation checks.

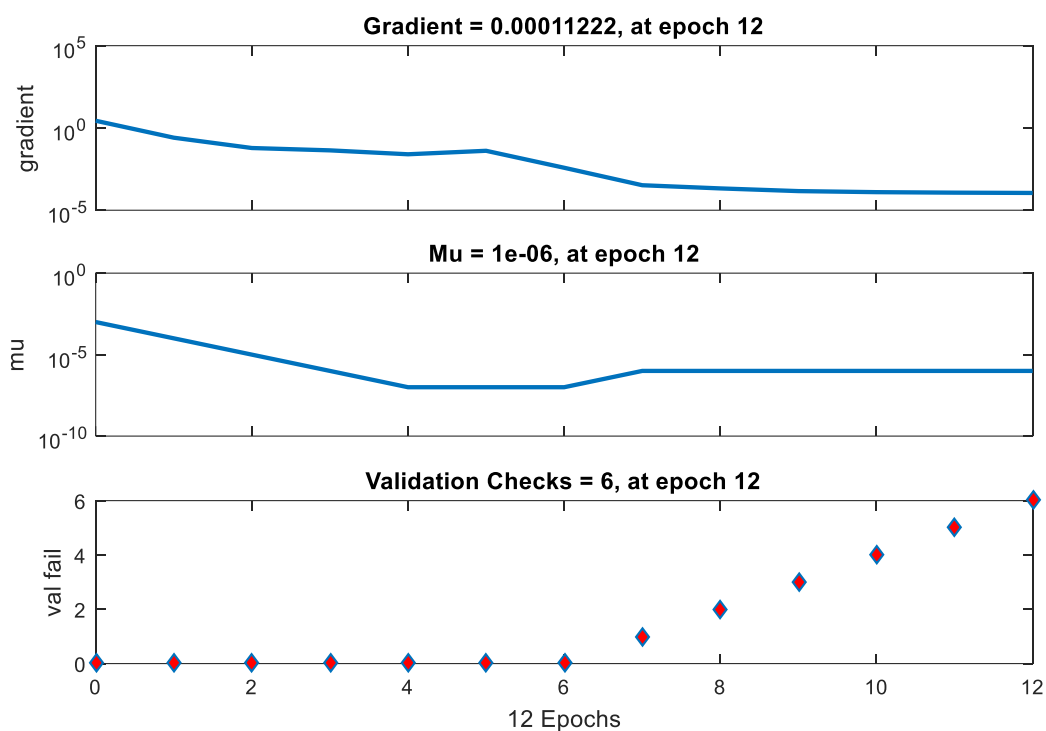


Figure 3 Network learning process

Source: Own processing.

Figure 4 illustrates the development of mean squared error regarding all three sets of data. It is remarkable that mean squared error declined even more rapidly on never-seen testing set.

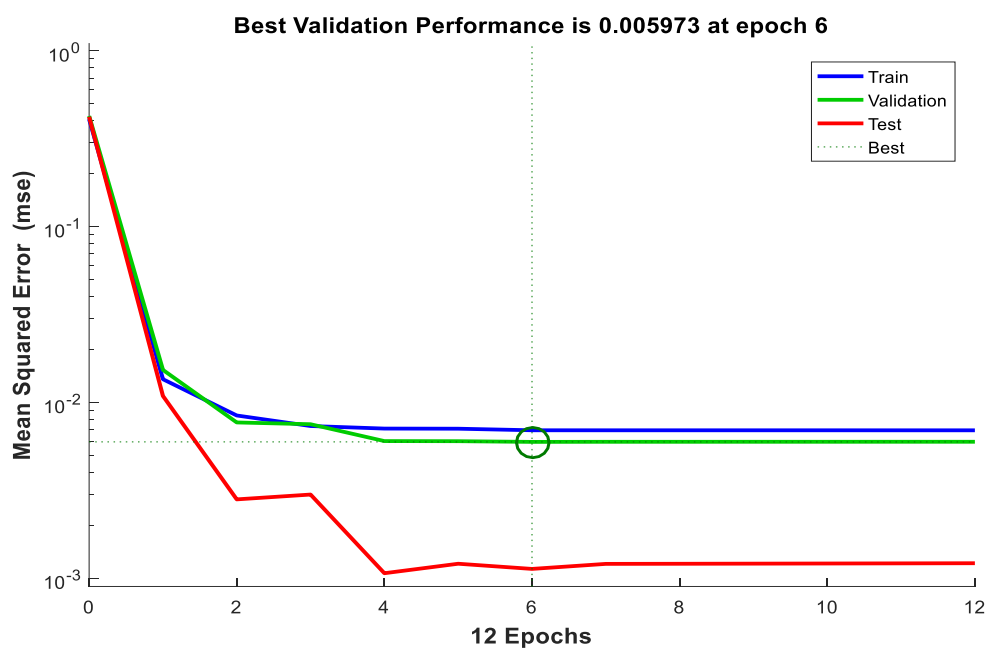


Figure 4 Network learning process

Source: Own processing.

Figures 5 and 6 present error histogram and error autocorrelation.

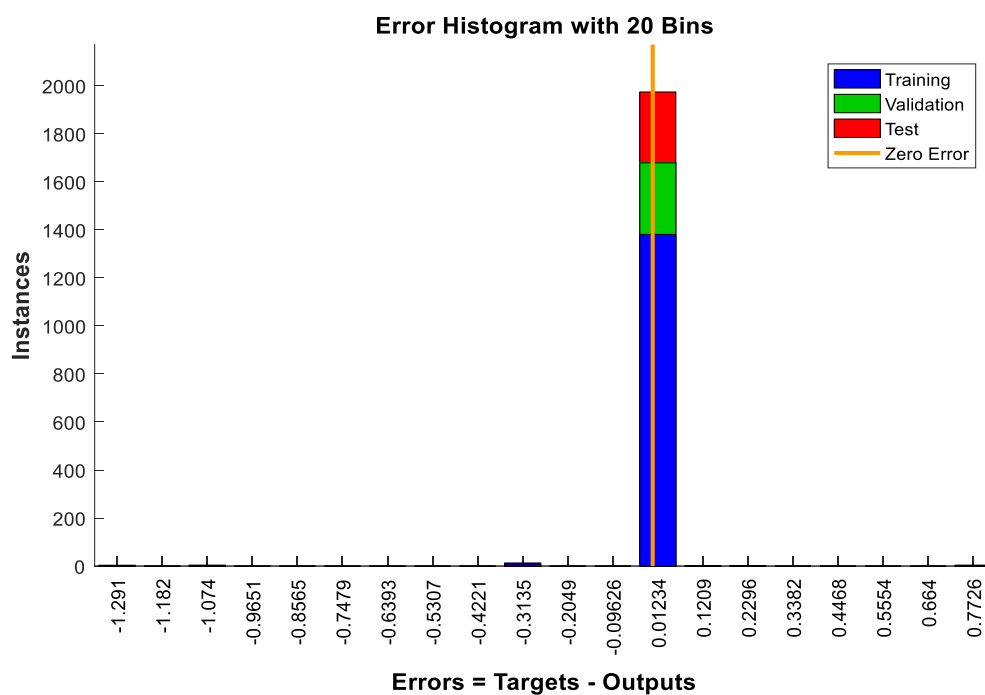


Figure 5 Network error histogram

Source: Own processing.

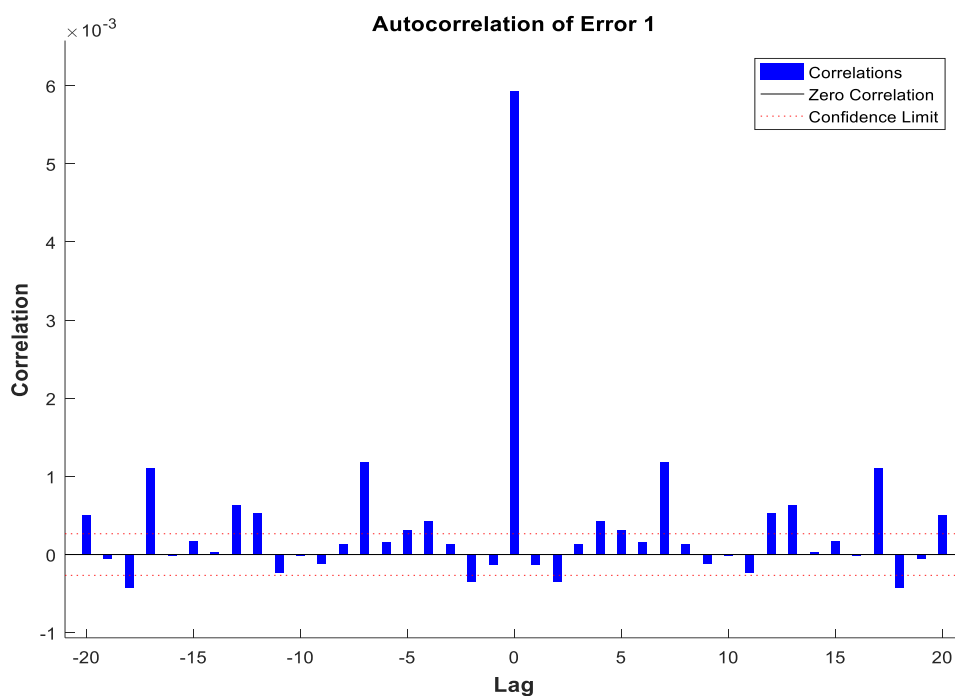


Figure 6 Network error autocorrelation

Source: Own processing.

It is necessary to notice that correlation of errors depicted on Figure 6 is divided by the number of data in the sample. The average autocorrelation at lag 0 is equal to the mean squared error. Table 1 presents the results of designed nonlinear autoregressive network trained by Levenberg-Marquardt algorithm in terms of mean squared error and coefficient of determination on all three data sets.

Table 1 Network results

	Sample	MSE	Coefficient of determination
Training sample	1400	0,0069564	88,16%
Vlvalidation sample	300	0,00597302	81,47%
Testing sample	300	0,00113244	98,83%

Source: Own processing.

Mean squared error and determination coefficient were the lowest on testing set, followed by outcomes on training and validation set. Figure 7 shows regression results of the network depicting results of regression on all three sets.

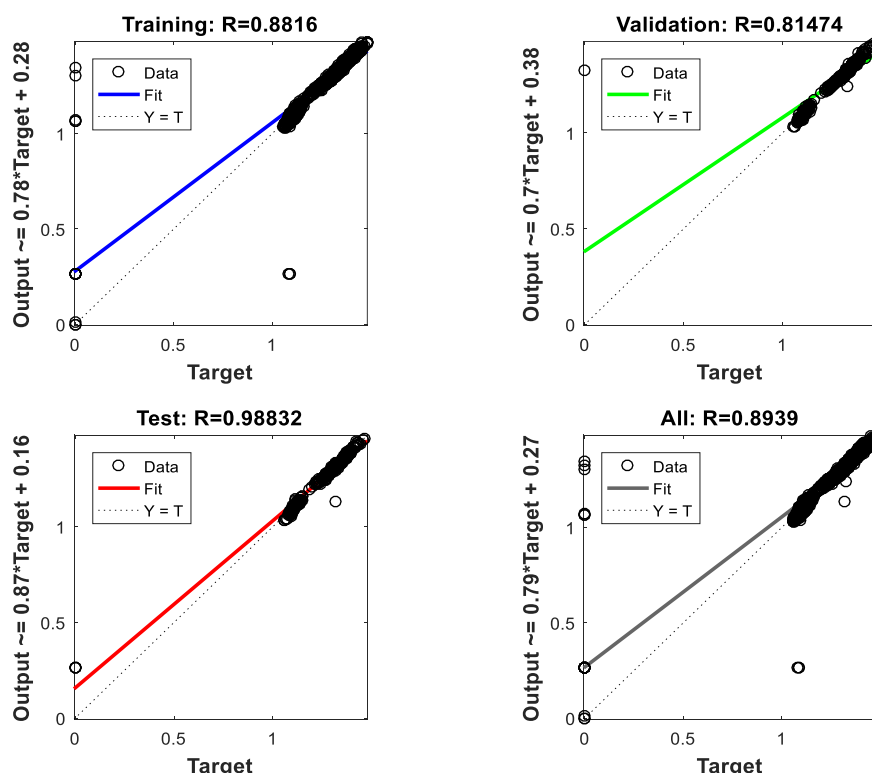


Figure 7 Regression results

Source: Own processing.

Conclusion

Neural networks are simple to construct and deal very well with large amounts of noisy data. They are very adaptive in nature and in settings, where are no rules. It makes them particularly useful in fields such as finance where the environment is potentially volatile and dynamic. They are also very tolerant of noisy and incomplete data sets. This elasticity comes from the fact that information is duplicated many times over in the many network connections, just like in the human brain. This feature of neural networks contrasts to the serial computer, where if one piece of information is lost, the entire information set might be spoiled. The training procedure of an ANN itself is relatively simple. But the preparations, including the data selection and representation to the neural network and the elaborating of the outputs mean a considerable amount of work. However, modeling a problem with a neural network is still easier than simulating with conventional statistical methods.

This paper presented feedforward neural network to predict future exchange rates of the most liquid currency pair EUR/USD. Based on obtained results we can argue that neural networks are able to estimate future movements of EUR/USD rate and they have potential for practical applications. Our further analysis will aim at other neural network learning techniques and combination of neural networks with other nonlinear methods. It is worth to mention that there exist statisticians who claim that the rigid restrictions that are applied to conventional statistical models must be also applied to neural networks as they are just a special case of statistics. But there are probably more successful contemporary applications using neural networks than conventional statistical tools. The growing number of commercial applications could be explained by the general attraction of the relatively easy methodology in setting up an neural network to solve a problem.

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MODERN APPROACHES OF EVALUATING THE FINANCIAL PERFORMANCE IN SELECTED COMPANY

Roman LACKO – Marián GUBACKÝ

Abstract

In this contribution we focused on efficiency evaluation of 10 retailing companies in the automotive industry. State of the efficiency of selected suppliers cannot be described as optimal. The companies are mostly far away from the border of efficiency. The model CRS indicates that only three companies were efficient and in the model VRS just one more was efficient, creating a quartet of efficient companies. The remaining companies has model evaluated as inefficient and this should be for the management one of the bad news. Hard to say why this is so, there may be several causes, poor asset structure, low sales, lack of profitability or creative accounting consequences which would in turn mean bias in the results.

Keywords:

DEA, financial statements, company, CRS, VRS

Introduction

According to Nanni, Dixon, and Vollman (1992), in a changing business environment is a key element in maintaining the competitive advantage of the company's business strategy. In this regard, the performance measurement are crucial for designing and implementing their strategies. In traditional metrics based on financial nature they are reported drawbacks when applied in a dynamic business environment, to assess the performance of the industry (Atkinson, Waterhouse, Wells, 1997).

Management accounting theorists argue that it is necessary to consider non-financial measures of performance arranged by the success in achieving strategic goals (Ittner and Larcker 1998; Malina and Selto, 2004). For this reason, advanced production systems were analyzed concerning the results of the use and the functional consequences of non-financial measures in enterprises (Hertenstein and Platt, 1998).

Analysis of the financial statements has traditionally been carried out using a set of ratios to highlight the relative performance of a company compared to its industry. The number of ratios that can be calculated based on financial data is limited only by the imagination of analyst. However, only a part of a potentially infinite number of ratios can be meaningfully interpreted. At present, generally accepted accounting principles in the United States to order that only indicators related to revenue may be reported in the financial statements. Financial analysts nevertheless consider several other indicators. The problem with the traditional analysis of financial statements is also subjective selection of specific ratios for assessing the overall health of the company.

Analysis of the financial statements is a commonly used management tool for analyzing business performance. However, during the late 70s and early 80s of the twentieth century, it was a methodology for analyzing financial statements seen as problematic and suspicious precisely in cases where two or more coefficients exhibit conflicting signals. This gave rise to a debate on whether the only classic financial indicators continue to be useful for monitoring business performance. To solve this problem was used analysis of data envelopment (DEA). The technique analyzes data envelopment through appropriate non-financial and financial measures such as input / output variables provides a metric for the industry and a solid performance measurement. More specifically, in several studies was used for DEA to measure the performance of the industry (Destefanis and Sen, 2007; Majumdar and Chang, 1996). Siriopoulos and Tziogkidis (2009) highlight the fact that researchers and practitioners use it on failure analysis of financial indicators in practice (ROA, ROE, cost) to achieve overall efficiency when used multiple inputs or outputs. Then the so-called global model of data envelopment analysis (GDM) that includes these selected variables, provides a single measurement of power (Gonzales and Bravo, 2007).

DEA is a mathematical programming approach to the relationships between multiple inputs and multiple outputs, and has become a proven way to measure business performance (Charnes et al., 1978). DEA can be applied to business entities created for profit by converting the indicators of financial performance and cash equivalents technical efficiency.

Sales, total assets and equity can be minimized opposite to revenue and net income as maximized output. This model identifies as the technically efficient company that uses a minimum of resources while producing maximum net profit. But since the DEA does not work with negative numbers as input to explicitly modeled Net profit (loss) may not be appropriate. Linear programming problem to handle negative net profit (loss) can be solved by defining zones of total assets, equity and cost, and defining output as total revenues. In this way, financial indicators, commonly used to evaluate the financial performance of the business are systematically included in operational efficiency; revenues are maximized in view of the limited use of long-term (assets and equity) and short-term resources (costs).

The DEA method is a widely used method to evaluate efficiency mostly within the area of services. This method is often applied to banks, see Sherman and Ladino (1995), Schafnitt et al. (1997), and many others. It is also used in the aviation sector (Gillen and Lall, 1997), in telecommunication (Kumar, 2015), and to evaluating the efficiency of universities (Ahn et al., 1988). It can be applied to measuring the environmental efficiency (Korhonen and Luptáček, 2004), and many others often cited publications.

1 Methodology

This chapter consists of next three subchapters.

1.1 Methods

To measure the efficiency according to the financial variables of selected companies we have to compute the efficiency scores using CRS output oriented DEA model according to following Cooper's et al. (2007) input oriented model just as a reciprocal value $1/\theta$.

$$\max_{u,v} \theta = \frac{u_1 y_{1o} + u_2 y_{2o} + \dots + u_s y_{so}}{v_1 x_{1o} + v_2 x_{2o} + \dots + v_m x_{mo}} \quad (1)$$

$$\text{while } \frac{u_1 y_{1j} + \dots + u_s y_{sj}}{v_1 x_{1j} + \dots + v_m x_{mj}} \leq 1 \quad j = 1, 2, \dots, n$$

$$v_1, v_2, \dots, v_m \geq 0$$

$$u_1, u_2, \dots, u_s \geq 0.$$

For better understanding of this method see Cooper et al. (2007). Model DEA VRS is assuming that in the companies are variable returns to scale.

1.2 Variables

For us, to determine the effectiveness of our choice of enterprises is to choose the inputs and outputs of the DEA model that will influence performance through variables. In many investigations (see. Table 4) we have seen a different choice of the inputs and outputs which gives us a relatively free hand in choosing. In the process of selecting variables, we rely on the availability and relevance of data and foreign literature.

We chose 2 inputs and 2 outputs. The first of the two inputs, the height of the company's assets, the assets are all assets of the company and we estimate that it is the assets will bring economic benefits. The second input will be the company's equity which is known as the main bearer of business risk. The outputs will then be total sales and financial indicator ROA (return on assets) - return on assets, which indicates a production force.

1.3 Object of the research

The first phase of choosing the subjects, we have collected the data of 80 suppliers from which we then selected after specific selections 12 enterprises in the supply industry for the automotive industry, resident in Slovakia, belonging to the category of Tier 1. All the companies are SMEs. As the period under review we opted for the availability of data the year 2014. We do not have permission to mention some of the companies so we will mark individual companies by letters

A through K. In this contribution, we will focus on assessing the effectiveness of the company Mkem, Ltd. seated in Stara Lubovna, founded in 1995 and active in the production of cable harnesses.

2. Results

The result is a measurement and evaluation of effectiveness based on selected inputs and outputs in the company Mkem, Ltd. with respect to the automotive suppliers industry. For purposes of this work we are using four DEA models determine specific values of efficiency. First, it is appropriate to bring the value of individual financial indicators monitored companies in the sector.

2.1 Variables and their values

The table no. 1 shows the recorded values of the variables in the model of DEA. Because of more thorough characterization of the investigational data, we calculate some basic indicators of descriptive statistics.

Table 1 Variables used in DEA models

	Inputs		Outputs	
Company	Assets	Equity	Sales	ROA
A	6 369 412 €	2 416 762 €	18 105 840 €	37.54%
B	27 722 940 €	14 279 424 €	28 231 168 €	7.35%
C	13 863 680 €	9 973 087 €	21 056 992 €	0.39%
D	6 679 620 €	5 231 191 €	5 739 845 €	0.80%
E	5 599 221 €	2 907 427 €	9 604 511 €	8.73%
F	11 781 462 €	3 026 099 €	15 964 163 €	8.78%
G	23 283 384 €	4 734 534 €	139 574 416 €	23.40%
H	10 117 059 €	6 583 522 €	17 109 920 €	4.91%
I	18 122 218 €	3 209 730 €	18 396 664 €	4.51%
J	62 586 002 €	38 308 944 €	143 581 984 €	17.02%
Mkem, s.r.o.	3 721 262 €	567 302 €	13 311 390 €	18.13%
K	10 783 073 €	5 386 458 €	27 793 856 €	17.90%
Average	16 719 111 €	8 052 040 €	38 205 896 €	12.46%
Standard deviation	15 496 708	9 785 740	46 645 525	10.36%

Source: own processing according to financial statements of the companies

Average assets in these companies in the area of automotive industry suppliers are at around € 15.5 million. Equity of selected companies is approximately € 8 million. Average revenues are at slightly above 38 million €. The average return on assets level is 12.46%, the standard deviation from the indicator is clear that the variation is set at significantly high levels. This fact may result from the

individual character of production parts. However, it can be assumed that companies producing several types of parts, respectively parts, which are not so similar in type. It is difficult to find an increased amount of companies that produce products similar in type. For the purposes of this work, but that is no obstacle, since analysis of a company belonging to the network of automotive suppliers and all selected companies are SMEs Variability is therefore expected. Mkem, Ltd. a relatively small number of assets and equity, while its sales are on the level of assets and equity relatively high return on assets is above average even at the level of 18.13%. Some companies have very low levels of ROA, suggesting a low profit company. Especially in the case of companies C and D, where the head of the company C sales are not low, the cost of the enterprise are therefore too high. Conversely Company A, is substandard in terms of assets, equity and sales highest ROA. Significantly above the average value of assets, equity, sales and ROA value was above average in the company J. Just because an appropriate comparison and evaluation of selected indicators DEA method was used, the results of which will be described in the next section.

2.2 Results of DEA computation

As mentioned in the previous subchapter, it is difficult to compare companies based on several financial indicators and criteria at the same time. One approach to the analysis according to the state of the art is to use DEA method. For analysis, we used two types of models and model DEA CRS (also DEA CCR), which implies that businesses are constant returns to scale and VRS DEA model (also DEA BCC), which foresees the contrary, variable returns to scale. For both models, we calculated values for the input and output-oriented model, the difference in orientation to the recommendations of changes in individual inputs respectively outputs, input oriented model is the recommendation for change inputs to achieve efficiency with the unmodified output and by analogy at the output model. The calculated values for the different types of models are presented in the following sections.

CRS INPUT model

As the first model, the results of which we describe select the input oriented model CRS. The figure no. 1 shows the value of the effectiveness of individual companies from the automobile industry.

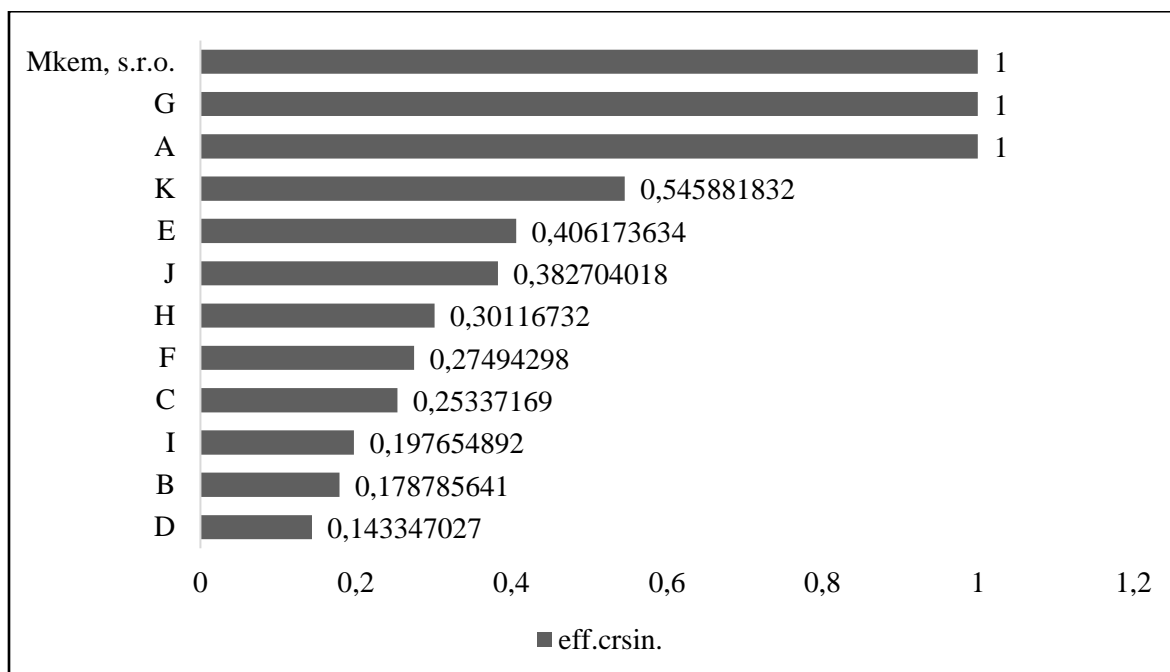


Figure 1 Efficiency values of input oriented model DEA CRS

Source: own processing

Effective according to this model are companies G, A, and our choice Mkem company. It was confirmed what we already assumed in the previous section, with relatively low inputs Mkem s.r.o. had a relatively high outputs. DEA model mathematically thus confirmed our claim. The company, which was "among the most effective non-effective", noted the value of the efficiency of 0.5459, suggesting a significant departure from the boundaries of efficiency. Gradually, individual companies from the frontier receded more and more. Company I, B and D have reached very low levels of efficiency. If you then look at the source data model, we can see that in these enterprises was below average ROA, respectively input values are high above average, even for enterprise D is ROA almost zero. This was reflected in the fact that the company has become the least effective. The average value measured CRS efficiency was at 0.474. It can therefore be concluded that above-average effective were only three companies, even those CRS were effective. The following section will focus on the value of the efficiency of CRS output oriented model.

CRS OUTPUT model

In the figure no. 2 we can see result of DEA CRS output oriented model.

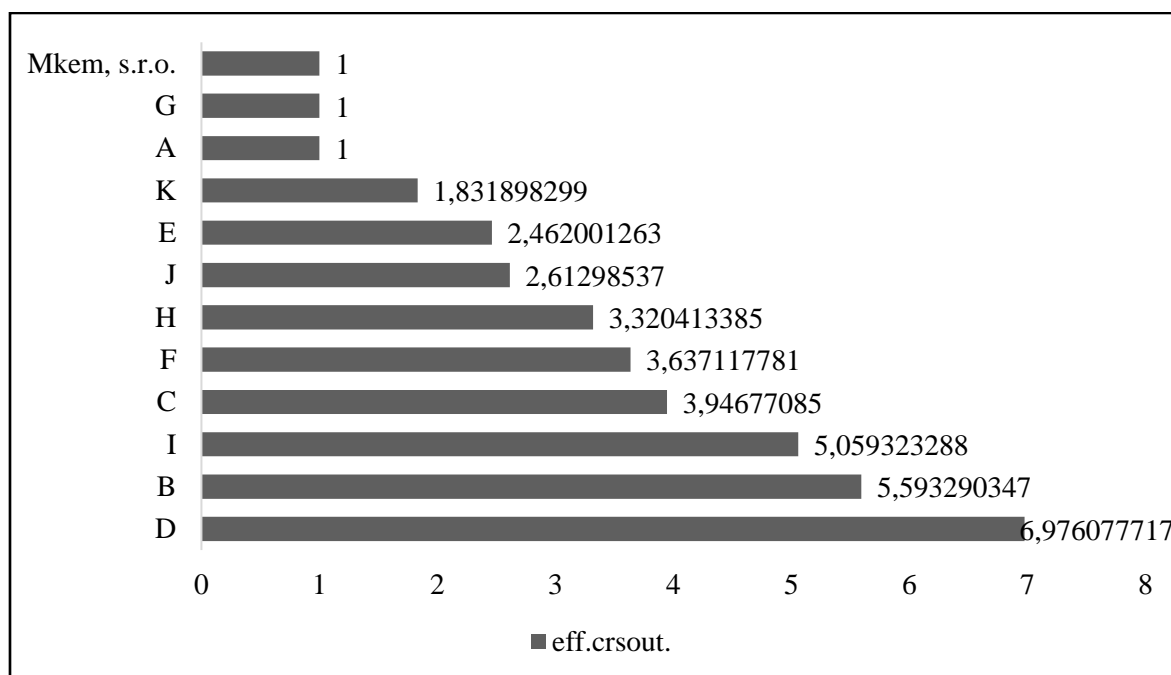


Figure 2 Efficiency values of output oriented model DEA CRS

Source: own processing

At the beginning, it is necessary to mention that in this case are effectively those businesses that have achieved a level of efficiency equal to 1. The higher value, the higher the value of inefficiency and so the distance from the boundary of efficiency. The difference compared to the input oriented DEA model results from the mathematical nature of the output model. It should be noted also that it is easy to calculate the value of output-oriented model based on the input model and vice versa. If we want to calculate the value of efficiency in input oriented model from the output, it is simply calculated as the inverse of the output-oriented model. Mkem company together with companies A and G are located on the border of efficiency and other companies are in fact below average. Again, the three worst rated companies are I, B and D. D enterprise inefficiency is quite significant. In the following sections, we will deal with VRS DEA model.

VRS INPUT model

In the next figure no. 3 are shown the results of VRS input oriented model.

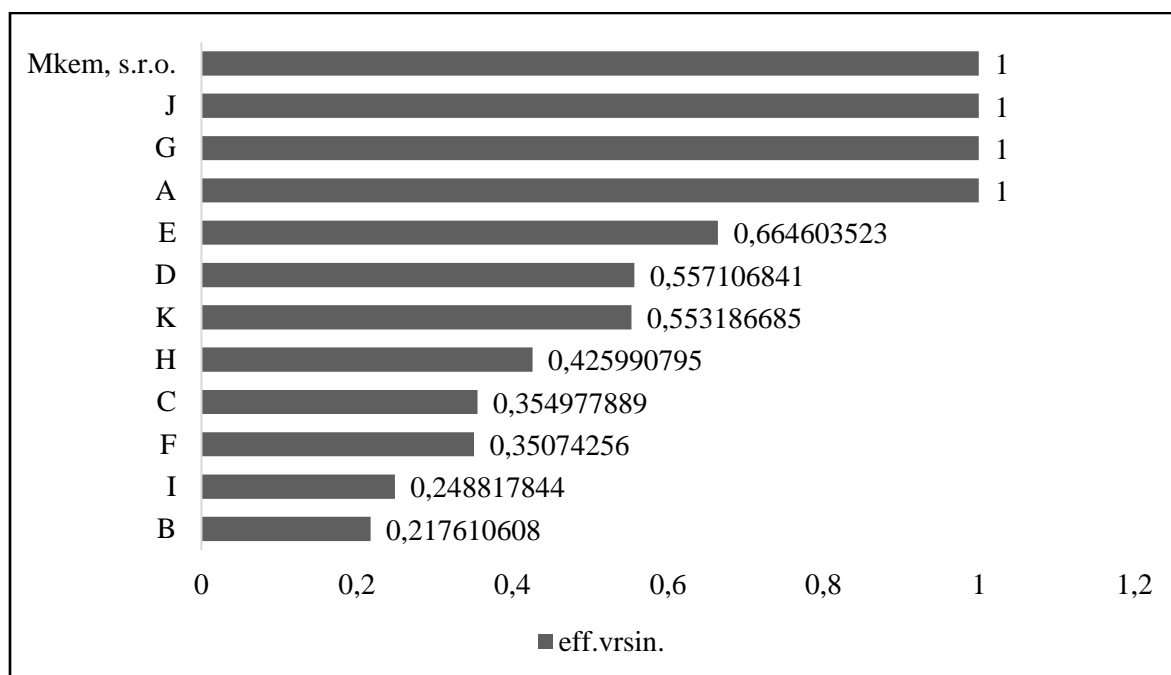


Figure 3 Efficiency values of input oriented model DEA VRS

Source: own processing

For a better understanding of the model VRS (BCC) is necessary to approach the shape of its boundaries efficiency. Limit the effectiveness of this model has the shape of the curve is therefore convex respectively concave unlike in CRS model, which has the shape of a line for businesses is thus "easier" to be on the frontier of efficiency, because efficiency frontier bends. Therefore, the fact, respectively, sentence that each CRS effective unit must also VRS effective, retroactively, however, this argument does not apply. The three companies Mkem, G, A and J were efficient. Interestingly the company J placed at 6 in model CRS. The average efficiency of undertakings under this model stood at 0,614, resulting in higher "benevolence" of the model. Because of the shape of the boundary companies have a chance to get closer to her than in the case of CRS model. The least efficient companies are I and B, which were also the least efficient by model CRS. An interesting situation arose in the case of D, which was the least effective in the case of CRS model, but in the model VRS, it managed to get close to average efficiency in the companies evaluated.

VRS OUTPUT model

To complete the picture, we show the figure no. 4 in which are the values of efficiency for output oriented DEA model VRS.

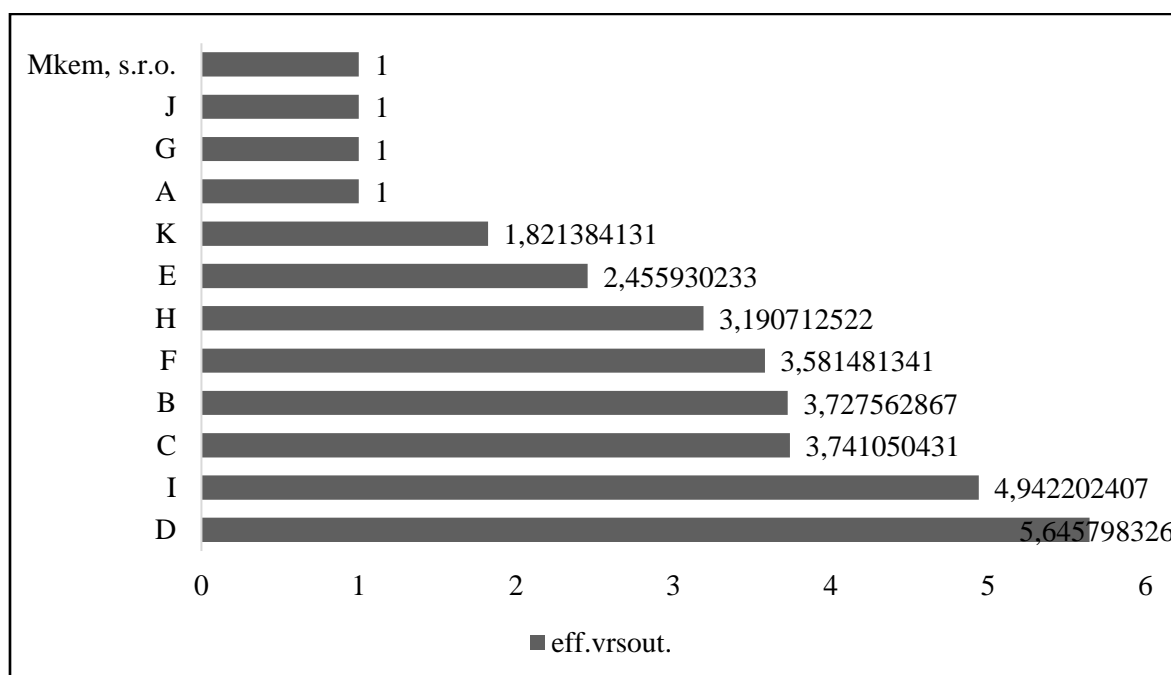


Figure 4 Efficiency values of output oriented model DEA VRS

Source: own processing

Output VRS DEA model offers us again look at all 12 enterprises and their efficiency values. As efficient are highlighted four companies, namely Mkem, s.r.o., J, G and A. As an expression of the least efficient companies we can evaluate enterprise I and D.

Conclusion

Out of the research and measuring the effectiveness of selected companies derive more facts. There are many indicators that will help to evaluate the financial condition of the company. If we want to evaluate the company within the sector and compare it with other companies, it is very difficult to choose appropriate indicators and even more difficult to choose the weight of individual indicators. There are summary indicators for assessing the financial performance of companies and it would be very interesting comparison of notice for these indicators of the results and efficiency of the method according to the DEA. It would also be useful to further examine the desirability of using different inputs and outputs in DEA model law for the conditions of the automotive industry in Slovakia. The method appears to be suitable for comparing the position of intra-sector undertakings, since input and output assigns weights automatically based on the nature of the data. Another recommendation and possibility for the future

is tackling the impact of the application of different quality parameters, such as type of business, location of companies, environmental levels of the company to describe the efficiency of the financial state of the company. Restriction arises only from a possible lack of resources for this information. Furthermore, it may be appropriate to establish a correlation between the results of an evaluation using a variety of bankruptcy and creditworthy models and effectiveness of the results. It would be very interesting to compare all the companies in the supply sector, the automotive industry not only in our country but also in neighboring and nearby countries, as we know that the neighboring countries have a relatively high number of cars produced per capita, we can include for example Czech Republic, Germany but also other European Union countries. All these possibilities of further research could be implemented also regarding the temporal change in each year. Again, the only limit seems to unavailability of some data.

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CHARACTERISTICS OF EVIDENCE IN EVIDENCE-INFORMED PRACTICE IN FINANCIAL EDUCATION

Bożena FRĄCZEK

Abstract

The idea of the all evidence-informed practice movement is that research can make a very important contribution to improving the current state of policymaking and practice in different areas. This philosophy has been developing for many years in many disciplines, starting from healthcare as evidence-based practice. The most important issue in evidence-informed philosophy is the evidence - its definition, features, types, sources and contents as well as the ways its usage in the practice. The aim of the paper is the presentation of the possibility of adaptation the idea of evidence informed practice to educational area - notably financial education.

The reviewing the literature provides the evidence for verification the terms and factors influencing the effective implementation of evidence-informed practice in financial education.

Keywords:

Evidence-Informed Practice in Education, Evidence, Financial Education

Introduction

At the beginning of the 20th century there appeared a general assumption that doctors, police officers, teachers and other professionals were the experts, whose judgment was to be trusted, and who were therefore left relatively unchallenged to carry out their duties. By the end of the century this culture of public trust had been changed in favor of judgment-based professional practice. There has arisen the important notion of evidence-based practice as a means of ensuring that what is being done is worthwhile and that it is being done in the best possible way. There are many factors influencing the rise in the role of evidence in policy and practice, including: the growth of well educated and well-informed public; the increase in the availability of data of all types, intensified by information technology development; the growth of size and capabilities in the research and science community as well as an increasing emphasis on productivity and international competitiveness, and an increasing emphasis on scrutiny and accountability in governments of many countries. (Davis et al., 2000).

Evidence-based practice (EBP) is the term closely related to evidence - informed practice. The notions are usually defined under specific areas and for their needs. The movement for enhanced use of research evidence in the work of the professions, started in medicine in the early 1990s (Hammersley, 2001) and nowadays is used in many other disciplines, including education. Considering the idea of evidence-based practice in the field of healthcare, it is defined as the conscientious, explicit and judicious use of current best evidence in making decisions regarding the welfare of service-users (Nevo & Slonim-Nevo, 2011). In this case, evidence could further be described as results found in randomized

controlled trials, descriptive and qualitative research, case reports, scientific principles, and expert opinion (Titler, 2008).

Evidence-based practices are those that have repeatedly and consistently demonstrated desirable outcomes through application of scientific research – mainly experimental methods. Common forms of experimentation consist of true experiments (the highest internal validity), repeated-measures designs, quasi-experiments, and time series designs (Smart Start, 2013).

An evidence-informed practice (EIP) is one that is guided by various development theory, practitioner/professionals wisdom, qualitative studies, findings from basic research, written guidelines, strong logic models, and a history of demonstrating positive results. They should be rated ‘promising’ or ‘emerging’ by at least one source that rates evidence-based programs. Thus, this notion includes wider range of sources of evidence.

Some of researcher concluded that in the concept of EBP, the research evidence can provide its exclusive foundation. And the response to this statement has been to change ‘evidence-based’ to ‘evidence-informed’ practice (Hammersley, 2001).

That is why the notion EBP arose in disciplines such as medicine (Pirrie, 2001) and nowadays is often used across various fields such as medicine (Graham-Smith, 1995), mental health, and early childhood (Buysse and Wesley, 2009) and EIP seems to be more suitable in educational contexts. Currently more than ever before experimenters in education are also more likely to use multiple data sources to obtain corroborative and supplementary evidence regarding the educational processes.

The 'evidence' in the concept of EIP seem to be interpreted in a rather widely way in comparison to EBP. Therefore ‘evidence’ seems to be the key aspect in the concept of evidence-informed practice and in its various permutations including evidence-based guidelines, evidence-informed decision-making, evidence-informed policy-making and evidence-informed individuals, etc. The significant challenges of evidence-informed practice remains the answer the question about what evidence is and - how practitioners should use it in decision making in the real education.

With respect to the mentioned insights, the objective of the paper is reviewing the literature to find different forms and source of ‘evidence’ and its specificity for EIP in education with particular emphasis on financial education.

Methodology

The paper is based on the study of literature in which both academic as well as non-academic sources have been used.

The literature review – especially academically reviewed articles - shows the concept of evidence-informed practice created on the base of evidence-based practice with special emphasis on the Issue of evidence - its definition, features, types, sources and contents. Development of the EIP philosophy tends to its

implementation into different areas, including education. Used in this article academically reviewed articles, renowned reports supported and published by significant international organizations and institution involved and responsible for financial education helped the Author to focus on financial education from the perspective the adaptation the concept of EIP. Listed kinds of literature sources allow for determine the state of past and current effectiveness of financial education taking into account many actions under financial education.

This paper, through a review of the literature, explores the current state of Evidence and concludes by highlighting gaps in EIP in financial education and the conclusions may be used in EIP in financial education policy.

Nature and types of ‘evidence’ in EIP

Considering the concept of evidence, the first difficulties appear in discussing, what constitutes evidence. For one sources the evidence is seen as confirmed to certain scientific rules of proof, while in other sources the circumstances and any observation on an issue may be considered as the evidence. But it should be underlined that the unifying theme in all the definitions is that the evidence can be independently observed and verified, and that there is broad consensus as to its contents (if not its interpretation). More and more often the evidence takes the form of ‘research’, broadly defined. It means that evidence comprises the results of systematic investigation towards increasing the sum of knowledge (Davis et al., 2000).

Philosophy of both ‘evidence-informed’ and ‘evidence-based’ practice imposes nature of evidence and ways of its using. It should be best and current (up-to-date) and should be used in conscientious, explicit, judicious way. Modern attitude to evidence-informed philosophy creates a wide understanding the notion ‘evidence’, including research based evidence.

Research based evidence means evidence produced from scientific studies under different methods. The idea that evidence from research can make a major contribution to improving practice stems from the assumption that research is systematic and rigorous, and that the provided evidence can be assessed objectively.

The first place in the various sources of research evidence always keeps experiment. The reason is probably fact, that the etymology of the word ‘evidence’ is rooted in the concept of experience (Upshur, 2001).

The experimental method formally surfaced in educational psychology around the turn of the century (Cronbach, 1957) in behavioral psychology, physics and healthcare. The experimental methods also have a long tradition in educational research, e.g. in educational technology (Ross and Morrison, Ross et al., 2005) but sometimes they are criticized as being overemphasized and conflicting with the improvement of instruction. In many cases experiments have been used in very strict, formal ways in respect to past results to gain understanding about learning processes. many researchers promote the usage the experimental

methods in conjunction with other research approaches and with nontraditional, supplementary ways of collecting and analyzing results. Very important evidence is research designed and conducted by scientific authorities in given fields, especially when they are repeated and used by other researchers in continuously way. In the literature there may be found the idea of 'methodological hierarchies' for quantitative methods, according to which some study designs are more able than others to provide robust evidence of effectiveness.

Other type of evidence is evidence comes form secondary research. Its role in hierarchy of evidence increases over recent decades, because of the accumulation of research findings into a robust body of knowledge and the development of the techniques of secondary research. The special importance is assigned systematic reviews, where all studies relevant to a given evaluation issue are uncovered, assessed for methodological quality, and synthesized as well as to meta-analysis, which allows for a quantitative estimate of overall effect size aggregated across a given group of primary studies. Many created hierarchies of evidence prefer high quality secondary research to single studies, true randomized experiments to quasiexperiments, and experiments to pure observation. Of course, such are not without their critics (Davis et al., 2000).

An important issue is also perceiving the professional experience as the evidence, which is presented as unsystematic, because it reflects only the particular cases with which a practitioner has happened to come into contact and it is not built up in an explicit and methodically correct way (Hammersley, 2001).

Many definitions of evidence informed (or based) practice refer to the term 'up to date' or 'current' and these terms are not clarified (Sackett et al., 1997). Some academics accept work that is written within ten years while others argue that even work written within five years can be out of date. The term 'up-to-date evidence' indicates that the most recent evidence is the best but this should not necessarily be accepted as no study is perfect. Every piece of evidence should be evaluated for its strengths and weaknesses. The 'evidence' is problematic concept in another aspect - an unequivocal understanding of evidence is not guaranteed and unfortunately is infrequent. Research and practice in many fields are growing to help professionals provide the best services possible to produce the real positive changes.

The next question is, that for many studies to have an impact on theory and practice, their findings need to be disseminated. Researchers in many areas (including healthcare and education) argue that the practice would be improved if all stakeholders (policymakers, practitioners, beneficiaries) could be more familiar with the results of research. Knowing the evidence about the disease, the patients are more likely to be aware of and receive the latest treatments for their disease. The awareness of symptoms in many diseases results in the early detection of disease. But unfortunately, in the case of many diseases the knowledge about recognizing and preventing represented by most of patients is poor (Jones et al., 2011), although it seems to be very useful in prevention. The analysis indicates a significant relationship between awareness and effective

people behavior in many areas (Ishak and Zabil, 2012). Awareness leads to ignorant and reduction of individual capacity also in education. Awareness of many facts (evidence) in area of finance, eg. the role of financial literacy in financial wellbeing the knowledge in combination with awareness of the low level of financial literacy as well as the knowledge on the best educational methods, have a great impact on efficiency of financial education. There is one way for translating what is known from research into practice. To move evidence-based interventions into practice, several strategies may be needed. Very popular are traditional and electronic version of scientific papers and reports available free or paid. Many electronic databases in each area were created. They facilitate searching the evidence and implementing these results of research into practice. Also awareness campaigns are commonly used by organizations from different fields to promote evidence.

Specificity of evidence in different areas with emphasis on education

Many researchers do not focus on explanation and understanding what travels under the heading of 'evidence-based' or 'evidence-informed' practice but focus on real and valuable evidence for the given area (in theoretical and practical aspect). There are specificity of evidence in healthcare, education and even financial education.

Very characteristic for evidence in healthcare are levels (hierarchy) of evidence, which were originally described in 1979 (Burns et al., 2011). They included: 1st level: At least 1 Randomized Controlled Trials (RCT) with proper randomization; 2nd level: A. Well designed cohort or case-control study and B. Time series comparisons or dramatic results from uncontrolled studies; 3rd level: Expert opinions. The initial levels were further expanded and modified. Under level of Randomized Controlled Trials were specified large and small RCTs with clear cut and unclear results. Under level of cohort or case-control studies specified current and historical ones as well as case series and studies with no controls. Then have adopted many variations of the classification system and depending on the diverse specialties, research questions were divided into the categories: treatment, prognosis, diagnosis, and economic/decision analysis. There are also specified the filtered and unfiltered resources of evidence. In the first group there are appraised the quality of studies and often are made the recommendations for practice. It includes the evidence from systematic reviews, critically-appraised topics (evidence syntheses and guidelines), critically-appraised individual articles (article synopses). The evidence from randomized control trials, cohort studies, case-controlled studies, case series, reports or expert opinions is evidence is not always available via filtered resources and the searching of primary literature may be required.

The similar pyramid of evidence is created for evidence in various disciplines of education. The filtered sources of evidence mean published studies and syntheses in specified synthetic reviews and meta-analyses of data in published

studies. The unfiltered sources include original studies, eg. qualitative and quantitative cohort studies, qualitative and quantitative case studies as well as expert opinions. The strength of evidence in the group of filtered sources is higher. But there is relationship among particular sources. The example may be usage by experts the evidence from other sources or changing the category of sources after publication in research papers (John et al., 2015).

But particularity and categories of 'evidence' in evidence-informed practice in education is determined by specificity of education. Evidence in educational practice is information acquired through research and the scientific evaluation of educational practice. Generally the evidence also derives from a broad range of rigorous methodologies including quantitative studies (such as randomized controlled trials, observational studies) qualitative studies (such as case studies) and meta-analysis. Evidence also includes expert opinion in the form of consensus documents, commission reports, regulations and historical or experiential information. But the evidence of education refer the first of all to effectiveness of education and usually they include: evidence from examination results, evidence from inspection reports, evidence from international comparisons, evidence from experiments. Public or final examinations (evaluation) have been part of the education systems in many countries. The rankings created on the base of results of evaluation and the pressure on schools to show good examination influenced the validity and reliability of evidence from evaluations. Schools feel they are judged on the base of their position in the ranking tables by parents or legal guardian of potential students and funds represent a major income source for schools depends of number of students. Next source of 'evidence' are the inspection reports. Although the judgments made by inspectors are often referred to as evidence, it is rather far from being research-based. A number of international comparative studies of achievement in science may be also seen as evidence. The studies usually rely on tests that may or may not match the curriculum of a particular country, but the samples are drawn to be nationally representative and the tests are very carefully administered and objectively scored.

Evidence informed education concept supports an evidence-informed approach to classroom practice, professional development, school improvement and education policy. The sub-area under evidence-informed practice in education is evidence-informed practice in teaching, where are different types of evidence (EBTN, 2016). The examples of such evidence are: the results of classroom experiments which show which methods work best (Marzano et al., 2001; Petty, 2009) or cognitive science research which shows what's happening in the brain when learning happens. The neuroscience evidence takes the form of both providing explanations for the effective teaching methods highlighted in 'Classroom evidence', but also suggesting new possibilities for effective methods.

It might seem, that education should offer similar opportunities for evidence influencing the teaching as evidence in medicine and other fields of healthcare. But it was shown that the relationship between research and education policy and

practice is disputed (from the methodological and philosophical point of view). The primary weakness is lack (small number) of rigorous experimental trials. This is all the more important now when there are trend to in evidence-based practice philosophy (notably medicine) to encourage practitioners (practicing) and stakeholders to make more use of the research evidence that is already available (Hammersley, 2001). The main reason of the lack of good quality research which could feed evidence-based practice in education are limited costs. Much experimental research is conducted by investing not more than one day into education, indicating that these measures have small effects.

Multidimensional aspects and role of evidence under EIP in financial education

Finance is a part of everyday life for most of people who are consumers of financial services such as bank accounts with access to payment facilities, savings, credits and loans. The basic objectives of financial education are to improve the level of financial literacy and increase the degree of financial inclusion. Level of financial literacy determines the financial behaviors and financial wellbeing of individuals, influences on quality and scale of participating in the financial market of households as well as enterprises, especially medium and small and thereby has a great impact on financial market development and performance of economy.

Evidence-informed practice in financial education may place large information demands on all participants of the process of education: professionals, managers, policy makers as well as students, teachers and other individuals. In the EIP very important is to determine what the goals of good practice should be and how the evidence may help to achieving these goals. An evidence-based approach requires the carefully implementation of current evidence to integrate it with defined goals and ongoing evaluations of effectiveness.

Since the enhance the level of financial literacy is the aim of financial education the 'starting evidence' in educational policy based on idea of EIP is the determining the level of financial literacy and factor influencing it. Results (evidence) from research from conducted for many years confirms the very low level of financial literacy (e.g. Xu and Zia, 2012). These evidence comes from academically reviewed articles as well as renowned reports supported and published by significant international organizations and institution involved and responsible for financial education (OECD reports, World Bank reports or supported or promoted by these organizations the reviewed academic papers).

Number of filtered sources allow for collecting data which are representative for the whole population and gives the chance for the measurement repeatability (Lusardi and Mitchell, 2006; Lusardi and Mitchell, 2007a; Lusardi et al., 2010). In addition, the results of such research may be seen as benchmarks for the next edition of similar research. The most important findings from mentioned past research, except the unsatisfactory level of financial literacy in both developing as well as developed countries, point the main socio-demographic factors

influencing the level of financial literacy: gender (OECD/INFE, 2013; Berggren and Gonzalez, 2010), age (Chen and Volpe, 1998; Atkinson, 2007; Lusardi et al, 2010; Atkinson and Messy, 2012; Finke et al., 2011), income and level of education (Atkinson and Messy, 2012; Spataro and Corsini, 2013), cultural norms (Nannyanzi, 2009) and motivation (Mandell and Klein, 2007). Only such comprehensive, integrated and relevant with significant internal value evidence in area of financial education should be considered and involved in educational policy under coordinated actions under financial education.

Therefore many very different ideas and actions started to be conducting under the improvement of financial literacy process. Already in 2003, OECD called on national governments to prepare appropriate regulations and develop national strategies of financial education (NS) (EC, 2008). The actions under financial education and outside of them include very wide range of initiatives and events. There is indeed very long list of courses, curriculums, conferences, seminars, summits, workshops, competitions, contests, practices, grants conducted under formal as well as non-formal and informal education. Listed activities are conducted, supported, promoted and funded by many entities like financial regulatory authorities - mainly financial market authorities, central banks, the government represented by relevant ministries – especially by ministries of finance and ministries of education, universities, foundations, funds, consumer associations, entities of financial services sector (including commercial banks and investment funds), units of voluntary and community sectors and many others.

It should be underlined that the process of coordinated actions on financial education under NS and out of them is still in progress, but as it was mentioned above without clearly expected results. Sadly, recent research continues to confirm presented earlier facts.

Table. 1 An example of Evidence on current state of financial literacy for different groups

Source of evidence	Description- main conclusions
Evidence of Financial Literacy among the young people	
<i>Survey of the States: Economics and Personal Finance Education in Our Nation's Schools</i> , National Council on Economic Education's (NCEE), USA, 2016	<p>Every two years research shows that there has been slow growth in personal finance education in recent years:</p> <ol style="list-style-type: none"> 1. Seventeen states require high school students to take a personal finance course. This is the same number as in 2014. Still only 5 states require a standalone semester course in personal finance. 2. Forty five (two more than in 2014) states include personal finance in their K-12 standards Thirty seven (two more than in 2014) states now require educational standards on personal finance to be implemented. 3. Fewer than 20% of teachers report feeling competence to teach personal finance. 4. More than one in six students in US does not reach the baseline level of proficiency in financial literacy.

OECD (2014), PISA 2012 Results: Students and Money: Financial Literacy Skills for the 21st Century (Volume VI), PISA, OECD Publishing.	<p>Nearly 30,000 teenagers from 18 countries (13 OECD countries and economies: Australia, the Flemish Community of Belgium, the Czech Republic, Estonia, France, Israel, Italy, New Zealand, Poland, the Slovak Republic, Slovenia, Spain and the United States) and 5 partner countries and economies (Colombia, Croatia, Latvia, the Russian Federation and Shanghai-China), representing 40% of world GDP) took part in the first large-scale international assessment of young people's financial literacy</p> <ol style="list-style-type: none"> 1. Wide differences in average financial literacy performance between the highest- and lowest-performing countries and economies: more than 75 score points among OECD countries and economies (mean score of OECD countries is 500) , and more than 225 score points across all participants (mean score of Shanghai-China is 603 and mean score of Colombia is 379) . Only 16% of the variation among countries' mean financial literacy scores is explained by per capita GDP. 2. Only 10% students across participating OECD countries and economies is able to tackle the hardest financial literacy tasks in PISA 2012. 3. A more socio-economically advantaged student scores higher results (41 points difference) in financial literacy than a less advantaged student, on average across participating OECD countries and economies 4. Gender gaps in financial literacy among 15-year-olds are small, in comparison those found in adult populations. 5. Students' attitudes towards learning, such as perseverance and openness to problem solving, are positively associated with financial literacy.
<i>Financial knowledge and skills of young future economists in 4V Countries</i> (Frączek, 2016)	<p>Survey research on students of Economics University in Visegrad Countries</p> <ol style="list-style-type: none"> 1. Low level of basic and extended knowledge and skills in finance 2. Ignorance and illusion of knowledge among students
Evidence of Financial Literacy in the Adult Population	
S&P Ratings' 2015 Global Financial Literacy Survey and Financial literacy around the World – insights from S&P Raport (Klapper et al., 2015)	<p>The data was collected in 2014 by Gallup as part of its Gallup World Poll survey and was analyzed by researchers from the World Bank and The George Washington University (Global Financial Literacy Excellence Center). The number of respondents: more than 150,000 adults in 144 countries who were tested on four basic financial concepts: numeracy, interest compounding, inflation, and risk diversification. The results are directed to researchers, policymakers, and practitioners a unique and extensive perspective on financial literacy.</p>

	<p>Main findings:</p> <ol style="list-style-type: none"> 1. Only 33% of adults worldwide are financially literate: <ul style="list-style-type: none"> - 65% in Europe - 27% in Asia - 57% in US - 68% in Canada - 66% in Germany - 28% in China (whose economy and financial service sector is dynamic and growing) 2. Other findings on financial literacy <ul style="list-style-type: none"> - lower financial literacy among women and the poor - financial literacy is lowest among adults age 65+ - financial literacy grows with income - many users of financial products lack financial skills - adults who lack an account also lack financial skills - low understanding of credit puts credit users at risk - high financial literacy among homeowners
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These disturbing results should be considered with the second main objective of financial education - appropriate financial behavior. The evidence from World Bank research dated 2011 and 2014 (World Bank, 2012; World Bank, 2015) shows the very diversified, but insufficient and unsatisfactory level of financial inclusion (measured by percentage of people having banking account, savings and credits in formal financial institutions) in particular countries. Taking into account the involvement of many entities in organization and carrying out the many actions under financial education positive changes seems to be inadequate. The low level of financial literacy is seen as the one of the most important reason these results. Similar evidence was achieved in other research (table 2).

Table 2 Evidence on impact of financial education on financial behavior and financial wellbeing

Source of evidence	Description - main conclusion
Meta-analysis, summary of financial education studies (Kaiser and Menkhoff, 2016)	<p>115 studies from 1999-2015 (including randomized experiments). Main findings:</p> <ol style="list-style-type: none"> 1. Financial behavior can be improved by financial education measures but the respective coefficient on effect size is very small. 2. Evaluating the impact the financial education on financial behavior without the necessary methodological rigor by not conducting a randomized experiment that accounts for selection effects, focusing on the treatment effects on the treated instead of those intended to treat and choosing a short delay for measuring program effectiveness, selecting the topic of education and the target group may contribute to inflated effect sizes without improving outcomes in reality. 3. Increasing the intensity of financial education affect both the level of financial literacy (in terms of knowledge gain) and financial behavior (probability of behavioral change).

	<p>4. Expected effects of financial education are bigger for the young (rather in area of financial literacy). But mandatory financial education seems to be in general as less effective in impacting financial behavior.</p> <p>5. For many low-income consumers there are small effect of financial education on behavior and much larger effect on financial literacy.</p>
An experimental study (Jariwala and Sharma, 2013)	<p>The series of financial education workshops were conducted for 300 homemakers in November–December 2012, in the state of Gujarat, India.</p> <p>1. Positive effect of financial education workshops on the financial behavior of participants.</p>

Due to persistently low level of financial literacy and a very high cost of financial education, there are promoted postulates ‘against the financial education’ (Willis, 2008) and suggestions for solving this problem by training the future experts (instead the society as the whole). There are also the alternative proposal. Some researchers argue that more effective than educating consumers may be simplifying financial decisions, e.g. by limiting the kind of available products (choices), by altering the choice architecture (Caroll et al., 2009), by working with financial advisors, experts notably prior to borrowing (Willis, 2011) or alternatively by offering incentives (Saez, 2009). Presented proposals may contribute to improving consumers’ financial lives but they do not solve the problems of ineffective financial education.

In the light of presented evidence, consideration should be given as to whether the education policy in personal finance should be changed. And if so, what changes should be carried out, how to make changes and how to take advantage of available resources of evidence.

Despite the illusion of financial knowledge as well as ignorance against the financial education, the actions under the financial education are needed. Undoubtedly greater emphasis should be placed on increasing the financial awareness of individuals on the importance of financial literacy to cause the informed, considered, conscious and active participation in different educational actions.

The next issue under financial education (and education as the whole) is specificity of forms of financial education as well as the substantive content of the curriculum in given specificity of education. The specificity of financial education is that its educational contents are delivered by various channels under formal, non-formal and informal education and the largest share is attributed to non-formal education, which is optional (not compulsory) and does not facilitate the motivation to study the finance.

Very helpful in evidence-informed practice may be combination of available evidence with features of given fields of education (e.g. characteristics of educational content, types of information, data). The example may be evidence of the best methods of teaching regardless of the area of teaching and features of

educational content in financial education. As the best ways of teaching for every area are accepted (e.g. Marzano, 2001): similes and analogies, note-making and summarizing, reinforcing effort, repetition, graphical methods, cooperative learning, goals and feedback, hypothesis testing, activating prior knowledge, advance organizers. Taking into account the specificity of financial information and data used in financial education the list the best ways of teaching may be narrowed.

Similes and analogies. Financial data and facts allow for using the similes and analogies. Financial markets and many financial parameters are characterized by periodicity (e.g. financial market phases expansion, boom, recession, depression) or seasonality (e.g. inflation) and similes and analogies may be used. In addition financial markets create the time series, consisting of trading courses and volumes of financial instruments and many secondary time series. This method (similes and analogies) facilitates financial education in the area of education by practice, by doing financial data analysis and in many cases leads to create financial theories or their elements (e.g. chart patterns as the main elements of technical analysis). Similes and analogies are also the foundation of one of the forecasting methods in economics and finance - analog prediction. Similes and analogies may be conducted in time and in space. In a certain sense the usage of similes and analogies means repetition (as the method).

Graphical methods. Much of educational content is based on data analysis. For easier explanation, interpretation and learning the results of the analysis may be presented using graphical methods. In the finance there are a lot of theories, models and relationships explained by graphic way.

Activating prior knowledge. Many educational contents in finance is based on evolution. More advance financial instruments (e.g. derivatives) or financial strategies is based on the simplest ones. To understand many sophisticated financial processes it is necessary to know the many elements, functions, actions, etc.

Conclusions

The evidence-informed concept philosophy is becoming more and more popular and recognized and many communities represent a positive attitude toward it. There are many compelling reasons for adopting an evidence informed approach to education and the first of all providing effective education.

Analyzed the example of financial education and presented data in the background of idea of evidence-informed practice allow for conclusions and implications.

In educational research there is the lack of necessary methodological rigor. The effective implementation of EIP in education (including the financial education) require increasing a randomized experiment and other types of sources of filtered and unfiltered evidence.

The available evidence in EIP in education should be considered as integrated evidence with combination with specificity of educational content. The idea of EIP should be implemented in financial education but it should take into account coordinated actions of many stakeholders and integrated data (available evidence).

The large number of available evidence does not guarantee the more effective practice in education. There is very important stage between the gathering the available evidence and using it in practice – evidence-informed decision making. Evidence-informed decision-making in financial education is a continuous interactive process involving the explicit, conscientious and judicious consideration of the best available evidence to provide education which results in improving the level of financial literacy and increase financial inclusion to ensure the financial wellbeing, achieve the cost-effective financial education.

The next implication is necessity of supplementing the lack of the evidence in area of an analysis of costs being involved in the specific measures of financial education effect, which results may be reliable evidence in evidence-informed practice.

Considering the specificity of the financial education and taking into account the fact that most activities of financial education is conducted under optional non-formal education it should be considered the increasing the scope of financial education in school as mandatory financial education.

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FOOD DESERTS AS A CONSEQUENCE OF MODERNIZATION OF FOOD RETAIL

Erika DUDÁŠ PAJERSKÁ

Abstract

Paper presents the development of the food retail which is characterized as a trend of replacing of traditional small grocery stores with large scale formats such as supermarkets or hypermarkets. These companies are looking primarily at the ratio of the market scale when they are activate their business. We analyze the impact of the initiative of the coverage and availability of food for population. Object of investigation are the areas with inadequate possibility of saturation of basic and essential needs of human also called food deserts. The basis for the contribution of the paper are opinions of experts both from domestic as well as from abroad environment on which characterizes the influence of modernization of food retail on creation of food desert as well as the opposite relation.

Keywords:

retail, food, food desert, availability, modernization

Introduction

By monitoring developments in food retailing in developing countries can be characterized by a trend of replacing traditional small grocery stores with larger scale formats such as supermarkets or hypermarkets. This process – termed as modernization of food retail, result in extensive research attention for more than four decades. As a result, many authors offer a picture of the future distribution of food retail.

The effectiveness of the initiative has a significant impact on coverage and availability of (quality) food for the population. International food chains are seeking to improve their market shares. But many economies provide an example of how changes in conventional (small) supermarkets have not brought any improvement in market share, but paradoxically resulted in the introduction of hypermarkets improved market share in food retailing (Hsueh, 2000). This encounter with the trend that the companies in the activation of its food retail are looking primarily at the ratio of the market and not ensuring the availability of food for consumers. Therefore, we are witnessing the creation and dissemination of areas with low possibility of saturation of basic and essential needs of human - food deserts. The paper will focus on the issues outlined through application of modernization in food retail. In doing so, we will use analysis of views from domestic as well as from foreign environment. Such analysis we create a basis for analysis of food deserts. We are interested in the impact of the modernization of food retail on creation of food desert as well as the opposite relationship.

Provided activities allow paper to discuss different views on the issue of food deserts in relation to the modernization of food retail.

1 Food availability in the concept of food deserts

Food deserts are relatively new problem, respectively they are one of the newest research of interest to retailers but most published works on this subject is represented mainly by studies and articles in professional journals. The focus of the publications is significantly different which is related to the interdisciplinary nature of the problem but also with how the authors define the term of food desert and how they performer it.

Although, during the recent years, food deserts become the object of numerous studies¹, the issue retains its interdisciplinary nature as evidenced by the increased interest in the issue not only by geography, but also sociologists, doctors or politicians.

Due to weaker terminology in the Slovak literature, paper is focusing mainly on understanding of food deserts through definitions from foreign authors. Such a step contributes to the fact that the experts who have been engaged in this field in Slovakia based on the experience of foreign authors.

1.1 Contributions of Slovak authors

So far, Slovak (geographical or economical) literature has paid very little attention on food deserts especially in a radius of several geographers and economists.

Food retail publications have been devoted to orientating primarily on post-transition phase in the rural environment of Slovakia (Lauko - Krizan - Tolmáči 2008; Krizan - Tolmáči - Linhart, 2009). Furthermore, the issue of food deserts deal with many opinions within the purview of the territory of Bratislava; it has to underline the publication of Križan, Tolmáči and Linhart (2009) or Križan and Danielová (2008). Food deserts in rural environment were undertook by Križan, Riška and Bilková (2013).

As it was said Slovak experts who have been engaged in this field took inspiration from the experiences of foreign authors.

1.2 Review of foreign experts on food deserts

Phenomenon of food deserts was first observed in British cities and due to this reason; the majority of literature about urban food desert comes from this environment. Therefore, the first time the term appeared in 1996 in a study for the British Government in addressing issues related to the population with low incomes where there are food deserts defined as the area where people face physical and economic constraints in the procurement of health-promoting foods (Reisig – Hobbiss, 2000).

¹ It is necessary to highlight contribution of papers of authors Walker et al., 2010; Wrigley, 2012; Gregory et al., 2009; Aparicio et al., 2007; or Reisig, 2001.

The term of food desert is quite wide and commonly defined and different definitions, respectively understandings often differ from each other. It also highlights Wrigley who admits that food deserts have become (in the late 90s of the 20th century) the part of the political concepts and despite their imprecise definition it is believed that also without systematic research showing evidence of extension of food deserts they still exist (Wrigley, 2002).

As was already indicated above, in the literature it can be found several definitions of food deserts in the context of field authors. Authors Cummins and Macintyre define a food desert as an area in which the food is expensive and also relatively inaccessible (Cummins - Macintyre, 2002). Others have defined them as the areas with low availability to the provision of health, affordable food normally associated with fewer big-sized retail store (Gregory et al., 2009). Wrigley conventionally defines a food deserts as locations with unfavorable approach to the provision of affordable healthy food, where the population is characterized by deprivation and deepening social exclusion (Wrigley, 2009). Russell and Heidkamp apply food deserts to the territory in scale or larger residential areas whose inhabitants have significantly limited access to adequate retail source of healthy and affordable food (Russell - Heidkamp, 2011). These residents live in relatively disadvantaged areas where socio-economic shortcomings are aggravated by a lack of transport options, so they have to look for other, more favorable retail food sources (for example supermarkets) even far distant. This definition is shared by several authors (Apparicio et al., 2007; McEntee - Agyeman 2010; Walker et al., 2010).

Significant are understood various definitions of food deserts (Furey et al., 2001; Whelan et al., 2002; Clarke - Bennison, 2004; Hendrickson et al., 2006; Hubley, 2011) that focus on the status of food deserts in rural of the country. However, those already occur less frequently, although that rural environment can be considered to have sufficient structural strength in the context of food retail.

Many authors focuses its attention on the international aspect of food deserts². Examine in detail the incidence of these areas, respectively draws their attention to the area (s) shall not subject such revolutions in retail food and therefore the availability of food in these areas is low. As a leading work in this area operates study by Reardon and Timmer, specifying different wave onset and development of food retail in the context of the world economy (Reardon - Timmer, 2007):

- a) First wave: South America, East America, West America
- b) Second wave: Southeast Asia, Central America, Central Europa
- c) Third wave: Russia, India, China and some of African regions
- d) Hypothetical Fourth wave: Sub-Saharan Africa

In identifying food deserts in the literature, it can be met with a number of methodological approaches (Commings - Macintyre, 1999; Furey et al., 2001;

² This is mainly for contributions of Dolan - Humphrey, 2000; Kherralah, 2000; Reardon - Barrett, 2000; Wheaterspoon - Cacho - Christy, 2001; Kirsten - Sartorius, 2002; Gibbon, 2003; Reardon et al., 2003; Wheaterspoon - Reardon, 2003; Humphrey - McCulloch - Ota, 2004; Minot - Ngigi, 2004; Minten, 2008.

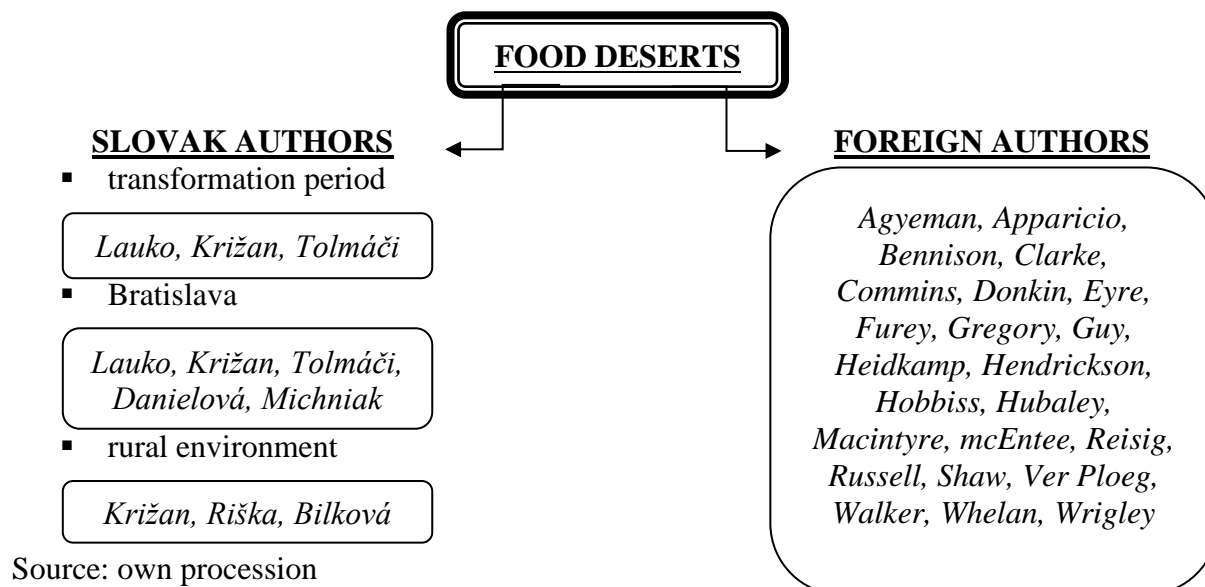
Smoyer-Tomic et al., 2006). Reisig and Hobbiss (2000) argue that the term food desert is more conceptual than it would be operated in defining geographic areas. Methods for such research are often based only on the quantitative measurement of physical distance to the nearest grocery (Whelan et al., 2002), or on the number of such outlets in a radius of a distance (for example Donkin et al., 1999). Further research include additional aspects of the issue and created a more comprehensive method which includes a variety of combined measurement of availability (for example Clarke - Eyre - Guy 2002; Smoyer-Tomic et al., 2006; Križan - Danielová, 2008). Yet there is no conclusive argument which method, respectively methods are relevant in the identification and characterization of the food deserts (Shaw, 2006).

As an appropriate tool for analyzing field of food deserts can be considered assessment of the availability of the selected (large-sized) stores in the region (Apparicio et al., 2007; Križan et al. 2008). Here protruding key concept of accessibility is one of the most important in connection with the issue of food deserts but is characterized as one of the hardest-defined terms (Michniak, 2002). The literature can come across plenty of definitions of the concept with different approaches to the study and the availability of different applications to solve economic or geographic problems. A more exact statement was formulated by the availability of W. R. Vickerman in 1974 as a combination of two elements. The first is a position relative to the target site. The second element is a characteristic of networks linking the monitored sites (Michniak, 2002).

Finally, in identifying food deserts is questionable choice of frontiers of territories included a food desert. To imagine, for example Križan et al. (2008) set out (in the application of binary rate) access to supermarkets and hypermarkets in the urban environment in the public transport network of the 15 minutes. In the network for pedestrians in the food deserts bounded distance, respectively time 15 min. walk (Ver Ploeg et al. 2009) or a distance of 500 meters from the residence (Wrigley, 2002). In general, however, most consumers used car when buying food which is the time usually set at a distance of less than 15 minutes (Furey et al., 2001).

Taking everything into the consideration, it is important to clarify approaches for definitions of food desert in scale of Slovak and foreign authors. For this intention, paper design Figure 1 Review of used approaches in terms of characterizations of investigated areas.

Figure 1 Review of used approaches (food deserts)



2 Food deserts as the effect of modernization of food retail

Due to the wide range of types of units that can act as an intermediary for the sale of food to the final consumer, we observe different evolution trend of modernization of retail foods. Individual types of stores are proclaimed and popularized by of how they can best adapt to new conditions and challenges of the market. Of course, in relation to how they can use these opportunities for the benefit of the consumer, too.

Currently, retailers are using technology to gain competitive advantage. For this reason, they use computers to design better forecasts. They serve them in order to better control costs, supplies and various electronic orders. Furthermore, they use it for making and maintaining contact between the merchant and the customer. Till nowadays, it was made directly in the store but now the communication takes place in other ways, such as the Internet (Kotler et al., 2007). Internet offers us a new dimension for communication, purchase and actual sale of goods and services. Microsoft's director sees it as a business tool: „The Internet is not just another sales channel. Future business will operate based on digital nervous system "(Kotler, 2003, p.45). Internet and information - communication technologies are not a primary impetus for innovation in retail. These are partly explained through the theory of evolution of retail. According to them, modernization of retail sale of food begins in dealings with low margins, prices and lower levels of sales and creates the preconditions for successful functioning competing retailers (Kotler, 2004). In recent years, modernization is manifested in the creation of certain trends - for example so-called. Shopotainment characterized by the combination of shopping with entertainment - and thus further outlines the direction of the food retail and retail sales ever (Hes et al., 2008).

Modernization of retail food also occurs in a similar concentration of commercial enterprises, higher retail specializations to standardized types and qualities of food, the pursuit of market dominance of trade and broad use of technology. And these are just examples of retail response to changes in society and in the economy. Providing universal respect, paper focus attention on the following three phenomena that influence the course of radical modernization of food retail.

The first phenomenon - globalization and internationalization of trade becomes part of the world, formed over the economy. Food retailers with unique business model and strong brand positioning will still appear in new countries, often due to escape from the saturated domestic markets. Concrete expression of global internationalization of the other food retailers, the development of multinational food companies, large retail chains and buying alliances, applying consistent global approach. Here it is important to note that hereinafter also referred holistic approach is also reflected in the understanding of the role of space in the modernization of retail foods. Retailers are focused on the placement area on a global scale by the level of the site. Global food retailers invest equally in all countries and even some countries - particularly those poorer behind the revolution in food retailing (Minten, 2008). The possibility of new potential raise for continuing modernization of this type of retail. Further said, the process of expanding trade companies from abroad also acts on the part of the consumer. There is, *inter alia*, a gradual unification of interests, tastes, lifestyle and preferences for brands to customers from different countries. Describing retail and consumer reaction to the first trend presents both strengths and drawbacks. As a positive fact, it appears that this will extend the possibilities for the application of the retailers store and abroad. The consumer gets the product range enormous size, and consistently functioning distribution network ensures the freshness and quality of food. From another perspective, however, this trend undermines growth market with domestic food (Cihelková et al., 2009), and the preference for a single global tastes in turn dampen the motivation of small retailers in selected economies that do not possess to such an important position. It is important to said that due to globalization and internationalization of trade in the future will have food retailing deal with certain expected uncertainties. One of the major problems seems to be the economic situation in which retailers will need to choose a strategy to eliminate any economic problems (Chmelíková, 2002).

Another trend of trade is characterized by developing new forms of selling food. It could be defined as booming sales without physical stores and represents a significant competitive classical trade. In developed European countries, we can see expanding electronic purchasing³, sales from vending machines⁴ or

³ e-commerce – buying and selling of products or services over electronic systems such as the Internet or a similar computer network. In this way, performed a large number of trade by using innovation, through electronic transfer of funds in the accounts, supply chain management, Internet marketing, online transaction processing, electronic data interchange (EDI), inventory management systems and automated data collection.

⁴ vending machines – sales through vending machines that offer customers 24-hour self-service. Automated sale apply when selling a wide range of goods such as cigarettes, coffee, newspapers, etc.

multimedia buying⁵. There is significant growth of retail without stores. Although it is typical that the food retail trade carried out through the chest, consumers are now offered by for example catalog or television shopping or selling via telephone and the Internet. In many cases, these forms of sale are only supplements to traditional forms. Online shops in most cases carried out traders who also have physical stores (Kotler et al., 2007). The modern trend is also spread of sales opportunities for individual or even unique application of new forms of selling food. The most promising and dynamic kind of business units in the world today are shopping centers, they have a specific form of horizontal integration in distribution channels. They combine different types of retail units including operations that provide a diverse range of services with extra fun activities (Kita et al., 2010). In the area of retail food is essential to note that participation of food retail in shopping centers acts as absolute fact for manager of the company and the consumer. The second trend of trade brings with appropriate advantages but also disadvantages in the field of retail food products. On the one hand, the expansion of new sales channels and facilitates purchases by consumers as a strong motivating factor for revenue growth seller. On the other hand, precisely the modern format stores increases the demands for application in the food.

The third issue of the phenomenon paper had already outlined. To strive for the broadest coverage of consumer needs through its offer of food induces the formation of a strong trend in retail chains. These can be defined as two or more outlets that are jointly owned and jointly managed. Offering essentially the same product, they are similarly equipped, use the same control system and procedures have centralized management and purchasing functions. They hire experts who deal with pricing strategies, sales policy control and create sales forecasts (Francová, 2009). On the basis of their size they can purchase large quantities of goods at low prices and economies of scale.

In many cases, retail chains operate as non-inspiring competition for traditional home food shops. They also can be defined as costly distribution level for the application of the smaller traditional retailers. The effort retail chains, however, is the coverage of the widest coverage of consumer area in order to achieve adequate revenues. This fact and especially its consequence result in two ways. On the one hand there is densely covered area of sales area, but on the other hand, the density depends on the level of the region (area) of their influence. Therefore, there is the creation of food deserts or opposite examples as food oases.

⁵ multimedia buying – form of shopping that uses a variety of tools for information and communication technologies involved, creating the need for belief or consumers to purchase a selected product or service. These funds are also used to simplify and speed up the actual act of purchase.

In general, the reasons why are still discovering new forms of trade and also happens to the modernization of food retail – these are explained by hypothesis so-called wheel of retailing⁶. Conventional retailers are increasing their services, but also the price to cover the costs related to their progress. Mainly these higher costs provide an opportunity to modernizing the food retail trade and the use of unit with lower costs and low availability of service (Kotler - Keller, 2007).

Recently, the modernization of the retail food is characterized by gradual expansion of the basis of some form of retail organizations. For this reason, paper point to the existence of the following types of such organizations as a result of the modernization of food retail:

a) *trading companies*

Considered as one of the biggest development of this century. Most often found in department stores, grocery stores, shoe stores, women's and men's clothing, and others.

b) *consumer cooperatives*

These are retail businesses that are owned by consumers. Team members got together the money to start their own business, how to vote on the business and elect a leadership team. Their essence lies in the fact that these stores sell at or below current prices and team members receive dividends based on how much during purchase (Chmelíková, 2002).

c) *concession organizations*

Treaty organization association between the concessionaire (wholesaler, manufacturer) and the concessionaire (independent retailers). Concessionaire has to demand compensation for the concession, for example initial fee, license fee on all sales, revenue share and more. Among one of the most successful concession system considers McDonald's.

d) *business conglomerates*

It is a freer form of company that combines several different retail lines and forms in the common ownership of the central ownership (Hricová, 2006). This creates a single combined company that performs certain functions in the distribution and management for all participants.

Diversity modernization of food retail depicts a study Kotler, Armstrong and Saunders in 2007. In a way summarize previously offered ideas on the modernization of the retail store, but most point to the uncertainty. They think that although the majority of retailers are still taking place in the traditional way

⁶It is hypothesis of author Malcolm Perrine McNair and is one of its most valuable contributions. Simply put, in this hypothesis professor provides guidance for understanding the patterns of changes in the retail sector. In fact, it suggests that there is a pattern or process life cycle of retail. It moves from the starting position, characterized by low prices, continuing to try to gain market share and eventually expanding its operations to more affluent consumers through higher product quality. For example, Japanese carmakers proceeded through the cycle after entering the US market with cheap cars. They captured to gain high market share and then gradually moved to more solvent clients with luxury vehicles with a higher price (Acura, Infiniti or Lexus).

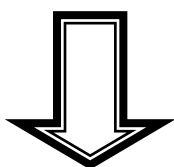
through the store shelves, consumers are now offering a range of other options, including orders from a catalog, TV purchases, purchasing by telephone and via the Internet. Although this development should act as a threat to some traditional shops, the authors argue that precisely those they should be taken as offering interesting opportunities (Kotler - Armstrong - Saunders, 2007).

Paper adds that such unpredictable directions for the modernization can be defined by the fact of interdependence of store and online sales. This is not an exclusive status of one of these types but to find their optimum point of interconnection. Most online stores is also made by traders who sell both online and in physical stores, not those who offer goods only in this way.

It is important to draw attention on rich literature about the development of supermarkets and modernization of food retail. The authors describe the problems and challenges faced by supermarkets in order to gain recognition both in developed and in developing countries (points in particular to the study Appel, 1972;. Findlay et al., 1990; Goldman 1976; Guerion, 1964; Kaynak - Cavusgil , 1982; Samiee, 1993; Zimmerman, 1955). Paper also rely on the work purchasing the formula describing the food in the different regions (Dannhaeusen, 1984; Goldman, 1982; Othman, 1990; Slater - Riley, 1969; Yavaş et al, 1981; Zain - Rejab, 1989). These in many ways explains why certain areas of reaching the level of modernization of the retail sale of foodstuffs which do not provide the other region. Taking everything into the consideration, paper simulate the effect and the ways of modernization of food retail by Figure 2 as a result of own procession.

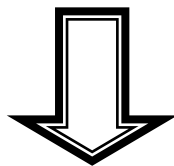
Figure 2 Chronology of modernization of food retail

<i>TILL YEAR 1989</i>	
<i>Status</i>	Centrally managed Abnormal prices Defined sales
<i>Sale capacity</i>	Undersized
<i>Structure of assortment</i>	Undersized
<i>Concentration</i>	Strong – to city centres
<i>Structure</i>	Predominance of small traditional shops
<i>National aspect</i>	Vast majority of domestic sales Predominance of domestic products



1989 - 2004

<i>Status</i>	Freer relations Normalization of prices Sales release
<i>Sale capacity</i>	Growth of private business <ul style="list-style-type: none">• new operators• privatization
<i>Structure of assortment</i>	Inflow of new product
<i>Concentration</i>	Atomization (deconcentration) No greater cooperation
<i>Structure</i>	Onset of large-size formats
<i>National aspect</i>	Arrival of foreign retailers Arrival of foreign products



NOWADAYS

<i>Status</i>	Freer relations Globalization Regional disparities
<i>Sale capacity</i>	Extinction of traditional retailers Extinction of specialized retailers Predominance of universal retailers Strong competition
<i>Structure of assortment</i>	Without limits
<i>Concentration</i>	Strong between smaller retailers
<i>Structure</i>	Predominance of big sized format <ul style="list-style-type: none">• supermarket• hypermarket
<i>National aspect</i>	Predominance of foreign retailers Predominance of foreign products

Source: own procession

Conclusion

In the context of economic transformation occurred in the food retail sector to a number of qualitative and quantitative changes. One of the most visible changes has become the entry of multinational retail chains and related massive allocation of investment resources to the deployment of new, large-scale modern retailing formats - supermarkets, hypermarkets, shopping malls. With this development is linked some of organizational changes occur when a growing proportion of retail turnover takes place in a group of some of the largest companies (concentration process) as well as the spatial variation, which results in a new location of retail units. There is some reduction in the number of local outlets.

The new spatial arrangement and also a strong focus on the customer authorized without direct legislative regulation by the state led ultimately to the creation of sites in which the option to procure food is not enough. As we have already defined, these areas are in the scientific literature defined as food deserts. The issue of food deserts in the conditions of the Slovak Republic is not sufficiently analyzed. In the previous text, work has pointed to the work orientating the particular area of food deserts in terms of localization in western Slovakia. The absence of adequate study of the problem of food desert is in many cases associated with the weak interest by retailers. Professional public often emphasizes that effort of food retailers to be interested in the issue of food desert evokes only a form of development of public relations in an effort to have better access to the city markets (Huber, 2011).

For conclusion of the analysis provided by the effects of the modernization of the retail food market to locate the units work use guidance from the author Križan. He produced some general recommendations for the types of retail grocery stores in relation to the territory of their location.

Table 1 Types of sales concept in terms of population of served territory

Served territory	Type of sales concept
Population of 8 – 10 000 residents	<i>discount store</i>
Population of 10 – 30 000 residents	<i>discount store, small supermarket, bigger supermarket, (small hypermarket)</i>
Population of 30 – 50 000 residents	<i>discount store, small supermarket, bigger supermarket, small hypermarket, (hobbymarket)</i>
Population of 50 – 100 000 residents	<i>discount store, small supermarket, bigger supermarket, small hypermarket, hobbymarket, (bigger hypermarket)</i>
Population of more than 100 000 residents	<i>discount store, small supermarket, bigger supermarket, small hypermarket, hobbymarket, bigger hypermarket, regional shopping center</i>

Source: own processing according to Križan, 2009

On this basis, paper present a table in which we suggest selected formats stores in relation to the population, which should be undertaken. Thus defines a limiting factor for the occurrence of food deserts.

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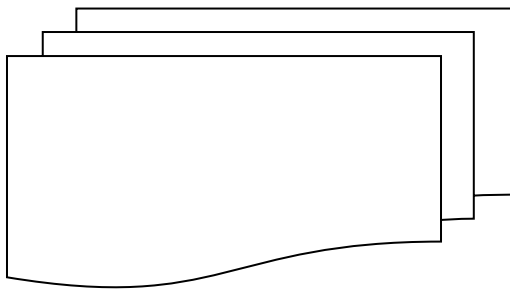


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