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Výkonný redaktor
Ing. Katarína Grančičová, PhD., e-mail: katarina.granciciva@euba.sk ; tel.: +421 2 67 295 556
doc. Ing. Miroslav Tóth, PhD.; e-mail: miroslav.toth@euba.sk ; tel.: +421 2 67 295 562

Administrácia
Ing. Ľudmila Lulkovičová, e-mail: ludmila.lulkovicova@euba.sk ; tel.: + 421 2 67 295 531

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Autori príspevkov

Peter Badura, Ing., PhD.
Faculty of Business Management, University of Economics in Bratislava, Department of Business Finance, Dolnozemská cesta 1/b, 852 35 Bratislava, Slovak republic
e-mail: peter.badura@euba.sk

Richard Bednár, Ing., PhD.
Faculty of Business Management, University of Economics in Bratislava, Department of Management, Dolnozemská cesta 1/b, 852 35 Bratislava, Slovak Republic
e-mail: richard.bednar@euba.sk

Vladimír Bolek, Ing., PhD.
Faculty of Business Management, University of Economics in Bratislava, Department of Information Management, Dolnozemská cesta 1/b, 852 35 Bratislava, Slovak Republic
e-mail: vladimir.bolek@euba.sk

Brigita Boorová, Ing., PhD.
Faculty of Business Management, University of Economics in Bratislava, Department of Production Management and Logistics, Dolnozemská cesta 1/b, 852 35 Bratislava, Slovak republic
e-mail: brigita.boorova@euba.sk

Nora Grisáková, doc. Ing., PhD.
Faculty of Business Management, University of Economics in Bratislava, Department of Business Finance, Dolnozemská cesta 1/b, 852 35 Bratislava, Slovak Republic
e-mail: nora.grisakova@euba.sk

Jakub Kintler, Ing., PhD.
Faculty of Business Management, University of Economics in Bratislava, Department of Business Economy, Dolnozemská cesta 1/b, 852 35 Bratislava, Slovak Republic
e-mail: jakub.kintler@euba.sk

Miroslav Kmeťko, Ing., PhD.
Faculty of Business Management, University of Economics in Bratislava, Department of Business Finance, Dolnozemská cesta 1/b, 852 35 Bratislava, Slovak Republic
e-mail: miroslav.kmetko@euba.sk

Klaudia Porubanová, Ing., PhD.
Faculty of Business Management, University of Economics in Bratislava, Department of Production Management and Logistics, Dolnozemská cesta 1/b, 852 35 Bratislava, Slovak republic
e-mail: klaudia.porubanova@euba.sk

Robert Šlosár, Ing., PhD.
Faculty of Business Management, University of Economics in Bratislava, Department of Business Economy, Dolnozemská cesta 1/b, 852 35 Bratislava, Slovak Republic
e-mail: robert.slosar@euba.sk

Peter Štetka, Ing. Bc., PhD.
Faculty of Business Management, University of Economics in Bratislava, Department of Business Economy, Dolnozemská cesta 1/b, 852 35 Bratislava, Slovak Republic
e-mail: peter.stetka@euba.sk

Branislav Zagoršek, Ing., PhD.
Faculty of Business Management, University of Economics in Bratislava, Department of Management, Dolnozemská cesta 1/b, 852 35 Bratislava, Slovak Republic
e-mail: branislav.zagorsek@euba.sk

Michal Zelina, Ing., PhD., ACCA
Faculty of Business Management, University of Economics in Bratislava, Department of Information Management, Dolnozemská cesta 1/b, 852 35 Bratislava, Slovak Republic
e-mail: michal.zelina@euba.sk

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SCIENTIFIC CONTRIBUTIONS

The limited impact of business model on business' prosperity

Richard Bednár, Branislav Zagoršek

Abstract
In this paper, we present the partial results of our three-year study of startup companies focusing on business model and its impact on startup's prosperity. In our research, we analyzed over 70 startup companies gathering the data via one on one in person interview with startup founder. To analyze the data, we used statistical software and the methods of descriptive and inductive statistics. We considered the results to be statistically significant if the p-value was ≤ 0,05. In our research, we found different potential blocks of business model, which could have an important impact on startups existence. However, we must conclude that the impact of the business model on startups' prosperity is rather of an individual case by case nature than a universal one.

JEL classification *M10, M13*
Keywords: *startup, business model, prosperity*

1 Introduction

Companies are constantly looking for new opportunities to innovate their business, adapt to the needs of the market, and make it easier for the investor to imagine their idea. Through new technologies, information flows and opportunities created by globalization, companies have new opportunities for business development. The second aspect of this development is the increased demand from customers who can compare the price and quality of competing suppliers around the world. Companies have a large database of information that they are hardly able to systematize into a transparent form that would help the manager to make decisions. So startups look for new options for changing their business model, which will bring them better prosperity.

The development of new technologies and the rapid development of the Internet have brought the trend of global businesses that have managed to sell their products and services throughout the world over a short period of time. These businesses are called startups. Authors Blank and Graham (2010) define startup as a temporary institution created to find a repeatable and scalable business model. Such a business model is based on the potential to achieve substantial sales growth without significantly increasing costs. According to Blank (2010), the startup is temporary because its goal is to become a big business. English businessman Graham (Šrenkel, 2010) emphasizes that a company is not a startup just because it is newly established. Startup is a fast-growing company - focuses on the rapid growth without geographic limitations. According to Graham at startup expected growth of multiple key indicators (e.g. sales, number of customers, and so on.) within the first few years after entering the market. Wilhelm from TechCrunch quantified indicators or rules to help determine what is or is not a startup. If one of these parameters can be applied, a company is not a start-up: the rate of revenue over the last 12 months exceeds $ 50 million; an enterprise has 100+ employees and / or its value exceeds $ 500 million. (Shontell, 2014) Czech businessman Vaňhara sees a certain degree of seriousness in the startup. It's not just an idea or a project. Startup already has life, customers, and so it's already a normal business. Jariabka, one of the leaders of the StartupCamp community, defines startups as innovative forms of high-risk enterprise with the potential for huge growth. The word startup can therefore be labelled as any startup company that already exists on the market and meets the following criteria. It creates a blue ocean in the industry, has a higher

entrepreneurial risk in establishing itself on the market, and after a successful start it is likely to grow fast. Startup search and creation is a creative activity that deals with discovering free spaces and creating new markets. Each part of the business model is appropriate for testing hypotheses that later turn into real business. (Blank, 2014) Ljudvigova (2017) argues that The essence of the startup is unconventional thinking, creativity, originality, or novelty. Holacracy was identified and described by Skorkova (2016) as a new type of organizational structure suitable for startups. Bolek (2016) in his work argues that information technologies are the driving force of the current society and that they need a systematic approach to be fully utilized. Procházková (2016) in her work on startups argues that factors influencing stability and competitiveness of startups are a simple and scalable product, brand value, and the right and diversified source of financing.

2 Business model

In defence of the business model, it is most difficult task to identify those processes and business components that would comprehensively outline how the business works. According to Teece (2010), the concept of a business model does not yet have a steady theoretical basis in economics. However, we will try to analyse and compare the opinions of several authors and see what the business model is and which components it contains. The concept of business generally defines the provision of § 2 par. 1 of Act No. 513/1991 Coll. of Commercial Code, as amended, as a continuous activity carried out independently by the entrepreneur in his own name and on his own responsibility for the purpose of achieving profit. The glossary of foreign words is defined as a description of the phenomenon examined (Šaling & Ivanová-Šalingová, 1997): a metallurgical - solid form of casting; a cyber - device or math operator that displays or describes the behaviour of another device or operator. The model is a static description of reality in a form that is relevant to a given industry or region. We can say that the business model describes the activities of the entrepreneur that he creates in order to make a profit. Its benefits are both to improve the functionality and economy of the business, and consequently to find and develop a competitive advantage that can be revealed by an enterprise that is aware of the broader sense of the business model (Slávik, 2011). Remeňová (2017) in her research of revenue models wrote that whether the startups have one or more revenue streams depends on the business model and customer segmentation. Slávik and Zagoršek (2017) in their research claim that a strategy requires a certain business model configuration to be effective. Jankelová et al. (2013) studied the importance of the strategic decision-making process in micro-companies. They argue that effective strategic decision making significantly increases their performance, success and survival.

Several authors define the business model as a money-generating system. In their view, it is purely an economic concept where revenue and costs are generated. It is a set of activities where, due to proper interconnection of processes and technology, profit is ultimately created. The business model describes the processes and profits of the company. The following authors, whose views are shown in Table 1, explain the business model as economical, or are in favour of this opinion:

Table 1
The author's opinions on the economic business model

Author	Definition	Keywords
John Mullins and Randy Komisar (2009)	Business model means a model of economic activity - the cash flow in and out of the organization for various purposes and in different timings. This determines whether you are returning money and therefore attractive to your investors. In short, your business model is the foundation of your business in all its aspects.	cash flow
Henry Chesbrough (2006)	The business model is a useful structure that combines ideas and technologies with economic results.	structure, economic results
Alfonso Ganbardella and Anita McGahan (Baden-Fuller & Morgan, 2010)	The business model is a mechanism for ideas into revenue using the reasonable costs.	revenue generation, costs
Thomas Wheelen, David Hunger (2008)	A business model is a method of making money in a given business environment. It includes the key structural and operational characteristics of the company - as a profit.	revenue generation

Source: Own processing

In our opinion, a purely economic business model does not provide a comprehensive view of the business. Besides the description of income and costs, it should define the other side of the business, i.e. value creation. In Table 2, the authors combine in their definitions the concept of creating profits and values into one set.

Table 2
The author's opinions on the economic value business model

Author	Definition	Keywords
David J. Teece (Baden-Fuller & Morgan, 2010)	The business model defines how a company delivers value to the customer and converts payments into profits.	deliver value, revenue generation
Joan Magretta (2010)	The business model explains how the business works. It answers the questions: Who is a customer? How do we make money? What is the basis of our business? How do we deliver the value to the customer with appropriate costs?	business system, customer, revenue generation, value creation
Michael Rappa /2010)	A business model is a business method that is well run in company to generate revenue. The business model defines in detail how the company makes money and what brings value.	revenue generation, value creation
Alexander Osterwalder and Yves	The business model describes the logic of how an organization produces, delivers, and captures (controls) value and how the money is made in the company.	creation, delivery and control of value

Pigneur (2009)		
Štefan Slávik (2011)	The business model is a money-making machine, but money is important not only to produce, but also to absorb it. A business model depicts an enterprise as a place of decision and its consequences, is also a set of resources and activities, in varying degrees of detail and operational perspective, which ultimately result in and serve to offer value (benefit) to customers.	money-making machine, place of decisions, resources and activities, the result is value

Source: Own processing

Thus, we can say that the business model is a business logic, i.e. the way the business generates value for its interest groups. (Baden-Fuller & Morgan, 2010). Its creation makes costs; the sales generate revenue. A company produces this value, controls it and sells to its customers. In our opinion, the business model should define both areas, creating value and generating profits. It comes from business logic where value is created that is interesting to the customer and must be so profitable that it is also interesting for the entrepreneur. It is essential to combine these two worlds, both customer and corporate, into one. In our opinion, the business model describes the economic and value part of the business. It defines internal processes and activities, customers, distribution channels, value creation and business management.

The heterogeneity of the view to define the business model has also been reflected in the different understanding of the components that the business model should contain. In the following section, we are focusing on finding a concept that would comprehensively define the business model and analyse approaches. The business model, according to Johnson, Christensen and Kagermann (2008) consists of 4 elements that are interconnected and create value in the enterprise. The concept is shown in Table 3. These are the following components:

A. Benefits of customer value - we understand the successful company as the business that creates value for the customer and gives solutions for customers' problem. Without defining this value, no good business model can be created.
B. Profit formula – a plan how a company creates value for itself when it transmits value to the customer.
C. Key resources - key concepts: people, technology, products, long-term tangible and intangible assets, channels, accessories, and brand that delivers value to a targeted customer.
D. Key processes - successful companies have operational and management processes that allow them to deliver value in a way that can be repeated successfully. This concept includes training, development, manufactory, budgets, planning, sales and services.

According to Afuah (2003) the business model is influenced by the activities the company performs and the resources it uses. Because of this, the models are divided into either low cost or differential. Based on these two key approaches and activities, we can tell you what the company's profitability is. The Afuah's business model concept divides the business model into four key components: industry factors, resources, position, costs and activities.

The most complex concept was made by Osterwalder and Pigneur (2009). Two main scientists, Osterwalder and Pigneur, seven major collaborators (Jean-Pierre Cuoni, Dagfin Myhre, Mariele Sijgers, Gerts Steens, Bas van Oosterhout, Trish Papadakos, Iqbal Quadir) and 470 collaborators from the scientific environment from practice worked on the concept of the

Canvas model. The concept divides the business model into nine blocks. Their report is shown in Table 3.

Table 3
Concept of the Canvas business model

Components	Specification
1. Customer segments	For whom do we create value? Who are our most important customers?
2. The value the business brings	What value do we bring to the customer? Which of the customer's issues do we help solve? Which customer needs do we satisfy? What packages of products and services do we offer to each customer segment?
3. Channels	Through which channels do we reach our customers? How do we achieve them now? How are our channels integrated? Which of them work best? Which are the most cost-effective? How do we integrate them into our customer routine?
4. Customer Relationship	What type of relationship do we expect from each customer segment to create and maintain with them? Which of them have we already created? How expensive? How are they integrated with the rest of the business model?
5. Revenue stream	What value do customers want to pay for? What do they actually pay for? How do they pay? How would they like to pay? How much does each stream contribute to total revenue?
6. Key resources	What key sources require our values? Our distribution channels? Customer relations? Revenue streams?
7. Key activities	What key activities are creating value? Our distribution channels? Customer relations? Revenue streams?
8. Key partners	Who are our key partners? Who are our key suppliers? Which key sources do we get from partners? Which key activities do partners hold?

Source: Own processing

Taking into account all three concepts, the most suitable for our needs is the concept of Johnson, Christensen and Kagerman, and the Canvas concept by Osterwalder and Pigneur. Both describe not only the creation of value, activity and processes, but also the economy and therefore the economic component of the business. Canvas, however, generates more business insight. In a modern way, it analyses and describes the business model. The authors offer a graphical overview and visualization of the business model to the theoretical part, which adds value to this concept. It is sufficiently practical and broad enough to help us analyse business and look for innovations, gaps and deviations on the market. At this stage, knowledge of business models is important to analyse the processes of companies, their value and profit generation, and point to the need to use entrepreneurial business concepts for business innovation. If the company wants to change its model, it is important to not stay, only for a courageous idea, but also create a new concept, and later a strategy to help implement that idea. (Schmitt, 2007)

3 Methods and Aims

The main objective of our paper is to answer whether there is a direct and universal relationship between business model and prosperity of a startup company. To study this, we were trying to prove a hypothesis that the prosperity of a business can be influenced by developing the right business model block and that these have a universally applicable pattern. To test this, we used the number of users, number of paying users and the ability to cover costs and creating income and a dependent variable indicating prosperity.

During our three-year research project, we studied over 70 startups covering their business model and competitive strategy. In this paper, we present the results of the third and final research round. In our research, we applied following methods. First, we made a general description of the data that we acquired in our research. We described the present state of startup companies, using descriptive statistical methods. During the third round of our research, we collected the data from 53 surviving startup companies using a one on one in person interview with standardized structured questions, interviewing the company founders. Next, we studied the association between the business model blocks and prosperity of startup companies. To analyze the differences, we used the paired sample t-test. We considered the results to be statistically significant if the p-value was 0.05 or less. To analyze the data we also used the inductive statistical method of multiple linear regression supported by ANOVA.

In general, the variables were constructed that they could have values from 1 to 5, where the greater number, the better. This could measure the difference from none to great, the development from almost none to fully developed or performance from zero to creating an income. To analyze the business model, we used modified Business model canvas by authors Osterwalder and Pigneur (2010) presented in Table 4.

Table 4

Business model indicator construction

<table>
<tr><td rowspan="2">Key Partnerships
1.Partners Presence</td><td>Key Activities
1.KA Presence</td><td rowspan="2">Value Propositions
1.Customers' Needs Satisfaction
2.Product development</td><td>Customer Relationships
1.CR Development</td><td rowspan="2">Customer Segments
1.Customers Identification</td></tr>
<tr><td>Key Resources
1.KR Presence</td><td>Channels
1.Distribution Ch Development</td></tr>
<tr><td colspan="3">Costs Structure
1.Cost Structure Knowledge</td><td colspan="2">Revenue Streams
1.Knowledge of Final Price
2.Knowledge of Demand</td></tr>
</table>

Source: Adapted from Osterwalder and Pigneur (2010)

4 Results

In our research, we found following to describe the startups in our sample. The corresponding data are shown in Table 5. Startup teams were rather small. We found that 81 percent of the startups did not have more than nine team members. Those could be paid, unpaid or employed, depending on the policy and startup's options and policy. More than two-thirds of startups in our sample were providing some kind of services (either traditional or applications). Moreover, almost one-third were in the application business that is well scalable and is thought to be an obvious fit for startups. As this research round was conducted almost after three years, it is understandable, that the developmental stage is skewed in the direction of the well-developed business idea with a large majority of companies having at least some revenues.

Table 5
Description of startups‘ characteristics

	N	%		N	%
Startups‘ characteristics					
Number of team members			Number of users		
1 - 3	9	17	No users	2	4
4 - 6	19	37	A few	5	9
7 - 9	14	27	Tens	11	21
10 and more	10	19	Hundreds	15	28
Type of business			Thousands and more	20	38
Manufacture	14	26	Number of customers		
Service	22	42	No users	7	13
Application	17	32	A few	8	15
Phase of business idea development			Tens	16	30
Idea	0	0	Hundreds	11	21
Developmental	0	0	Thousands and more	11	21
Prototype	9	17	Income		
First revenues	16	30	No revenue	7	13
Growing revenues	28	53	Covering up to 25% costs	12	23
			Covering up to 75% costs	11	21
			Cover up to 100% costs	6	11
			Return on costs up to 25%	11	21
			Return on costs up to 50%	5	9
			Return on costs over 50%	1	2

Source: Own calculation

Regarding the prosperity of the studied startups, we found that two-thirds of studied startups had the number of users at least in hundreds after almost four years existence in average (M =3,84, SD = 1.87). On the other hand, the number of customers (paying users) is distributed more widely. Just over a third of startups in our sample had hundreds or more customers. This indicates that the startups have a problem to identify the right revenue model and have a problem to monetize their users and create paying customers. Using the paired samples t-test, we tested, whether there is a significant difference between the number of users and customers. We found, that there is a significant difference between the number of users (M=3,87, SD = 1,14) and paying users (M=3,21, SD=1,31); t(52)=3,54, p=0,001, what indicates the validity our previous argument. Regarding the income, one-third of studied startups in our research sample were profitable.

In Table 6 we describe the state of business model development level of studied startups. After almost four years existence in average of studied startups the most developed a fully functioning business model. Most developmental challenges can be expressed as finding the right and most effective activities, distribution channels, and understanding the demand. We interpret this as a potential failure of startups to produce and deliver the product effectively to customers. The most developed block is the product. The companies usually succeed to develop their product according to their vision.

Table 6
Description of business model attributes

	N	%		N	%
Attributes of business model					
Customers' Needs Satisfaction			Key Activities Presence		
First idea	2	4	Missing concept	1	2
Coherent concept	5	9	First idea	1	2
Finding the proof of concept	12	23	Coherent concept	7	13
Full functionality	34	64	Finding the proof of concept	19	36
Product development			Full functionality	25	47
First idea	1	2	Partners Presence		
Coherent concept	3	6	Missing concept	2	4
Finding the proof of concept	8	15	First idea	5	10
Full functionality	41	77	Coherent concept	2	4
Customers Identification			Finding the proof of concept	13	25
First idea	2	4	Full functionality	30	58
Coherent concept	2	4	Knowledge of Final Price		
Finding the proof of concept	4	36	Missing concept	1	2
Customers are identified	5	57	First idea	3	6
Distribution Ch Development			Coherent concept	3	6
First idea	3	6	Finding the proof of concept	13	25
Coherent concept	8	16	Full functionality	33	62
Finding the proof of concept	14	28	Knowledge of Demand		
Full functionality	25	50	Missing concept	2	4
Customer Relationship Dev			First idea	4	8
Missing concept	1	2	Coherent concept	10	19
First idea	1	2	Finding the proof of concept	10	19
Coherent concept	6	11	Full functionality	27	51
Finding the proof of concept	13	25	Cost Structure Knowledge		
Full functionality	32	60	First idea	2	4
Key Resources Presence			Coherent concept	5	10
First idea	1	2	Finding the proof of concept	12	24
Coherent concept	3	6	Full functionality	31	62
Finding the proof of concept	16	32			
Full functionality	31	61			

Source: Own calculation

The perceived final state of the product development in combination with the failure to produce and deliver it effectively opens a question of the viability of those businesses. This could be an interesting concept for further studies. We propose to study whether the combination of having a final product, in combination with not effective production and inability to deliver can be an early indicator of startups downfall. This could be then used in the evaluation of the business by the investors as well as by the startups themselves. The proposed mechanism is that if the product has its final shape and is made according to its vision, it should not fail to be produced or delivered. If so this could be a sign of concept failure.

5 Discussion

In our study, we can see different levels of separate blocks of the business model. Although our sample is skewed due to development of startups, if there is a relation between the level of development of each business model building block and prosperity of the business, our statistical analysis should show such relationship.

In this paper we were analyzing this relationship from the perspective of whether it is possible to give any recommendation from the perspective of business model or whether the business model is an obligatory part of the business, having an essential impact on each business but not having a universal effect.

We tested a hypothesis that prosperity of a business can be influenced by developing the right business model block and that these have a universally applicable pattern. To test this, we used the number of users, number of paying users and the ability to create income as dependent variables indicating prosperity.

In Table 7 we show the linear regression analysis of how the business model block influences the performance of startups measured in users, customers, and income. From these three models, only one is statistically significant. We found that stating to know customers' needs and thinking to have the right activities in place had a negative impact on the number of customers while understanding the demand had a positive one. Such formulated model involving all the business model blocks explains 24 percent of the variability of the number of customers. As this is an observational study without a real possibility to conduct an experiment with introducing randomness and control, we cannot be sure about the direction of influence. However, we can draw a model considering different possibilities and have them further tested.

The models of income and number of users are not statistically significant. However, we can see hints of possible influence. There is an indication the partners presence ($p \leq 0.01$) and the knowledge of cost structure ($p \leq 0.05$) positively influence the number of users. The income seems to be positively influenced ($p \leq 0.05$) by having the right partners. Based on our results it would be interesting to further study the potential causation chain of partners presence and cost structure knowledge on the number of users. We think about it as follow. To be able to serve a large number of users with the free product; the startup should have a good knowledge of the cost structure, otherwise it could create an uncontrolled negative cash flow. Moreover, it seems to be beneficial to have partners that can help with acquiring customers. Regarding the income, the regression analysis indicated that having the right partners present could positively influence the income. We think that the mechanism could be that the partners know what works. They could also be strongly motivated to push the startup to be financially successful having some financial incentives themselves.

Table 7
Regression analysis of the impact of business model on the startups' prosperity

	N of users		N of customers		Income	
	B	SE	B	SE	B	SE
Customers' Needs Satisfaction	-0,46	0,36	*-0,77	0,35	-0,29	0,48
Product development	0,58	0,56	-0,30	0,54	0,10	0,75
Customers Identification	-0,16	0,35	-0,06	0,34	0,01	0,47
Distribution Ch development	-0,31	0,23	-0,30	0,22	-0,08	0,31
Customer Relationship Dev	-0,51	0,38	0,00	0,37	0,34	0,52
Key Resources Presence	-0,51	0,46	0,52	0,45	-0,15	0,62
Key Activities Presence	-0,16	0,25	*-0,51	0,25	-0,57	0,34
Partners Presence	**0,62	0,22	0,42	0,21	*0,71	0,29
Knowledge of Final Price	0,24	0,36	0,68	0,35	0,10	0,49
Knowledge of Demand	0,13	0,23	*0,49	0,23	0,23	0,31
Cost Structure Knowledge	*0,82	0,38	0,27	0,37	0,50	0,51
R^2 Adjusted	0,02		0,24		0,12	
N	47		47		47	
F	1,09		*2,37		1,59	

Source: Own calculation
Note: ** $p \leq 0.01$, * $p \leq 0.05$

Considering our hypothesis, we must conclude that there is a very limited if any impact of the business model on startups prosperity that can be universally observed. The R^2 were low the SE high and the influences inconclusive. As we understand the business model, this makes sense, because there is not one best way how to develop a business. So we argue that the business model a well-developed business model is an obligatory part of businesses success, but there is not really a best way how to build it.

6 Limitations

There are also some limitations of our study design that we must acknowledge and that should be considered when using and interpreting our results. The selection of the sample was not made using randomness what is in our field nearly impossible, considering that the high non-responders ratio that would emerge otherwise, would make the sample not representative. The sample was selected from a specific area. To acquire the startups to cooperate we addressed organizations grouping them (e.g. accelerators). This, however, excludes startups that are not in such groups. Moreover, startups in accelerators tend to be ones that investors already invested in and are possibly better than others. Another possible bias is self-selection. Startups that respond to our request are more probable to have certain quality and self-confidence than those that did not. We also used self-evaluation of startups founders therefore also a potential for a bias. The idea is that the founders are experts and aware of their situation and the situation on the market. Despite these biases, our research can be of a great value as it provides a lot of information about the startup community and uncovers some behavior mechanisms.

7 Conclusion

In conclusion, a third of studied startups were able to create an income after average four years of existence. The biggest challenge in this regard is to find a reasonable revenue model. The studied startups were in general able to find user but were struggling to monetize them and to create paying users.

Studied startups were focusing mostly on developing their product. Meanwhile, most developmental challenges were to find the right and most effective activities, distribution channels, and understanding the demand, what we took as a potential failure of startups to produce and deliver the product to customers.

We were able to identify several significant but also some insignificant business model blocks that had an impact on businesses prosperity. However, we interpret this impact as effectively inconclusive as it was rather small. These impacts should be further tested as they have the potential to provide a developmental guideline for developing startup business model. Considering these factors as important on the individual level, we did not find conclusive evidence that there is a universally applicable impact of the business model on startups prosperity.

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Factors affecting a decentralized virtual currency on the money market

Vladimír Bolek, Michal Zelina

Abstract
The known alternatives to conventional money which use information technologies include virtual currencies. They represent currency in circulation. They are currently spreading and with them the possibilities of their use as a payment means for buying goods and services on the Internet. One of the virtual currencies is Bitcoin. Bitcoin is a complex product that represents the concept of cryptocurrencies. They are generally incomprehensible and abstract, and to understand how and why Bitcoin works requires a higher degree of technological knowledge. Conventional currencies, on the other hand, can be issued unlimitedly. In simple terms, we can say that the creation and the verification of transactions in this form of virtual money is based on the principle of mathematical computations known from cryptography. Saving and subsequent verification of completed transactions takes place in a publicly available distributed transaction database. This distributed database system is a set of nodes of the computer network that are interconnected in the communication network. The main goal of the article is to analyse the development of Bitcoin and to define the possibilities of its trading. The Bitcoin price has been very unstable lately making it difficult to assess the real value of this currency, while increasing the risk of investors' losses. There are several factors influencing the development of its exchange rate.

JEL classification: *E51, G19, M19*
Keywords: *virtual currency, cryptocurrency, cryptography, exchange rate, Bitcoin*

1. Introduction

Investors and traders are increasingly interested in investing in and trading virtual currencies. In professional terminology digital currencies are called cryptocurrencies. Perhaps the most famous virtual currency is currently Bitcoin. The idea itself and the subsequent Bitcoin introduction project originated in 2009 when a group of people, or an individual (it is not exactly known who founded it), with the pseudonym Satoshi Nakamoto, published a document that contained the new cryptocurrency algorithm and the source code of the first version of the open-source client (Nakamoto, 2008). This document included the first version of the open-source application software that practically reflected the use of digitized currency in practice. Due to the disclosure of the algorithm of this currency, new developers, programmers and enthusiasts of modern technologies became interested in it.

The article gives a picture of the platform on which cryptocurrencies are based, defines the most traded digitized, virtual currencies, points out and evaluates the development of the selected cryptocurrency Bitcoin. The main goal of the article is to analyse the development of Bitcoin and to define the possibilities of its trading.

2. Theoretical Background

The principle of the currency functioning is based on a decentralized system. It is a liberal currency with the absence of central authorities such as banks that would regulate it. Certain rules are set for the Bitcoin network, which are known in advance, they are transparent and fixed. The basic building block of the cryptocurrency is the use of a shared virtual book, cryptography and digital signatures to secure the currency against cybercrime. This currency is not covered by any real commodity. Using public transaction history, it is possible to ascertain

the movements and volumes of the bitcoins transferring and their very existence in order to avoid double-spending (Karame, Androulaki, & Capkun, 2012; Karame, Androulaki, & Capkun, 2012). The official Bitcoin.org website specifies double spending as: „If a malicious user tries to spend their bitcoins to two different recipients at the same time, this is double spending. Bitcoin mining and the block chain are there to create a consensus on the network about which of the two transactions will confirm and be considered valid".

In order to make financial transactions, the investor needs hardware and software, or use an available client. Basic hardware equipment includes a computer that meets the minimum requirements for a specific application software to manage his/her virtual wallet. Nowadays, there are several software applications (virtual wallets) to manage cryptocurrencies available, which can manage several virtual currencies and contain brief instructions for use. The principle of the virtual wallet application software algorithm consists of pairs of public and private keys (Reid & Harrigan, 2013). The public key is the bitcoin address itself that you need to own so that you can accept transactions, funds in the virtual currency. The opposite is the private key to that address, through which the owner can send money to someone else. The whole process runs on the principles of cryptography and digital signatures. Each Bitcoin transaction is signed by the private key of the user initiating the transaction, providing mathematical proof that the transaction is actually originating from the address owner and preventing the transaction from being changed after it has been dispatched. Because this key pair is mathematically linked, any data or information secured by the private key can only be decrypted with the corresponding public key, and vice versa. Encryption and decryption (Katz & Lindell, 2008) ensures privacy by preventing adversaries from accessing the message sent from sender to receiver. Message authentication, however, must also be used in conjunction with public key encryption. Digital signatures are a popular mechanism for message authentication, and have three desirable properties: it allows the receiver to validate that the correct sender did in fact create the message (authentication), that the sender cannot deny having sent the message (non-repudiation), and that the message was not modified in any way by an adversary (integrity).

Specifically, the Bitcoin protocol uses the Elliptic Curve Digital Signature Algorithm (ECDSA), a variant of the Digital Signature Algorithm (DSA). A group is an abstract mathematical entity "consisting of a set G together with an operation * defined on pairs of elements of G". The operation * must guarantee the following four properties (Johnson & Menezes 1998):

1. Closure: $a * b \in$ for all $a, b \in G$
2. Associativity: $a * (b * c) = (a * b) * c$ for all $a, b, c \in G$
3. Existence of Identity: $e * a = a * e = a$ for all $a \in G$ where e ∈ G is the identity
4. Existence of Inverses: $\forall a \in G, \exists b \in G$ such that $a * b = b * a = e$ and b is denoted as a^{-1}

Saving and subsequent verification of completed transactions takes place in a publicly available distributed transaction database. This distributed database system is a set of nodes of the computer network that are interconnected in the communication network. The Bitcoin network is a fully decentralized network, peer-to-peer, meaning there is no master computer on this network. So it cannot happen that someone would put it out of operation. Peer-to-peer (Schollmeier, 2001; Schoder & Fischbach, 2002) is a group of computers connected in order to share resources and information by users, with no central position in the network. Peng (2013) claims: „The peer-to-peer network essentially acts as a trusted 3rd party, ensuring that no double

spending can occur. In conjunction with this, the proof-of-work system prevents malicious users from forging or modifying transaction blocks that have already been added to the blockchain". On the opposite, in a typical client-server network, the central server controls the level of each user's access to publicly shared folders. Therefore, it is difficult to damage or disable the Bitcoin network. The principle of functioning of these nodes is that the nodes cooperate with each other so that from each node it is possible to make available data that are stored in another node as if they were placed on their own node. All transactions are recorded in blocks that are not created automatically but are linked to each other. A block is a processed transaction grouping, which means that the node will take transactions that need to be confirmed. It then sorts them in a certain way and then processes them using the encryption protocol. The result of the encryption is the so-called "hash".

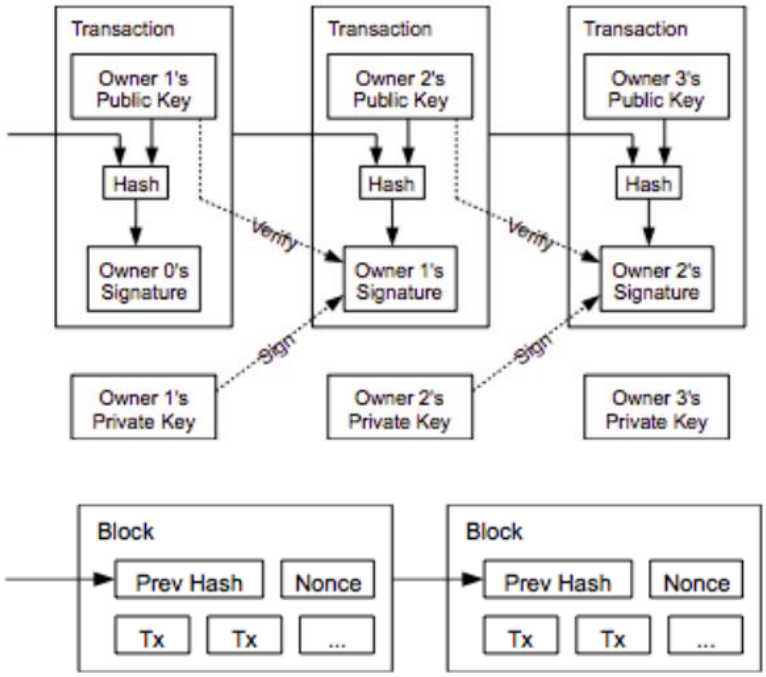
To supplement this, the Bitcoin protocol also uses a SHA-1 cryptographic hash function. Public key cryptography and digital signature schemes typically use hash functions in their algorithms, which convert strings of arbitrary length into shorter ones of fixed-length. For example, the widely-used SHA-1 hash function produces a 160-bit hash value. Rather than encrypting the entire message, it is often more sensible to encrypt a hashed version of the message. Ideally, the hash function should be one-way: given a fixed-length binary output, it would be very difficult to find a string that hashes to the given output (Mentis, 2005). Additionally, the hash function should be collision-resistant—that is, it would be computationally infeasible to find two messages that share the same hash value (Katz & Lindell, 2008). In other words, it would be infeasible for any probabilistic polynomial algorithm to find (Bellovin, 2005):

$$x, y, \ x \neq y \text{ such that } H(x) = H(x')$$

A one-way, collision-resistant hash function should make it impossible to forge the signature or modify the original message by attacking the hash function itself.

The main goal is to have the hash as low as possible. This chain of consecutive blocks is called blockchain. Blockchain specifically deals with the way in which data is structured and allows for the existence of decentralized digital ledgers where single organizations are not able to effect transactions (Hackett, 2016). Currently the two most widely adopted cryptocurrencies are Bitcoin and Ether, the currency that is used to power the Ethereum blockchain. Ethereum's main point (D'Alfonso et al., 2016) of differentiation is the ability to leverage the application of 'smart contracts' within its code. Ethereum (Wood, 2014) is a project which attempts to build the generalised technology; technology on which all transactionbased state machine concepts may be built. Moreover it aims to provide to the end-developer a tightly integrated end-to-end system for building software on a hitherto unexplored compute paradigm in the mainstream: a trustful object messaging compute framework. Ethereum, taken as a whole, can be viewed as a transaction-based state machine: we begin with a genesis state and incrementally execute transactions to morph it into some final state.

Figure 1
Blockchain Mechanism



Source: Nakamoto, S. (2008). Bitcoin: A peer-to-peer electronic cash system. Retrieved from http://bitcoin.org/bitcoin.pdf.

Each block contains and confirms transactions that have been made since the finding of the previous block. A valid block requires complex computational performance. A new block will be logged into Blockchain and all nodes start searching for another. If the node does not find a low hashed block, the block entry does not change, but only the so-called "nonce", which is essentially another number "pinned" to transactions. Hashing function is an algorithm that translates input data into a "relatively" small number. This feature is mostly used for faster table comparison or data comparison. Blockchain is a list of all valid blocks that have ever been created in the Bitcoin network. Because blocks contain data on all transactions, Blockchain is both an "accounting book" or an "account statement" of all the transactions that occurred within the Bitcoin network. In order for users to be able to execute transactions and safely pay by the cryptocurrency, the operation of the network is technically provided for by volunteers called "bitcoin miners", who supply it with appropriate hardware equipment. A miner who generates a valid block will receive a reward for this work in the form of completely new Bitcoins. The mining HW is unfortunately not a simple PC or a powerful graphics card. To be able to mine you need a special HW also called ASIC (Application-Specific Integrated Circuit). The mining pool is a combination of the calculating capacity of the individual miners grouped in this manner. Finding a block in the mining pool is much easier.

Bitcoin mining is nothing else but confirming the accuracy of transactions in the Bitcoin network. The mining process is rather complex and involves advanced cryptography concepts. In order to prevent users from being able to cheat and to send more Bitcoins than they own, someone has to monitor them. In the banking world, this role is borne by banks, but in a decentralized network, users have to monitor it by themselves. Using virtual currencies is often the target of both economic and computer crime. This currency is often used for anonymous transactions to pay for unconventional goods or services (weapons, medicines, drugs or hacker

services). Therefore, it is necessary to adhere to the principles of information security, to protect the user from malware and attacks by hackers or other interest groups.

There are several ways how to obtain the virtual currency into a virtual wallet. The most common and in terms of information security the least dangerous is the sale of goods, products and services. Through an e-shop various products or unnecessary electronics are sold, and so on. It is enough to find a buyer who wants to buy goods for Bitcoins. It's a fairly simple way to obtain this virtual currency.

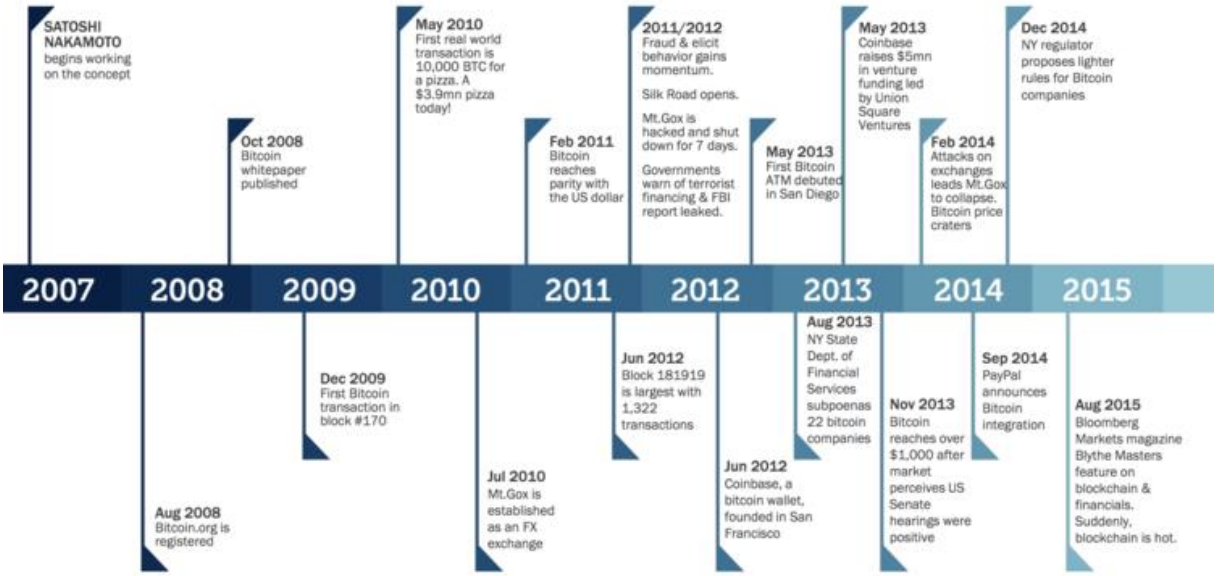
Simple ways of obtaining Bitcoins also include currency exchange. There are specialized currency exchanges that have the Bitcoin currency in their portfolio. There is the Slovak Bitcoin currency exchange available online as well. After entering an amount, completing the contact form and dispatching the Euros, subsequent conversion and verification, the Bitcoins will be credited to the virtual wallet. There are also locators available for those interested in buying and selling Bitcoins. These are the search engines that find and identify in the vicinity potential Bitcoin sellers and buyers. At the same time, you can sign up on a page and offer Bitcoins for sale.

Cash is transferred to an account via wire transfer serving as a deposit. An example is Bitstamp, the Slovenian stock exchange, operating under the British company Bitstamp LTD. It allows deposits in EUR, USD and GBP. Most of these exchanges require identity verification based on a copy of the ID card and the verification of the place of residence. The place of residence is verified based on a copy of a bill for telephone services or power. These conditions are also imposed by the Bitstamp exchange. In terms of information security, it is important to realise that personal and very sensitive data are provided to a third party, which may be misused. Trading on this exchange is through the USD currency, other currencies are automatically converted to USD. There is an exchange trading bitcoins also in Bulgaria - BTC-e, in China - BTC China, and online Bitcoin exchange called Coinfloor based in London, etc. Abroad, the services of brokers that act as a link on the exchange are also used to obtain the virtual currency. They require a remuneration for their brokerage service, which may also be in the form of Bitcoins.

3. Methodology

The object of the survey is the Bitcoin virtual cryptocurrency, which also represents an open source P2P payment network. When preparing this article, we analysed domestic and foreign literature and compared the views and definitions of the authors concerning the virtual currency Bitcoin. In the preparation we applied the history of the development of the virtual currency, as shown on the following figure.

Figure 2
History of Bitcoin development



Source: EADC. (2018). Blockchain. Retrieved from https://eacodex.com/blockchain/

At the same time, we identified the principle of its functioning and the platform on which it is based. From secondary statistics, exchange and money market trend data, we analysed the exchange rate development and identified the opportunities for trading with this cryptocurrency. In the section of the results of the paper and the discussion, we point out the advantages and disadvantages of this currency, we identify the key areas that influence the development of the exchange rate, and we point out possible developments and other currencies that are based on the same platform.

The main goal is to analyse the development of Bitcoin and to define the possibilities of its trading. The main goal is fulfilled by multiple partial goals originating from the work procedure:

- Analyse the theoretical bases - the virtual currency platform, the open-source P2P payment network, cryptography, the history of the currency development.
- Analyse the development of Bitcoin over time based on available data from financial markets and secondary statistics.
- Predict the currency development over time and identify factors affecting its exchange rate.
- Identify trading possibilities, advantages, disadvantages and limits of the virtual currency and point out other virtual currencies.

4. Results and discussion

In the results of the work, we point out and evaluate the development of the Bitcoin virtual currency. The Bitcoin price has been very unstable lately making it difficult to assess the real value of this currency, while increasing the risk of investors' losses. The exchange rate development is influenced by several factors.

The volatility of the exchange rate is relatively high. An analysis of previous periods shows that the exchange rate was stable between May 2013 and November 2013. In November, the currency strengthened to almost 900 EUR per 1 BTC. Since then, various currency fluctuations

have been recorded as a response to government and other measures. For example, a significant currency weakening was brought about by the People's Bank of China, which has declared that the Bitcoin currency cannot be considered a typical currency, but rather a virtual product. The Bank is aware that this virtual currency has not yet jeopardized the Chinese financial system, but it carries big risks. The development of the currency also affects the position of governments on the virtual currency. In Russia, China and India, they try to restrict or prohibit the sale of Bitcoins. An important argument is that there is no central authority over individual transactions. The largest share of the drop in the virtual currency exchange rate can be attributed to hacker attacks and the use of currency for illegal trade.

Despite the sharp fluctuations in the exchange rate and the risks, the virtual currency is gaining popularity. Currently it is accepted by more and more companies, institutions, entrepreneurs who offer services and products in exchange for this currency. An example is also abroad where the largest private university in Cyprus, University of Nicosia, said it would start accepting payments for studies in bitcoins as well.

In the Slovak Republic in the centre of Bratislava a Bitcoin ATM was installed in October/November 2013. The Slovak Republic thus became one of the world's leading countries that have an ATM for this cryptocurrency. The interest in the conversion was big, approximately 200 transactions per month. The fee for each exchange transaction is charged by the administering company.

In 2014, the price of bitcoin once again reached a thousand dollars threshold, in February 2014 Bitcoins got stolen. Mt.Gox exchange announced the theft of 850,000 bitcoins. Approximately 200,000 BTC were found a month later on inactive accounts. Since the beginning of 2014, Bitcoin collapsed and in the beginning of 2015 it reached a virtual bottom. Then it was worth about $ 150. It was also caused by the uncovering of the largest black Bitcoin market (Silk Road 2.0) in November 2014.

In 2015, the Bitcoin price oscillated around $ 250 and in the end of the year it jumped to almost $ 500 per BTC.

The year 2016 was beneficial for this cryptocurrency because during the year the exchange rate rose to almost $ 1,000 for Bitcoin. However, this year was marked by thefts of the cryptocurrency as well. The digital currency began to decline significantly after hackers stole $ 65 million worth of this currency. Trading was halted after the Bitcon lost 5.5% of its value during Tokyo's Wednesday trading and lost 13% in two days. Subsequently, the price fell by 6.3%, but it is unclear whether this movement was caused by hacking. The Honk Kong exchange Bitfinex announced the suspension of trading and also limited deposits and withdrawals after finding that its security had been broken. The exchange continues to investigate the circumstances of the attack and cooperates with security forces, but the fact that the Bitcoins of some clients were stolen is certain. Even though the exchange stopped trading on all digital currencies, the theft was limited to Bitcoins and dollar deposits were not affected either. Experts are interested in what the investigation will show and how Bitfinex will actually end up. When Mt. Gox was hacked, at that time the world's largest bitcoin exchange, it led to its bankruptcy several weeks later. Fred Ehrsam, a co-founder of Coinbase, a wallet and a business platform for this cryptocurrency, wrote that Bitfinex is a big Bitcoin exchange, so it's a big problem in the short run, but Bitcoin long ago proved its resilience to such problems in the long run.

Figure 3
Monthly development of the exchange rate BTC/ USD 12/2017 - 02/2018

Source: TradingView.com (2018). BTC/EUR exchange rate development. http://www.forexsrovnavac.cz/sk/bitcoin

A much more significant growth was brought by the year 2017. In the first half of the year, the price climbed up to $ 3,500 for Bitcoin. However, this growth was accompanied by many weaknesses and collapses of the exchange rate. The exchange rate was also affected by the uncertainty of Bitcoin fragmentation into two cryptocurrencies in 08/2017. The significant growth in Bitcoin's value was in particular driven by large investors who bought the currency in large volumes for the purpose of long-term investment. Among other things, Japan also boosted the course by recognising Bitcoin as an official and legal currency and some countries have so far only suggested a similar move.

Figure 4
Daily development of the exchange rate BTC/USD 01/2018 - 02/2018

Source: TradingView.com (2018). BTC/EUR exchange rate development. http://www.forexsrovnavac.cz/sk/bitcoin

The development of the Bitcoin price in 2018 is very difficult to predict. The price of the digital currency is steadily rising and almost every day it overtakes historical highs. It is still true that the enormous interest in cryptocurrencies due to the massive popularization of this topic exceeds the offer and the opening of short positions on the fall is not yet taking place. Although there were some signs of a decline in the value of the currency in early 2018, when the currency fell by several thousand dollars. The currency volatility is very high. It will be important how national and central banks will approach it. Regulation, the level of information security and the risk of infiltration also have a direct impact on it, and one of the major factors is that a portfolio of virtual currencies is growing.

It has been discussed for a long time, of course, what creates the value of this virtual currency. One common mistake is that the Bitcoin currency value is directly determined by the number of users who mine Bitcoin. According to the theory, it should mean that the more users mine Bitcoin, the higher its value is. On the contrary, the rising price of Bitcoin increases the number of miners, which means that the users who are involved in the mining of this currency cannot determine the real value. Therefore, currently it is believed that the value of this currency is based solely on demand and supply on the market and is thus covered only by the confidence that it will be possible to pay with in the future as it is today. The value of this most widespread cryptocurrency is also affected by the emergence of other cryptocurrencies that are mostly based on the Bitcoin platform. At present, they are already over 1300. The most powerful alternative to Bitcoin is currently Litecoin, whose market capitalization reached 680 million, which is eight times more than the next Peercoin currency. The development of Litecoin was inspired by more familiar and almost identical Bitcoin. In 2011, it was designed by Charlie Lee, a former Google employee. Many foreign media call it the silver along the Bitcoin gold. Lee confirmed the genius of Satoshi Nakamoto when he said for the Business Insider that he had only slightly modified bitcoins. For example, he wanted a quicker "confirmation". For transactions with bitcoins the complete processing when waiting for confirmation from other users takes usually about 10 minutes. Litecoin eliminates this problem, the processing of transactions runs four times faster than with bitcoins.

In addition to the aforesaid the exchange rate of this currency is also affected by its possible use, advantages and disadvantages. Bitcoin currently has a limited use, it can only be traded in some brick and mortar shops. Over time it is likely that the portfolio of these brick and mortar shops will expand, but so far it is a very small percentage. Compared to global currencies such as the US dollar, it does not have such a universal use. Bitcoin benefits in particular from being the first cryptocurrency. That is why we can say that they benefit from a certain competitive advantage. The total number of bitcoins is limited to 21 million, so it is unlikely to be devalued by the enormous influx of new bitcoins. Since Bitcoin is decentralized, it is not affected by interference and manipulation by national governments. Transaction fees are much lower than for conventional currencies.

The negative impact on the Bitcoin exchange rate development is brought about by the following characteristics in particular. A Bitcoin transaction can be confirmed within 10 minutes. Transactions are irrevocable and can only be returned by recipient. These limitations do not exist for conventional currencies, where debit and credit transactions are confirmed within seconds; some transactions may be detained for the legitimate reason of the sender. The biggest disadvantage is considered that Bitcoin's balance sheets are not covered. In case of bitcoins loss (damaged hard disk, hardware destruction, security infiltration, hacker penetration, crackers) and subsequent theft of the digital wallet, Bitcoin exchange bankruptcy. The relative anonymity of Bitcoin accounts can encourage illegal use and illegal activities, creating space for black trade and the black economy. Examples include tax evasion, public arms sales, gambling or avoiding currency controls.

In conclusion, we can say that cryptocurrency is currently neither a preserver of value nor an accounting unit. High volatility complicates the use of Bitcoin as a means of payment. For an investor who is primarily revenue oriented this does not have to be a problem, only as soon as he/she wants to use it for payment. It is necessary not to forget that according to the Slovak regulator, the National Bank of Slovakia, exchanges or purchases of virtual currencies represent investors' own business risk and their money is not protected by anything. There is no legal entitlement to the payment of any compensation for any losses caused by such exchanges or purchases.

5. Conclusion

The virtual currency Bitcoin has many proponents. Also in Slovakia it is possible to buy selected goods and services using Bitcoin. The current environment is not favourable for the virtual currency. In particular, government measures and attitudes of governments and national banks question the trustworthiness of this currency. The National Bank of Slovakia cautions citizens that virtual currencies do not have a physical countervalue in the form of a legal tender, so the risk is borne by the parties involved in the transaction. There is no entitlement to claim a legal compensation in case of losses. The stability of the currency is impaired by attacks of hackers and the fact that cryptocurrency is often a means of payment in illegal transactions, which has been reflected in its volatility. Only over time we will see how it will develop and it will also depend on the attitudes of individual countries. The fact that bitcoins exist primarily in digital form makes them vulnerable to loss. Sahoo (2017) claims that "But if bitcoin will be stable in the future, then it is easily accepted through worldwide and the security issue problem can be easily resolved, as we know more stability currency dominants other currencies".

The bitcoin rate itself is currently a bubble - it is not pulled by the development of any underlying asset or effect, but only by demand. It is caused by repeated reports of what price benchmark Bitcoint has already overtaken.

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Demand factors analysis of The pharmaceuitical products consumption in Slovakia

Jakub Kintler, Nora Grisáková

Abstract
Health is a basic variable that helps people live fulfil life. Therefor many people spent lots of money to assure their healthiness. In this article we are testing the dependency between medicine consumption and selected factors, that this consumption influence. By the all done analysis we were focusing on the Slovak market with pharmaceutical products. In the detailed analysis we were reduce our interest on consumption of prescribed and non-prescribed medicines and their development thru the selected period. In the first parts of the article we have derived the demand function for the medicine consumption. As basic we used time period during the years 1995-2016. We found out that the consumption of medicines directly and indirectly depends on the average price per package. In the last parts of the article we analyse influence of selected factors on the consumption of medicines in Slovakia. In two tables at the end of this article we summarize the dependency of each selected factor on the medicine products consumption thru the correlation coefficient. In the conclusion we declare influence of selected factors on demand and consumption of prescribed as well as non-prescribed medicines.

JEL classification*: D001, D012*
Keywords*: demand, medicines, factor analysis, population*

1 Introduction

In presented paper we analyse consumption of medicines in Slovakia influenced by selected factors, which will be closely examine in the further text. Health isn't a classic market product. Consumption connected with health consists from a lot of goods and services. Valuation, the feeling of consumers satisfaction from the consumption of medical products is hard and it is conjunctive to the different perceives of companies and customers. In this field of research, one can have problem with insufficient amount of statistical information, with fact, that each consumer uses the services of pharmaceutical industry in different level and different amount (for example medicines). In Slovakia there are some medicines and pharmaceutical products, which are partially or fully covered from public or private health insurance. This fact can also distort of market with pharmaceutical goods and services. Because of these market specifics final price received by the producers of pharmaceutical product is different. Therefor contribution to the coverage costs on pharmaceutical products varies from consumer to consumer. It depends from the health condition (risk of the occurrence of the insured event), amount of payed insurance premium, type of services offered by insurance company etc. All these facts make some complications in creation of medical aid and medicines demand function and its graphical identification. In this paper we derive the medicines consumption dependency curve (expressed as the number of consumed medicines packages) and average price per package. This dependency could be interpreted as a medicines demand function in Slovakia. Later we identify factors, which can affect the quantity of consumed medicines. Thru the correlation level we will explore their effect on the medicines consumption. Our analysis is made on total medicines consumption and on consumption of free sales medicines (medicines that are not prescribed by the prescriber and are fully covered by consumer).

2 Methodology

Analysis of behaviour each market components we made thru comparative statics and comparative dynamics. Comparative statics is the comparison of two different economic outcomes, before and after a change in some underlying exogenous parameters. As a type of static analysis, it compares two different equilibrium states, after the process of adjustment (if any). It does not study the motion towards equilibrium, nor the process of the change itself (Silerberg, E., Suen, W., 2000). Comparative dynamics is concerned with the effects of changes in the data (parameters, exogenous variables, initial conditions) on the whole motion over time of a dynamic economic model. This motion will usually be some sort of dynamic equilibrium path, such as, for example, a steady-state growth path where all variables grow at constant rates, or an optimal path deriving from a dynamic optimization problem (Besanko, D., Braeutigam, R. R., 2007).

We made a quantification of the impact of individual factors on demand and we also study other serious consequences and related facts with mathematical calculation. The base core of calculation in impact of selected factors quantification is statistical and econometrics calculations. For correlation coefficient calculation we used the same base data for all consumed medicines and for non-prescribed (free sold). Variable y represents quantity of consumed medicines (in packages) and variable x varies depending on selected demand factor (Lukáčiková, A., Lukáčik, M., Szomolányi, K., 2013).

As we have already mentioned, for quantification the impact of individual factors of health demand represented by medicines consumption, we have chosen to use the methods and procedures of correlation analysis. The main outcome of this analysis is the correlation coefficient. For us is its value indicative in determining strength and direction of a linear relationship between two variables. In our case one variable is medicine consumption and the second one is selected demand factor. Value of correlation coefficient (*r*) could be from interval < -1;1 >. There are a lot of definitions for strength interpretation according its value. Despite the inconsistency in the interpretation of strength, the theory is unified in interpretation of sign of the correlation coefficient. If the correlation coefficient is almost zero, there is not linear relationship between *x* and *y*. If the correlation coefficient is negative, there is a downhill (negative) linear relationship between *x* and *y* and if it is positive, there is an uphill (positive) relationship between *x* and *y* (Cohen, J., 1988). In presented paper we use the interpretation of correlation coefficient according Rumsey (Rumsey, D., J., 2016). To interpret its value, see which of the following values your correlation *r* is closest to:

- **Exactly –1** A perfect downhill (negative) linear relationship
- **–0.70** A strong downhill (negative) linear relationship
- **–0.50** A moderate downhill (negative) relationship
- **–0.30** A weak downhill (negative) linear relationship
- **0** Zero linear relationship
- **+0.30** A weak uphill (positive) linear relationship
- **+0.50** A moderate uphill (positive) relationship
- **+0.70** A strong uphill (positive) linear relationship
- **Exactly +1** A perfect uphill (positive) linear relationship

For the calculation of Correlation coefficient, we used the formula (Cohen, J., 1988):

$$r = \frac{k}{s_x * s_y}$$

where:

$$k = \frac{1}{n} * \sum_{i=1}^{n} (x_i - \bar{x}) * (y_i - \bar{y})$$

$$s_x = \sqrt{\frac{1}{n} * \sum_{i=1}^{n} (x_i - \bar{x})^2} \quad , \quad s_y = \sqrt{\frac{1}{n} * \sum_{i=1}^{n} (y_i - \bar{y})^2} , \quad \bar{x} = \frac{1}{n} * \sum_{i=1}^{n} x_i \ , \quad \bar{y} = \frac{1}{n} * \sum_{i=1}^{n} y_i \ ,$$

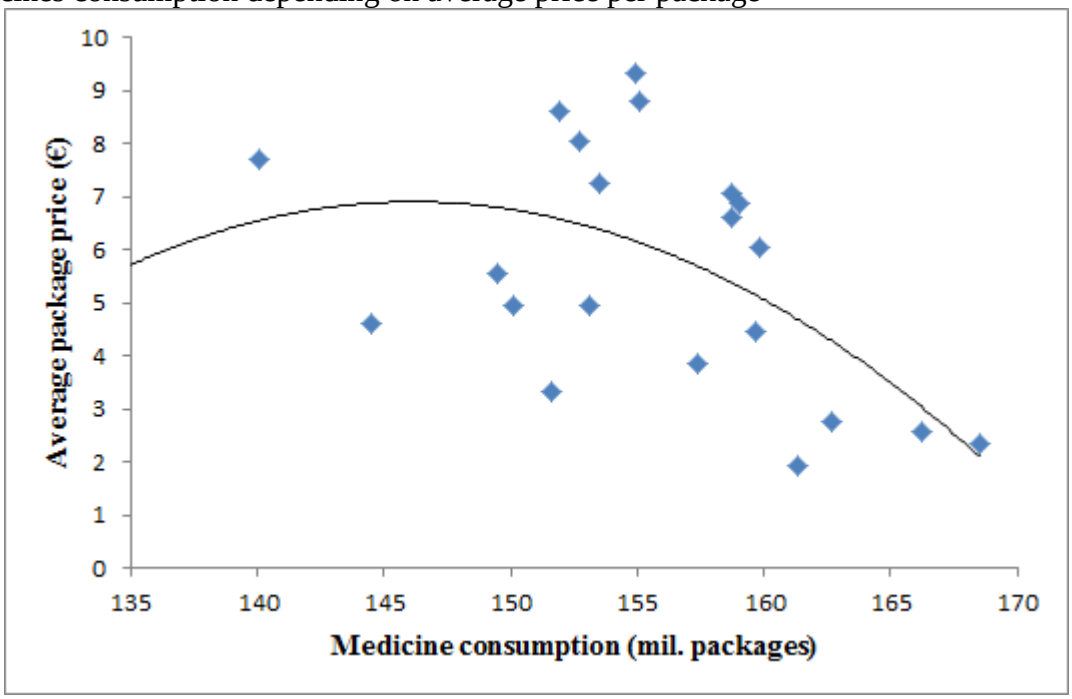
This means, that we can calculate the correlation coefficient as a share of covariance (*k*) and multiplying of the standard deviation of variables (s_x, s_y). It is necessary to fulfil the nonnegative condition for denominator. That means, neither one of the standard deviations s_x and s_y must be equal zero.

3 Medicines consumption in Slovakia

Quantification the level of bought and sold amount of pharmaceutical industry products is given by the total direct households' expenditures on healthcare. We made this conclusion based on a lot of tested alternatives and realised mathematical calculations. In our meaning healthcare includes all goods and services associated with prevention as well as treatment diseases. To the treatment of diseases are mostly used medicines, so we take their consumption as a principal representative for demand analyse. From the consumer perspective, we can divide medicines on prescribed and non-prescribed also called as free sale. For our analyses we used both groups of medicines. At analysis we mainly focus on factors, which affect medicines consumption, their change over time and possibility their tracking through different sets of indicators. Factors of our analyses are very often connected and influenced between each other, and it is impossible to clearly and precisely determine to what extent a particular factor influence demand development. However, it is possible to measure to how strong the selected factors influence demand, whether they act directly or indirectly on the medicines consumption.

We assumed, that the participation on medicines expenditure by individual insurance companies is roughly the same for all three insurance companies in Slovakia. According to this assumption we decided to make our first analyse through price impact on level of medicines consumption. For this purpose, we use the Slovstat database (a database of information and indicators of the socio-economic development of the Slovak Republic, which is part of the Statistical Office of the Slovak Republic) and data from year 1995.

Figure 1
Medicines consumption depending on average price per package

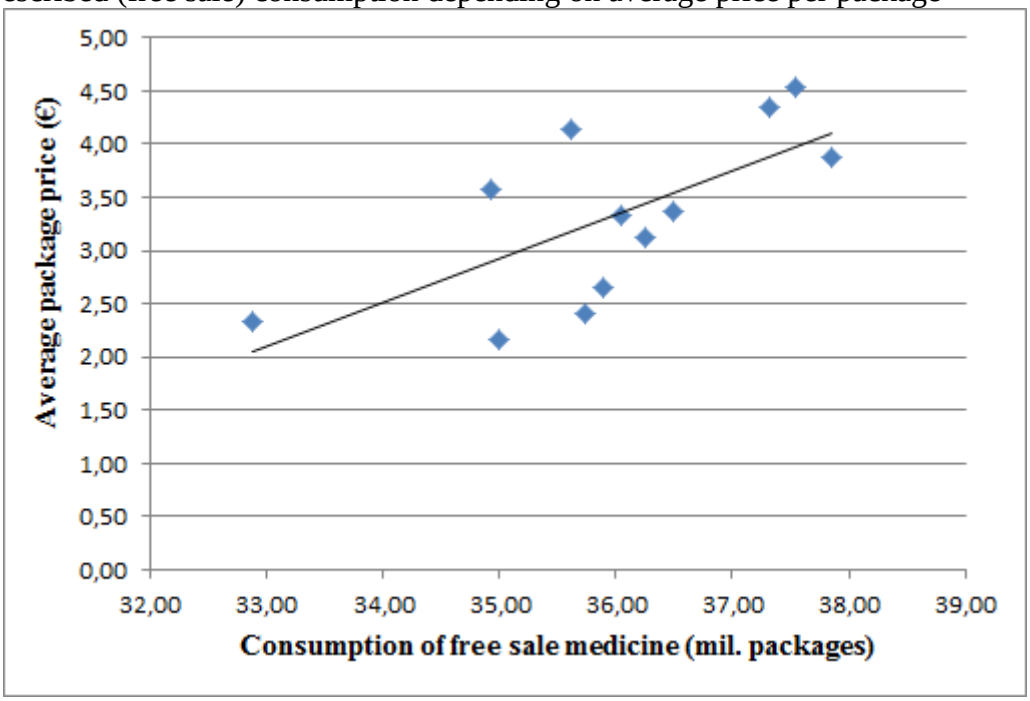


Source: Own processing based on data from the Statistical Office of the Slovak Republic

Figure 1 shows the dependence between medicines consumption (in mil. packages) and average price per package. We can see that there exists some dependence between selected variables, which is probably not linear. Therefore, we draw on the picture also trend line, by which we can describe the dependence between amount of consumed medicines and average price per package. People are making decisions about buying medicines because they want to be healthy and consumption of medicines can assure them healthiness. In Slovakia there is a small linear dependence between consumption and average price per package of medicines. We can say, that being healthy is more important than have money. According to this knowledge we need to identify also other factors which could influence the medicines consumption.

In the Slovak pharmaceutical market are widely used free sale medicines and dietary supplements. Non-prescribed medicines and medical products are medicines that are not covered by a health insurance. The level of consumption these kinds of medicines are quite high in Slovakia (NCZI, 2018). According National Health Information Center (NCZI) patients bought 37.5 million packaging of medicines without recipe in the year 2016. They paid in total 170.2 mil. €. The highest consumption according ATC medicines classification was on treatment of respiratory diseases (8.6 million packs), digestive tract and metabolism (8.1 million packs), and nervous system diseases (almost 7 million packs, of which 6.6 million packs were analgesics). The most commonly bought over-the-counter medicines were PARALEN, IBALGIN and MUCONASAL PLUS (NCZI, 2018). Next picture shows dependence between non-prescribed (free sale) consumption and their average package price in €.

Figure 2
Non-prescribed (free sale) consumption depending on average price per package



Source: Own processing based on data from National Health Information Center

Figure 2 and linear trend function show, that non-prescribed consumption rise with higher price. This fact can signify that law of demand is violated. Law of demand says that amount of purchased products fall, when its price increases. This law is valid only when other factors of consumption stays unchanged. We analyse data from year 2005 to 2016. In this period a lot of demand factors has changed. One from these factors that could has changed, can had been health status of the population or trust of the population in public healthcare. Also, people consider their health as much more important than their expenditures on medicines. That means, that change in price (increase or decrease) for non-prescribed medicines will haven't significant impact on change in its consumption.

In microeconomic theory this situation is known as Giffen paradox (Grisáková, N., 2013). Giffen good is a product that people consume more as the price increases and vice versa—violating the basic law of demand in microeconomics. For any other sort of good, as the price of the good rises, the substitution effect makes consumers purchase less of it, and more of substitute goods; for most goods, the income effect (due to the effective decline in available income due to more being spent on existing units of this good) reinforces this decline in demand for the good. But a Giffen good is so strongly an inferior good in the minds of consumers (being more in demand at lower incomes) that this contrary income effect more than offsets the substitution effect, and the net effect of the good's price rise is to increase demand for it (Marshall, A., 2006).

4 Factors that affect medicines consumption

The basic aim of this article is to quantify influence intensity of selected factors on medicines consumption in the market conditions of Slovakia. We did this analysis thru mathematical and statistical methods for both group of medicines (prescribed and non-prescribed). For all our analysis we use the time interval form the year 1995 to 2016. For non-prescribed medicines, we have had to shortened interval of analysis due to the lack of information from official sites of statistics. So, for this part of analysis we used interval form

the year 2005 to 2016. Among factors that affect total consumption of medicines (prescribed and non-prescribed) we include[1]:

- ***Number and growth of residents; number and growth of residents older than 65 years***

Demand for the services and goods of health is specific to the origin. Products (goods and services) of health uses all consumers, but in different range, different time and different amount. Because of that we consider demography and its change as a one of the key factor for the demand analysis of drug consumption. We work with perception that total amount of residents directly influences the demand for the medicines in the analysed period and place. We assume that the growth number of residents will increase the demand for the products of health. Concretely prescribed and non-prescribed medicines.

When we look closely to the structure of this factor we need to say that also the share of each part of residents who belongs to the specific group divided by the age influence the demand for the products of health in the different level. Without of analysis we can say that older people usually spent more money for the healthcare than youngers. Because of this assumption is also important to focus on the structure of the residents who are recipients of health products. It is scientifically proved that elders have much more health problems than youngsters. And they need to visit doctors more often than people in productive age. Due to this assumption older people spent more money for the treatment of diseases and for the usage of the other products of healthcare. After all we can say that the usage of the healthcare products rises directly with the age of consumer. Because of this, in this factor we focus our analysis not only on its global development, but also on its age structure. As a border age we set 65 years. We assume that from this age morbidity of the people rise faster and is much more often. With the assumption of the rising morbidity goes hand in hand rising usage of healthcare products.

We are working with direct linear dependence precondition for the factor number of residents in total, and number of residents in the age 65+. We assume strong direct dependence for this factor.

- ***Morbidity of residents***

Morbidity of the residents for the analysis of the demand factors that affect consumption of the healthcare products we can identify as a one of the key factor. We should mark this one as the crucial one. Its direct relationship to the consumption of medicines is significant and undeniable. Products of healthcare (goods and services) we can divide into two parts: prevention and therapy. As prevention activities in healthcare we consider: vaccination, prevent medical inspections, adherence to the healthy lifestyle, etc. As treatment of diseases we understand home treatment and hospitalisation. According to the information from the National statistics department (ŠUSR) we can morbidity divide to: transmissible diseases and non-communicable diseases. ŠUSR keep records only about transmissible diseases, which needs to be under control.

For better presentation ability we decided to use records of the residents' sick leave. Evidence of sick leave as a parameter for doing demand analysis has some restrictions. We see restrictions in this parameter in its informative ability, because its monitor only residents in productive age, who stop working due to the illness and their doctor give them sick leave. This factor excludes all retirees, workers who decide to take day offs or vacation to heal themselves, and workers that despite of the illness continue in the working process. On the other hand, this

[1] Data for selected factors were obtained from the statistics of the Statistical Office of the Slovak Republic (ŠÚSR, 2018)

parameter better outlines the relationship between morbidity and usage of the healthcare products.

- ***Caring of the sick people***

Care of sick people under the condition of hospitalisation or due to the inability of working can be also factor that influence consumption of medicines. We decided to monitor this factor thru two attributes. First one represents the total number of the healthcare workers, concretely number of doctors. Second one monitors the absolute amount of the beds in the hospitals on thousand of residents.

We assume that the rising number of the doctors-specialists can cause decreasing consumption of the medicines. This phenomenon can be explained as availability of the healthcare to the people, which helps for the earlier diagnose actual and future health problems, what dramatically reduces expenses to the healthcare. On the opposite way decreasing number of the doctors-specialists can cause rising consumption of medicines, because potential patients will first try to solve their bad health situation by their own force with the non-prescribed medicines.

We are also working with the assumption, that the patients who take healthcare in the hospitals get targeted treatment, that influence amount of non-prescribed medicines consumption. Absolute number of beds in hospitals can cause both rising and decreasing numbers of prescribed and non-prescribed medicines, depended on the process of treatment.

5 Discussion

In this part of our article we will discuss influence of the selected factors on the consumption of medicines in Slovakia. In the previous parts of this article were identified several factors that may affect level of drug consumption. We had analysed their influence onto the consumption on prescribed as well as non-prescribed medicines. Our target was to identify direct linear dependency between drug consumption and selected factors. For evaluation of the dependency level between selected factors and medicines consumption as well as the level of dependency among selected factors we had used correlation coefficients. It may occur that between several data can be achieved strong direct dependency without any causality. This may occur, because we didn’t examine causality of correlation coefficients that were measured between them. According to the conditions of measurement we can process two tables one for the prescribed and non-prescribed medicines and second only for non-prescribed medicines.

Table 1
Correlation coefficients of consumption on prescribed and non-prescribed medicines in the years 1995-2016

	drug consumption (packages)	average price per package in €	number of residents	number of residents over the age of 65	morbidity of residents	absolute number of doctors-specialists	number of beds in hospitals on thousand of residents
drug consumption (packages)	1	-0,0371	0,2060	0,0716	0,6190	-0,1727	0,0956
average price per package in €		1	0,8205	0,9038	-0,8142	0,7052	-0,9853
number of residents			1	0,9117	-0,5058	0,5300	-0,7591
number of residents over the age of 65				1	-0,5967	0,5923	-0,8750
morbidity of residents					1	-0,5454	0,8968
absolute number of doctors-specialists						1	0,8968
number of beds in hospitals on thousand of residents							1

Source: personal processing based on information from ŠÚSR and NCZI
Notes:
Correlation coefficient is a pair coefficient, therefor $r_{xy} = r_{yx}$ – values in the lower part of table are equal to the upper part
Residents in Slovakia – absolute number of residents
Residents in Slovakia 65+ - absolute number of residents over the age of 65 years
Number of doctors-specialists – absolute number of doctors situated in the medical facilities (hospitals)
Number of beds – absolute number of beds to the thousand of residents situated in the medical facilities

Consumption of medicines (prescribed and non-prescribed) indicate indirect linear dependency only with two from examined factors. It has indirect linear dependency with average price for a medicaments package and with number of doctors-specialists. To both of these factors we had expected indirect dependency.

About relationship between level of drug consumption and the average price for package we talked on previous sites. Relationship is shown as the demand function at the figure one. Mathematically is this relationship given by the quadratic trend function for all sold medicines (prescribed and non-prescribed).

$$y = -0{,}0096x^2 + 2{,}7972x - 197{,}7$$

where:

y – average price for package of medicaments
x – number of medicines consumption in millions of packages

Quadratic equation identified above clarifies behaviour of consumers given by the change in price level of medicines on 40,78% ($R^2 = 0{,}40779$). If we will raise polyneme of equation on 6, the trend function will explain behaviour of the consumers given by the change in the price for package of medicines up to 61,05%.

All other factors influence level of medicines consumption directly. As we can see in the table 1, presented values indicate direct linear dependency. This dependency reaches values from the interval (0,07-0,62). Achieved values except one, shows weak or trivial dependency. Factor morbidity of residents show strong direct linear dependency. Value that proclaim strong dependency is logic and we should expect it, because sick leave strongly indicates illness and the need of medicaments to recovery. Because of that, consumption of medicines increases.

Table 2
Correlation coefficients of consumption free sale (non-prescribed) medicines in the years 2005-2016

	drug consumption (packages)	average price per package in €	number of residents	number of residents over the age of 65	morbidity of residents	absolute number of doctors-specialists	number of beds in hospitals on thousand of residents
drug consumption (packages)	1	0,6868	0,7035	0,6767	0,5424	0,6057	-0,5379
average price per package in €		1	0,7814	0,8877	0,2494	0,7174	-0,9595
number of residents			1	0,8358	0,4179	0,6756	-0,5364
number of residents over the age of 65				1	0,3113	0,7574	-0,7369
morbidity of residents					1	0,4408	-0,0721
absolute number of doctors-specialists						1	-0,0721
number of beds in hospitals on thousand of residents							1

Source: personal processing based on information from ŠÚSR and NCZI

There is only one medium resp. strong indirect linear dependency in the field of non-prescribed medicines. This indirect dependency shows factor identified as number of the beds in hospitals. This dependency is in line with the assumption of decreasing consumption of non-prescribed medicines by the increasing number of beds in hospitals. It is caused by direct indication of need medicines which is fully covered from the health insurance. So, the patient is do not need to buy non-prescribed medicines.

For the free sale medicaments, we have also assumed indirect linear dependency between price for medicines package and consumption. This assumption wasn't proved. According to the measured values there is a strong direct linear dependency between consumption of the non-prescribed medicines and their price level. We were discussed this situation on previous sites of this paper. Equally expectation of the indirect dependency wasn't proved neither with the factor number of doctors-specialists. All other factors show from medium to strong direct linear dependency as we have expected. Accurate values are presented in table 2.

6 Conclusion

In the article we had examine influence of the selected factors on the consumption of medicaments. We did our analysis in two steps. In the first round we made analysis of the level of consumption, whether consumer consumes medicines which were prescribed or non-prescribed. In the second round we have reduced our analysis only on non-prescribed medicines. It means that we were focusing only for the medicines which are available to the customers without doctoral prescription. From all possibilities we had identify six factors that directly or indirectly influence consumption of medicaments. Identified factors were same for prescribed and non-prescribed medicines.

We have assumed indirect dependency of the price level for the package of medicines on medicines consumption to the both groups of analysis. This assumption was proved only for the first group (all medicines prescribed and non-prescribed), but only for the small size of dependency. After all made calculations we suggest for this group of factors replacement of linear dependency with the nonlinear dependency of higher polynomic level. For the consumption level of the free sale medicines we have identified strong direct dependency. This unusual fact we can explain as a paradox, because of the stability all other variables. This assumption is in market of goods and services unrealistic. Presented paradox can be also displayed as specificity of a product and its inelasticity may relate to the specific conditions, which are not usual. For example, all residents will become healthier.

Changes in the number and structure of Slovakia residents have direct dependency to the level of medicines consumption. Our assumptions were proved by the analysis. We have found out that this factor has strong direct dependency on free sale medicines and small or trivial direct dependency on prescribed medicines.

Morbidity of residents is directly correlated with consumption of medicines in global range as well as in the group of residents over the age of 65 years. This direct dependency could be assumed. It is likely that ill residents will spent more expenses on medicines than healthy people. Absolute number of the doctors-specialists in hospitals is directly correlated with free sale medicines, but indirectly correlated with the total amount of consumption all medicines. We were assumed direct linear dependency to the consumption of all medicines and indirect linear dependency with the consumption of non-prescribed medicines to the absolute number of beds in hospitals. These assumptions weren't validated.

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PRÍSPEVKY DO DISKUSIE

CONTRIBUTIONS TO THE DISCUSSION

Trends in Domestic and Foreign Securities Held by Slovak Banks for Third Parties

Peter Badura, Miroslav Kmeťko

Abstract
Except trading that is carried out through official Exchanges there are also many trades done in the Over-The-Counter (OTC) market. That is the reason why we have not analyzed the stock exchange trades in this paper, but looked primarily at the data about volumes held by investors on the bank accounts. The data are divided to various groups according to domicile of investors (domestic or foreign investors), by type of security (equity or debt instruments) or by the type of investors (asset managers, financial institutions, retail, companies and public institutions). Moreover, we have focused on the total value of securities held in banks' accounts and have included retail investors, too.

JEL classification*: G 1, G 21*
Keywords*: stocks, bonds, banks*

1 Introduction

Recent financial literature finds the relationship between capital markets development and economic growth (see Levine 1997, Rajan and Zingales, 1998, Arestis and Luintel, 2001). Also Garretsen et al. (2004) found out a causal relationship between economic growth and financial market development: a 1 % improvement of economic growth determines a 0,4 % rise of market capitalization/GDP ratio. While studying the link between domestic stock market development and internationalization, Claessens et al (2006) concluded that domestic stock market development as well as stock market internationalization are positively influenced by the growth of GDP per capita, the stock market liberalization, the capital account liberalization and the country growth opportunities and negatively influenced by the government deficit/GDP ratio.

Because the European Commission wishes to create fully integrated European capital markets, also the Slovak capital market is not only intended to work as a solely domestic market but is influenced by foreign investors, as well. The Capital Markets Union (CMU) is intended to make it easier for lenders and borrowers to come into contact with one another within Europe, especially across borders. This is regardless of whether it is arranged through the intermediary of a bank, through the capital markets, or through alternative channels such as crowdfunding (Busch, 2017). King and Levine (1993) state that the level of financial intermediation is a good predictor for the rate of economic growth, capital accumulation and productivity. "We live in a world that is shaped by financial markets and we are profoundly affected by their operation. Our employment prospects, our financial security, our pensions, the stability of the political systems and nature of the society we live in are all greatly influenced by the operations of these markets" (Fenton-O'Creevy, et al, 2005).

Fully integrated European capital markets can lead to institutional investors who are attracted to invest in Slovak securities. According to study of Bonizzi (2017) two key results emerge: firstly, consistent with 'search for yield' investment behaviour, weaker balance sheet conditions, measured by the lower funding level of pension funds, positively affect the asset allocation to emerging markets. Secondly, the accumulation of reserves by emerging markets is a significant attractor of foreign institutional investment. As for the Slovak capital market, it is mostly represented by trading of bonds. And foreign investors are also more likely to invest

into bonds than to shares. There were more studies carried out to address the issue of the bond liquidity and stock returns. Anderson (2017) presents that an improvement in bond liquidity can positively impact stock returns by reducing funding costs and improving profitability. Moreover, average abnormal returns are significantly related to the improvement in bond liquidity, the probability of informed trading, leverage, growth opportunities, and propensity to access corporate debt. So it can be claimed that liquidity is very important factor in trading securities. It is one of the apexes of so-called investor's triangle. The other ones are the risk and the revenue. Despite the fact that we have not any formula for measuring the liquidity, there are three important dimensions of it: trading costs, depth, and resiliency (Black et al., 2016).

Investing to securities mostly means investing to shares and bonds. Investments relate to decisions concerning stocks and bonds and include a number of activities: (1) Security analysis deals with finding the proper values of individual securities (i.e. stocks and bonds). (2) Portfolio theory deals with the best way to structure portfolios, or "baskets" of stocks and bonds. Rational investors want to hold diversified portfolios in order to limit risks, so choosing a properly balanced portfolio is an important issue for any investor. (3) Market analysis deals with the issue of whether stock and bond markets at any given time are "too high," "too low," or "about right" (Brigham & Houston, 2010).

By capital market we mostly understand the trading on various exchanges. Besides the official exchanges, there are also trades that are carried out on non-exchange platforms, which are being called as Over-The-Counter (OTC) trades. OTC market can mostly serve for securities that are not traded on regulated market (represented by the Exchanges). If we want to include all the trades - the ones that are done in the official markets as well as the ones that are carried out over-the-counter, the main question would be: where can we find the data for analyzing the OTC market? We decided to use the data published by the Central Bank of Slovakia (NBS). According to the Slovak law the commercial banks must report data concerning their clients' accounts, involving data divided by type of securities and also by type of investors, on a monthly basis.

After analyzing this monthly data we got very different results. We have focused only on the total data and retail data - because this data mostly represents trading on the Capital market. The absolute numbers and also ratios of investments to equity and debt instruments have been the main point of the analysis. It was found that sometimes there were more foreign investors than the domestic ones and sometimes on the contrary. Moreover, we have also studied the additional information about foreign investor owing foreign securities.

2 Research Design

Most capital-market literature deals only with the question of trading on the stock exchange. However, if there are only a couple of companies traded on the stock exchange, there can be a problem of measuring the whole capital market size. That is the reason why we have focused on the data provided by commercial banks to the Central bank, not on analysis of the stock exchange trades.

Each month, commercial banks provide data on the total value of securities they hold for third parties. That means, they register securities for their clients outside their balance sheets. These data are published by the Slovak Banking Association (SBA) and are publicly available on the last business day after the reference month. The data are structured both, by type of security and by the domicile of investor.

By the type of security, the statistics are held as equity securities (shares, preferred shares, warrants, Exchange Traded Funds, unit certificates and co-operative units) and debt securities (bonds, municipal bonds, mortgage bonds, bills of exchange, investment certificates, etc.).

By the domicile of an investor, the statistics are based on investor's residence. The domestic investor is a resident domiciled in the Slovak republic while the foreign investor's domicile is located outside the SR. In addition to the overall securities statistics, the data are next broken down by the type of investor as follows:

- Asset managers
- Financial institutions
- Retail
- Legal persons
- Government

The statistical data is also broken down by Type of securities management into the following categories:

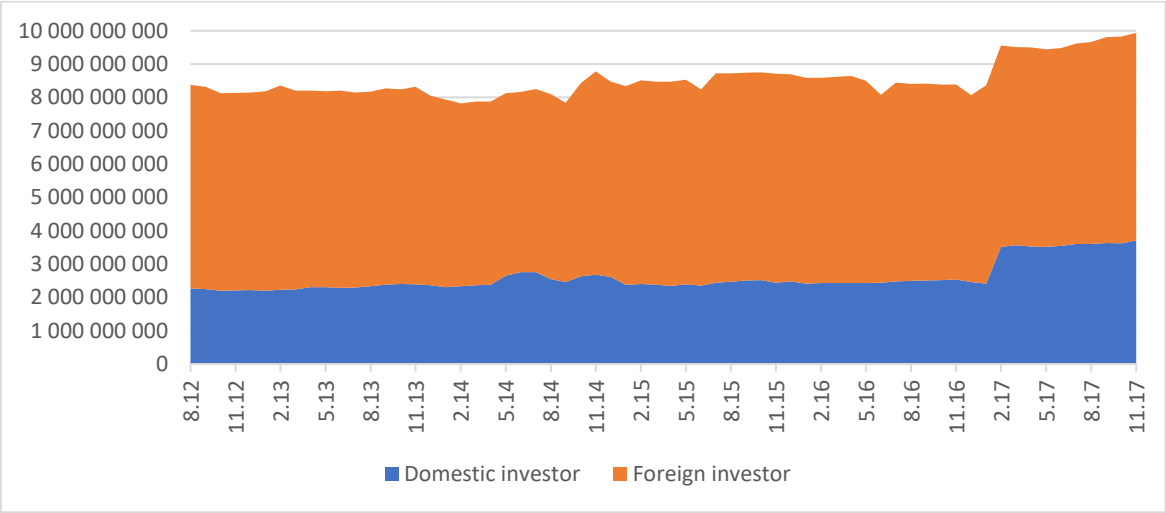
- Custodianship
- Asset management
- Managing the owner's account
- Securities registered with the Central depository
- Registration of securities
- Portfolio management

Some of the commercial banks have also given their consent to disclosure of some additional data to the Central bank of Slovakia (NBS). Consent to disclosure of the data was provided by the following banks (as of 31st December 2014):

- Slovenská sporiteľňa, a.s.
- Československá obchodná banka, a.s.
- Uni Credit Bank, a.s.
- Sberbank Slovensko, a.s.
- Poštová banka, a.s.
- OTP Banka Slovensko, a.s.
- Privatbanka, a.s.
- Other (non-authorized banks)

Our analysis will begin with the total volume that is held on the securities holders' accounts as for the equity securities and debt securities. The data are in euros and our source of information is the NBS. The values of equity and debt securities in this paper are almost solely stated as market values (prices equilibrium created on the secondary market) and officially referred by the banks to the Central Bank of Slovakia.

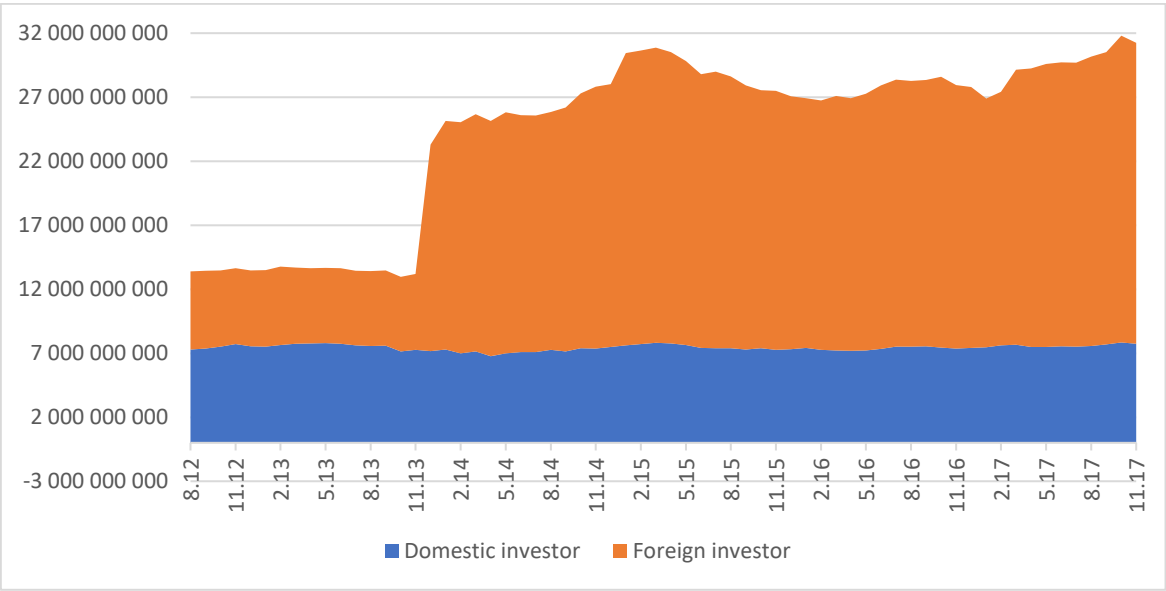
Figure 1
Comparison of retail ownership of domestic equity instruments held by domestic and foreign investors



Source: www.nbs.sk, authors' calculations

The total amount of equity securities, hold by domestic and foreign investors, is almost EUR 10 billion (Figure 1). However, most of the equity securities are held by foreign investors. This may also be related to direct foreign investments because the securities held by banks are also securities that are not publicly traded. The detailed breakdown will be listed later in the paper.

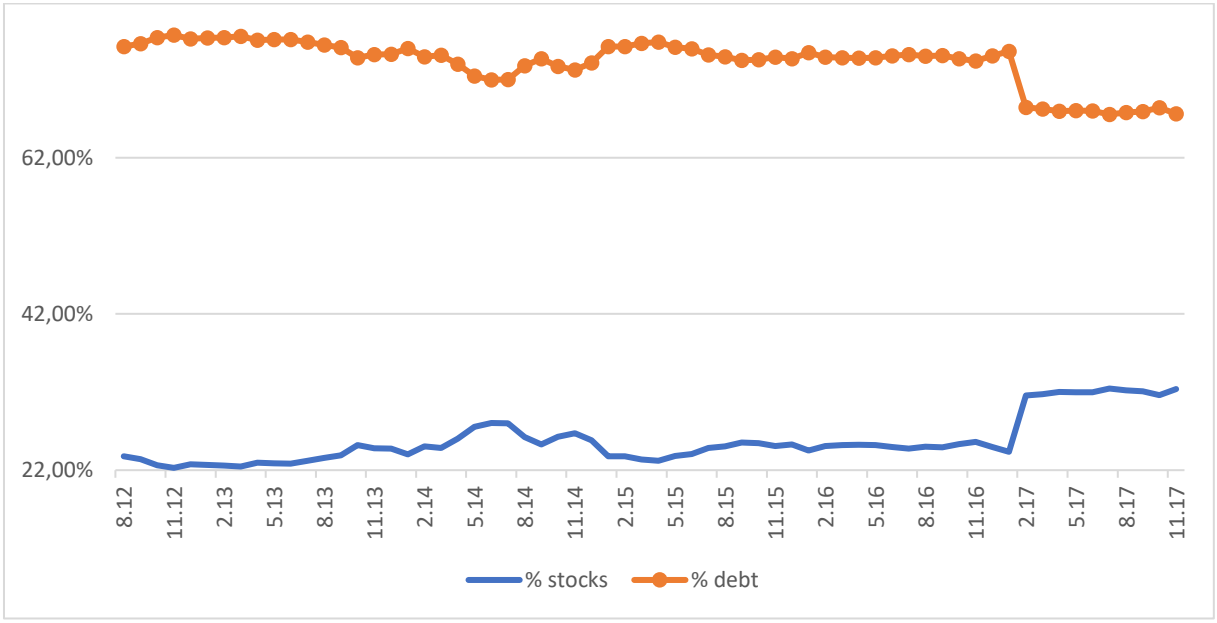
Figure 2
Comparison of retail ownership of domestic debt instruments held by domestic and foreign investors



Source: www.nbs.sk, authors' calculations

Compared to equity instruments, the total value of bonds, held in the bank accounts for domestic as well as the foreign investors, is considerably larger (Figure 2). Generally said, the value of bonds held is almost 3-times higher than the value of equity instruments. Also in this case, the majority of the owners are the residents outside the Slovak Republic.

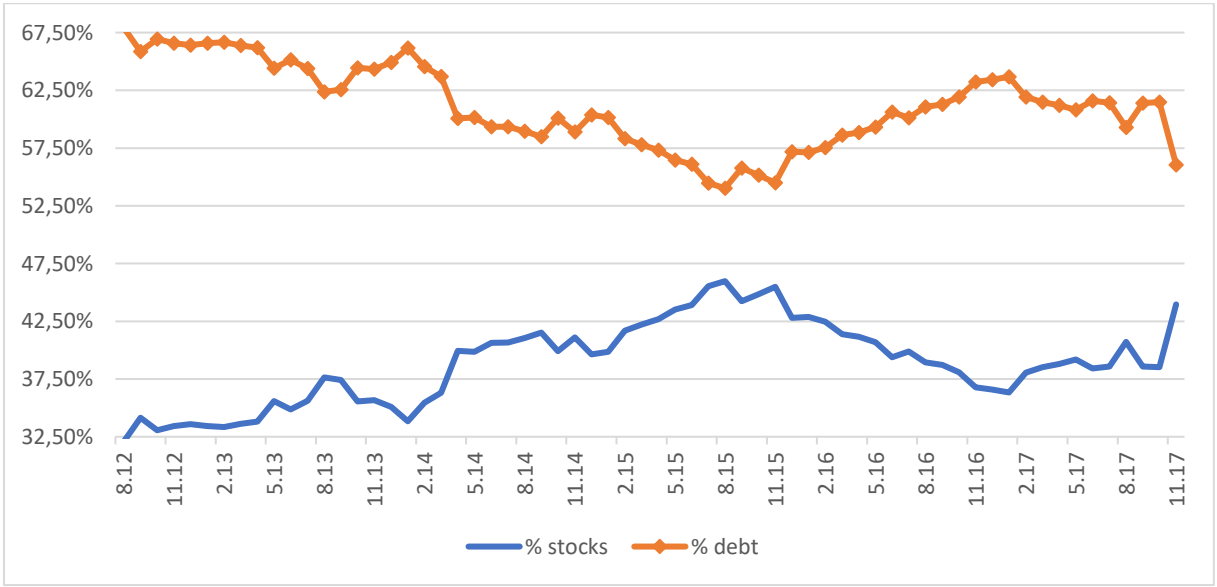
Figure 3
Comparison of total ownership of domestic equity and debt instruments held by domestic investors



Source: www.nbs.sk, authors' calculations

The Figure 3 presents interesting recent relative growth in shares (compared to debt securities) that are held by domestic investors.

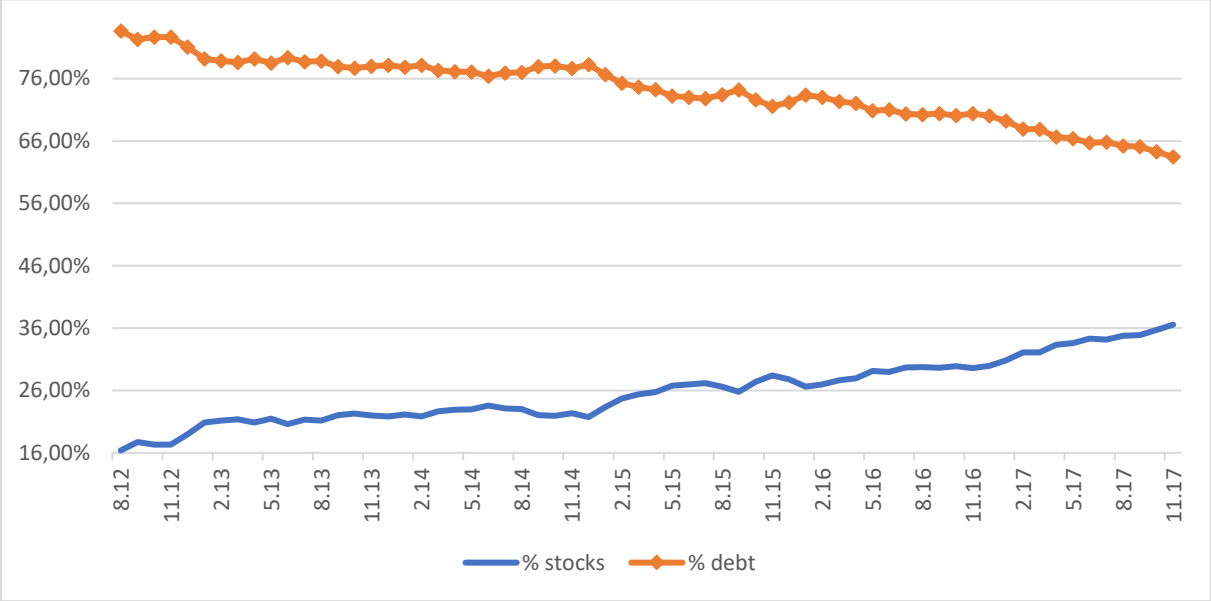
Figure 4
Comparison of retail ownership of foreign equity and debt instruments held by domestic investors



Source: www.nbs.sk, authors' calculations

A more detailed look at the investments of the domestic retail investors shows that they prefer investing into foreign debt instruments before the foreign equity instruments (Figure 4).

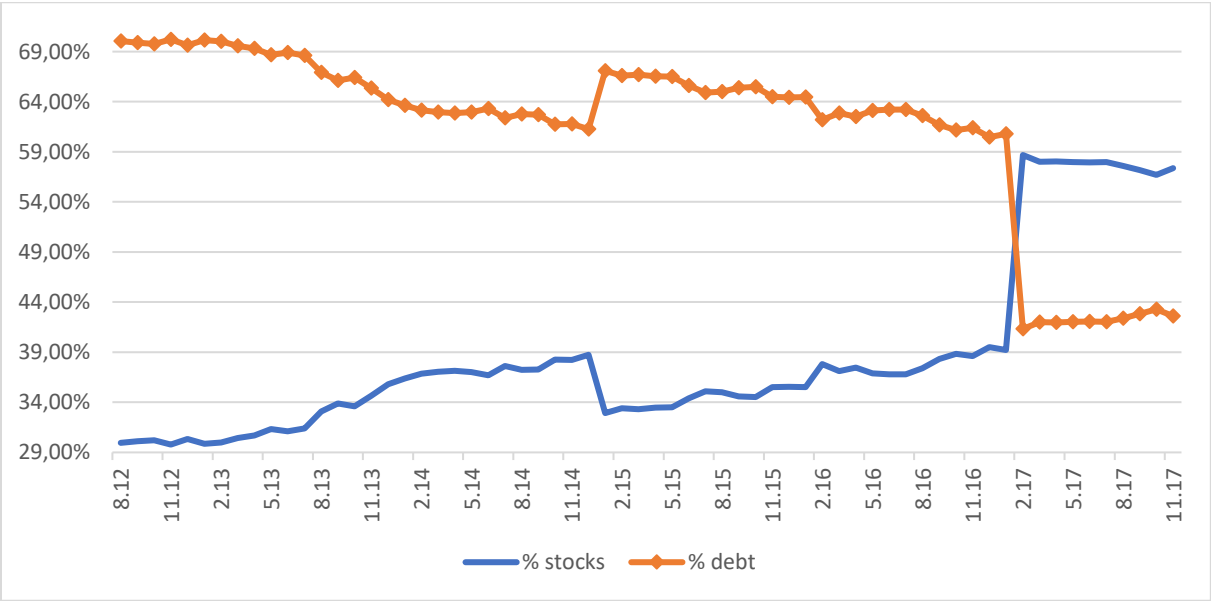
Figure 5
Comparison of total ownership of foreign equity and debt instruments held by domestic investors



Source: www.nbs.sk, authors' calculations

As can be seen from Figure 5, the domestic investors start to prefer a more aggressive investment strategy which leads to increase in foreign equity instruments and decrease in foreign debt instruments.

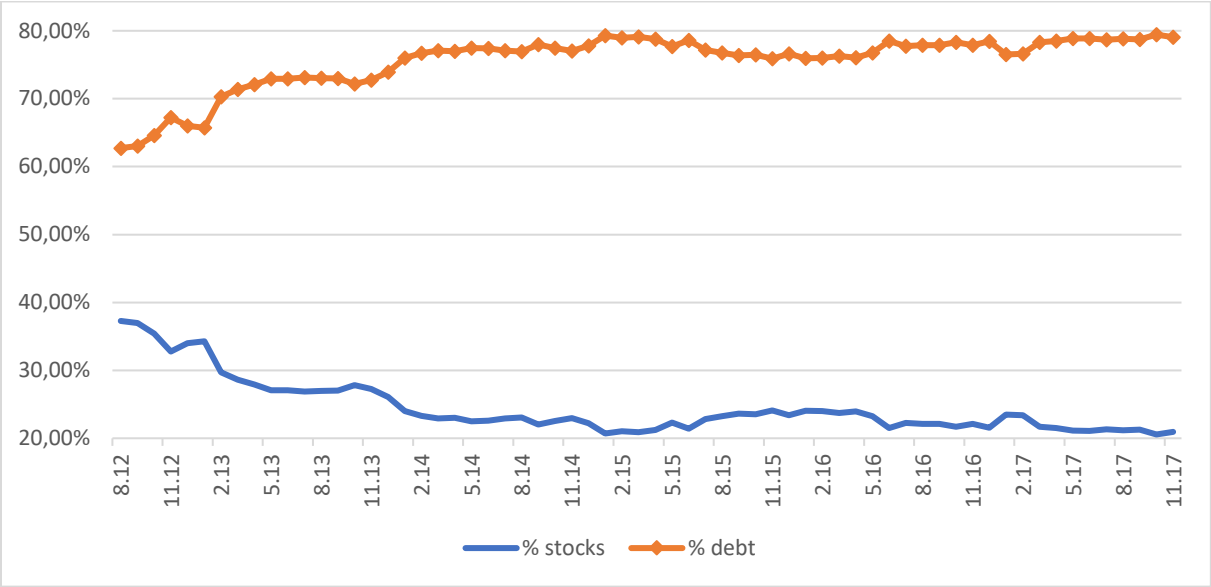
Figure 6
Comparison of retail ownership of foreign equity and debt instruments held by domestic investors



Source: www.nbs.sk, authors' calculations

As can be seen from Figure 6, the domestic retail investors (once again) start to prefer a more aggressive investment strategy which leads to increase in foreign equity instruments and decrease in foreign debt instruments.

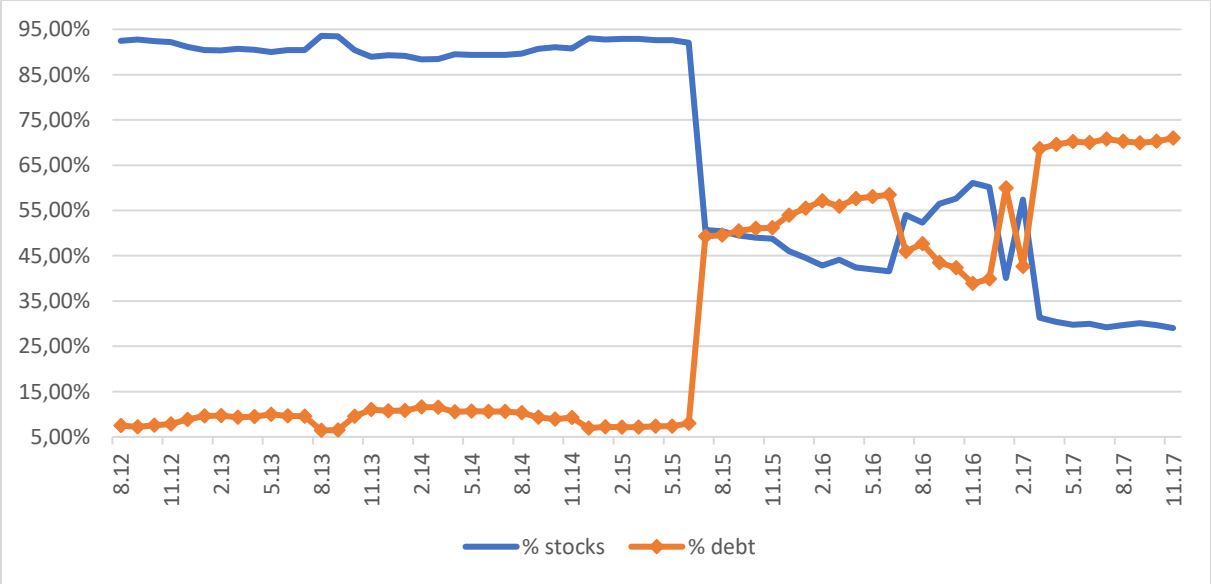
Figure 7
Comparison of total ownership of domestic equity and debt instruments held by foreign investors



Source: www.nbs.sk, authors' calculations

As is clear from the Figure 7, the ownership of domestic debt instruments that are held by the foreign investors is increasing compared to decreasing value of domestic equity instruments that are hold by them. The percentage ratio of holding the domestic debt instruments has increased significantly from the original value around 60 % to almost 80 %.

Figure 8
Comparison of retail ownership of domestic equity and debt instruments held by foreign investors



Source: www.nbs.sk, authors' calculations

As can be seen in the previous chart (Figure 8), there is a clear change in the ownership of debt and equity financial instruments. The original prevalence of equity instruments has changed in the favour of ownership of the debt instruments in 2015.

We have also analyzed the order of the banks which gave the permission to publish the data of securities volumes within individual years. Following Table 1 shows the leading banks that hold shares or bonds either for domestic or foreign investors.

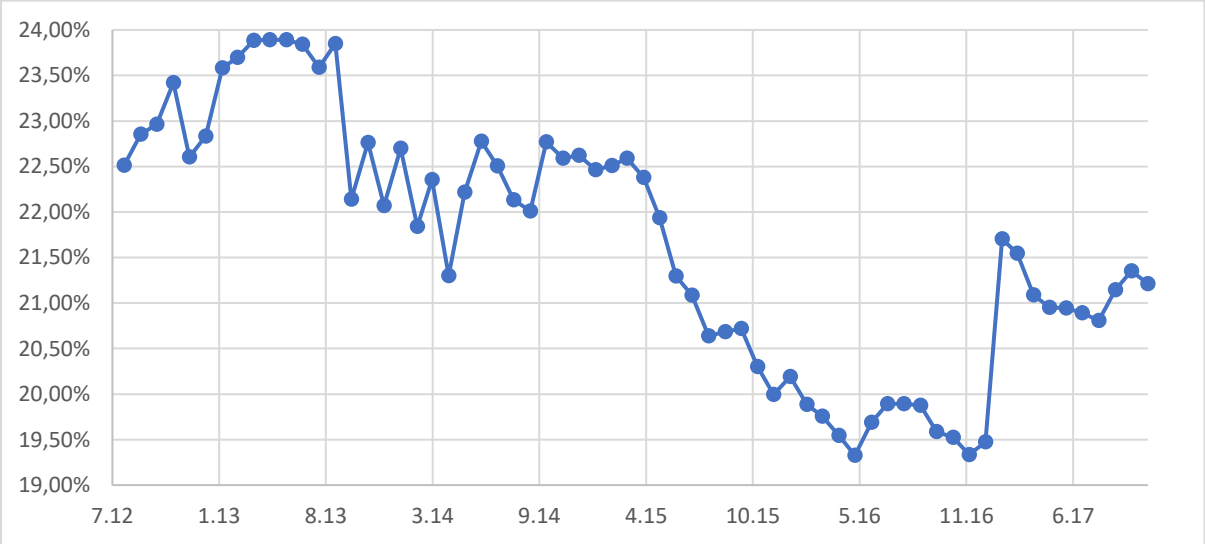
Table 1
Leading Banks that hold Securities

Year	Domestic shares – domestic investor	Domestic bonds – domestic investor	Domestic shares – foreign investor	Domestic bonds – foreign investor
2017	Slovenská sporiteľna a. s.	Československá obchodná banka a. s.	Slovenská sporiteľna a. s.	Československá obchodná banka a. s.
2016	Poštová banka a. s.	Československá obchodná banka a. s.	Slovenská sporiteľna a. s.	Československá obchodná banka a. s.
2015	Poštová banka a. s.	Československá obchodná banka a. s.	Slovenská sporiteľna a. s.	Československá obchodná banka a. s.
2014	Poštová banka a. s.	Československá obchodná banka a. s.	Slovenská sporiteľna a. s.	Československá obchodná banka a. s.
2013	Poštová banka a. s.	Československá obchodná banka a. s.	Slovenská sporiteľna a. s.	Československá obchodná banka a. s.

Source: www.nbs.sk, authors' calculations

It is clear from the Table 1 that the order of leading banks does not change significantly. It also applies that the leader is almost solely the biggest bank in the Slovak republic (by the assets) as a holder of the domestic securities. We have also analyzed the comparison of domestic deposits to domestic ownerships of securities.

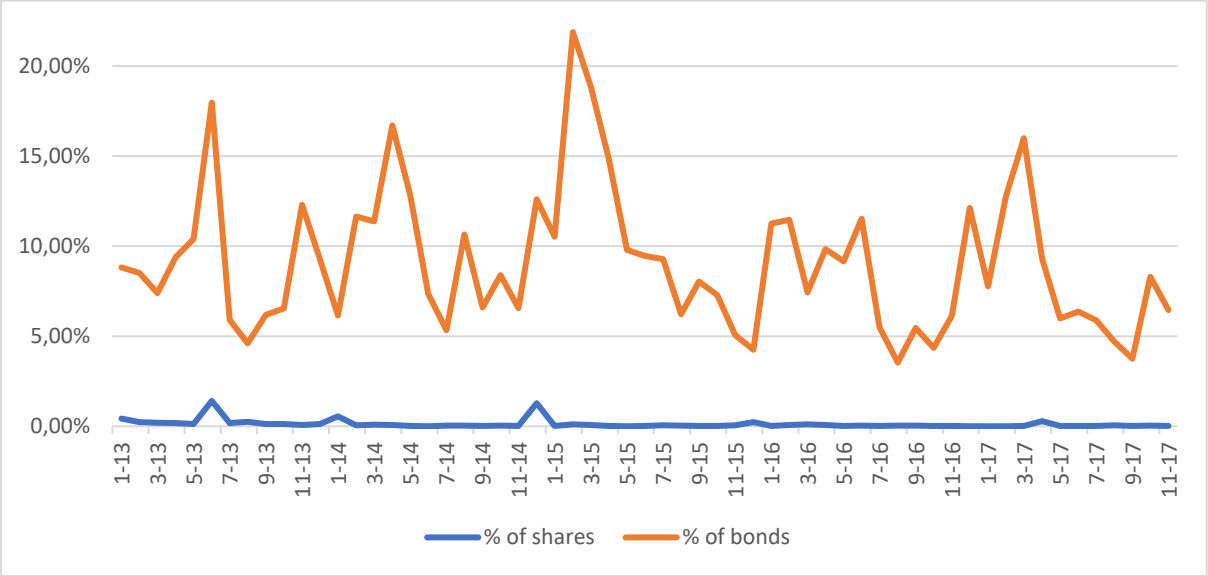
Figure 9
Comparison of ownership of domestic securities to domestic deposits



Source: www.nbs.sk, authors' calculations

As can be seen in the chart (Figure 9) the most actual percentage value of domestic investors who owned securities was approximately at the level of 21 % of all the ones having domestic deposits (which is surprisingly high value, according to us).

Figure 10
Comparison of monthly trading volumes to the total value of securities in %



Source: www.nbs.sk, www.bsse.sk, authors' calculations

Monthly stock trading, compared to the total value of securities held in banks, is close to zero for most months. The maximum value reached 1.41 % (in June 2013). However, for bonds the trading volume has fallen below 5 % only a few times. The peak of bonds trading was at 22 % of the total value of securities held in banks (in February 2015).

4 Conclusions and policy implications

The total value of securities held by banks for third parties is slowly increasing. However, it is important to note that the foreign investors hold the larger share of securities compared to the domestic ones - and that concerns both shares and bonds. Domestic investors, both at the total and at the retail level, are changing their preferences in favour of holding riskier domestic stocks even though the value of domestic bonds held is undoubtedly higher. A more significant change was recorded in the structure of foreign securities held by the domestic investors. At the retail level the value of foreign shares held is even higher than the value of foreign bonds. On the contrary, the foreign investors start to prefer the less risky domestic bonds before the domestic equity shares.

We can conclude that the statistical data and the results are more or less in favour of the foreign investors. It is therefore possible that they may affect the price of domestic securities more than the domestic investors might.

Next part of our research was to compare the value of the securities held in banks in relation to the deposits in banks. We have found out that the value of securities represents approximately one-quarter of the volume of deposits during the period under review. There has been a decrease at the beginning, but the correction has ended and the volume is rising again.

We have also examined the liquidity of securities (on Bratislava Stock Exchange) in relation to the total value of the securities held. Our findings are that the stocks have very low liquidity while for bonds, the situation is significantly better. On average, 9 % of the monthly trading volune is made by domestic investors – not to even mention that domestic bonds held by the foreign investors have not been included in the calculation.

Acknowledgement
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Circular Economy as an approach to innovations and new business opportunities

Brigita Boorová, Klaudia Porubanová

Abstract
Circular Economy is based on principle within which all product and material flows are connected within their cycle in a way they will become repeated source for new products and services. It means that waste should exist no longer, or it is eliminated. System of circular economy aims to sustain added value in products for as long as possible. Circular economy is currently considered a very important part of market economy. Studies in the field are various. Article presented is focused on theoretical analyses of foreign researches in given area and execution of circular economy problematic in national businesses of market economy.

JEL classification*: Q 53,Q 56, Q 57*
Keywords*: circular economy, environment, production system.*

1 Introduction

Circular economy limits the throughput flow to a level that nature tolerates and utilises ecosystem cycles in economic cycles by respecting their natural reproduction rates. This is done by using cyclical materials flows, renewable energy sources and cascading1-type energy flows. Successful circular economy contributes to all the three dimensions of sustainable development. The circular economy is not a new concept. The intellectual roots of Circular Economy include the 3R principle (reduce, reuse, recycle), regenerative design, performance economy, cradle-to-cradle, blue economy, green growth, (McDonough & Braungart, 2002). As well as the scientific fields industrial ecology, industrial symbiosis studies, an ecological and environmental economics (Ghisellini et al., 2016). Circular Economy can be seen as part of a wider movement towards sustainable business practice (Kopnina & Blewitt, 2014).

Circular economy (CE) is currently a popular concept promoted by the EU, by several national governments and by many businesses around the world. Circular economy is an economy constructed from societal production-consumption systems that maximizes the service produced from the linear nature-society-nature material and energy throughput flow. However, the scientific and research content of the CE concept is superficial and unorganized. CE seems to be a collection of vague and separate ideas from several fields and semiscientific concepts. The European Union action plan recognizes the importance of the consumption stage. Among the goals, we can mention more reliable green claims, enhanced integration of CE in Green Public Procurement, testing a methodology to measure environmental performance and examining how ecolabels can contribute to CE (European Commission, 2015). Additionally, new forms of consumption are stimulated, such as sharing or collaborative economy based on accessing and recovering products to utilize idle capacity and new forms of the business model such as Product Service Systems (PSS).

Regarding the market for secondary raw materials, it is a set of activities related to the development of quality standards for secondary raw materials and further development of the EU Raw Materials Information System (European Commission, 2015). Another initiative in the European Union action plan is related to introducing product labelling for extended product durability, the use of pricing instruments, consumer protection rules and innovative consumption (McDowall et al., 2017). Another CE initiative is headed by the Ellen MacArthur Foundation, which has the mission to accelerate the transition towards a CE, working with

business, government and academia in order to build a framework for an economy that is restorative and regenerative by design (Ellen MacArthur Foundation, 2014).

Non-renewable resources include a large variety of mineral deposits from which metals, fossil fuels and other processed minerals can be obtained. Although the extraction of these resources provides local employment and revenues, it is usually accompanied by negative environmental externalities. For example, quarrying sand and gravel can be noisy and dusty and traffic to the mining pit can create disamenities for neighbours. Furthermore, the natural environment can be damaged by biodiversity loss, run-off water, waste generation and visual pollution (Eckermann et al., 2012). The currently popularized Circular Economy concept extends conventional waste and by-product utilization and recycling by emphasizing the utilization of the value embedded in materials in as high value applications as possible (see e.g. Asif et al., 2016; Rashid et al., 2013). The new business community popularized concept of circular economy is considered from the perspective of the concept of and scientific research on sustainable development. In particular, sustainability science (Broman et al., 2017; Broman and Robért, 2017; Robért et al., 2013). CE concept is based on a fragmented collection of ideas derived from some scientific fields including emerging fields and semiscientific concepts. These sources cover, for example:

- industrial ecology (Lifset and Graedel, 2001),
- cradle-to-cradle design (Braungart et al., 2007),
- industrial ecosystems (Jelinski et al., 1992),
- product-service systems (Tukker, 2015),
- resilience of social-ecological systems (Crépin et al., 2012),
- industrial symbioses (Chertow and Ehrenfeld, 2012),
- cleaner production including reviews on manufacturing systems' circular materials flows and developments to that end (Lieder and Rashid, 2016),
- eco-efficiency (Haas et al., 2015.),
- the performance economy (Stahel, 2010),
- the concept of zero emissions (Pauli, 2010) and others.

Circular Economy (CE) currently represents a viable option for countries, governments, academia and society to transform the linear and semi-circular materials and energy flows into circular flows and obtain better sustainable benefits.

1.1 Models and Data of researched problematics abroad

One of research models is analysis of Circular Economy problematic and their indicators, grouped into 3 levels as micro-level (organizations, products, consumers), meso-level (symbiosis association, (eco)- industrial parks), and macro-level (city, province, region, or country) (Balanay and Halog, 2016; Geng et al., 2012; Mathews and Tan, 2011; Saidani et al., 2017).

Within the studies of circular economy authors analyse different aspects of the problematic. As an example we can state authors such as Saavedra , Iritani , Pavan , Ometto (2018), whose studies consisted of three main phases for analyses of circular economy problematic. It is 1. Systematic approach regarding CE. ; 2. Bibliometric Analysis regarding CE and 3. Discussion based in the phase 2 regarding CE, general concepts, its evolution and main contributions.

The eventual impact of the CE movement on closing material cycles is yet unknown. A recent assessment of CE strategies finds a positive but limited effect on raw material demand (Fellner et al., 2017), and another study demonstrates that the global implementation of core

CE strategies can lead to savings of 6–11% of the energy used to support economic activity (Cooper et al., 2017). An estimate of the impact of material efficiency in the steel cycle on material flows and GHG emissions, which includes more ambitious changes than those investigated by Cooper et al., shows that, in case of a quick strategy roll-out, a 50% emissions cut could be possible (Milford et al., 2013).

Another researched area of circular economy problematic was service providing in hoteling. Authors of this study are Hoogmartensa, Eyckmansb, Passela (2018), exploring hoteling model for the circular economy including recycling, substitution and collection of waste. Results of their research were following findings:

The first extension relates to the inclusion of recycling sector in which recyclers choose a recycling effort in order to maximise profits. Consequently, recycling is an endogenously defined function within the optimisation model. The recyclers' source input for their recycling process on a waste market where consumers try to dispose of end-of-life consumption products (Hoogmartensa et al., 2018). The second extension is that we allow for the possibility that a substitute material can come onto the market at a fixed price. If such a substitute – such as imported material from abroad – came on the market, its price would act as a choke-off price at which the switch is made from virgin to substitute material. This substitute would actually constitute a third supply source, next to virgin and recycled material. Throughout the developed model, the full material flow system that includes these different supply sources is taken into account by imposing appropriate material balance constraints. As recycling rates will never reach 100%, every unit of material will, eventually, end up as recycling residue in a landfill (Hoogmartensa et al., 2018). Thirdly, environmental externalities are considered that can be linked to different stages of the material's life cycle. We distinguish between externalities caused by the production of virgin and substitute material, by the recycling process, by the consumption phase of the good, or by the accumulation of recycling residues in the landfill (Hoogmartensa et al., 2018). Fourthly, we introduced different policy instruments (extraction, production or consumption taxes, waste taxes, etc.) that can be used to correct for different environmental externalities (Hoogmartensa et al., 2018). Fifthly, different degrees of product durability can be simulated by selecting different functional relationships between past consumption and future waste generation (Hoogmartensa et al., 2018).

2 Circular Economy in conditions of Slovak Republic

Circular Economy, also called circuit or green economy, is a new economy model representing opposite to the current model – linear economy. Core for profit of the current system „take-produce-throw out" is mainly high consumption of non-renewable sources, which cannot function in a long term. When we add other negative factors such as cheap work force from developing countries, population explosion, growing consumption, and devastating impact of human on environment, current system can be considered unsustainable – economically, ecologically and socially. On the contrary, circular model aims to ensure competitive ability of countries, their stable economic growth and healthy environment. Profit in circular economy is based on effective use of natural resources achieved by efficient assessment of used materials, products and components. Their continual return to technical and biological cycle represents closure of material flows. This way waste and costs for material inputs and energy required for production of new products are radically minimalized. Main features of this concept are utilisation of renewable resources for energy, eco-innovations, rentals, sharing or local market support (Cséfalvayová et al., 2017). Circular economy is based on principle within which all product and material flows enter their cycle in a way that after their consumption they become again resources for new products and services. This means that

waste should not exist anymore, or that it is eliminated. Circular economy systems aim to maintain added value in product longest possible.

2.1 State environmental politics of SR and perpetually sustainable development (PSD)

Proposal of the first Slovak strategy, norms and priorities of state environmental politics was approved by government of SR on 07. September 1993 by act nr. 619 and National board of Slovak republic with all votes on 18. November 1993 by act nr. 339. Strategy is determined by 5 following field oriented priorities for the whole duration of its validity:

- protection of atmosphere from harming substances and global environmental safety,
- securing enough of drinking water and decreased contamination of other waters under allowed standard,
- protection of soil from degradation and ensuring clean food and other products,
- minimisation of creating, using and correct diffusion of waste,
- conservation of biological diversity, protection and rational utilisation of natural resources and optimisation of space structure and land use.

Stated priorities are comparable with priorities of other countries, Slovak Republic shares longest boarder with, hence 5 priorities of environmental politics with Hungary and Poland, where priorities are divided into long term and short term and are identical with strategic objectives. Also in developed countries they have up to 5 to 7 priorities. For example, in Canada, as well as in Slovakia, with an orientation towards clean atmosphere, waters and land and global environmental security (MŽP SR, 2018).

Perpetually sustainable development (PSD) was defined in 1987 in: „Board of world commission for environment and development“, names: „Our common future“, as: „Development that satisfies needs of today without limiting possibilities of future generations to satisfy their needs“. According to an act of legislation nr. 17/1992 SR PSD is such development that preserves possibility to satisfy needs for future generations and their basic needs without decreasing nature diversity and preserves natural ecosystem functions. **National strategy for perpetually sustainable development of Slovak Republic** accepted in 2001 includes main dimensions of perpetually sustainable development: environmental, social, economic, institutional. To achieve this orientation it is crucial to emanate from principles and criterion of PSD in all spheres of society and orient towards following long term priorities, including also: high quality of environment, protection and rational utilisation of natural resources, effective protection of environment, careful utilisation of natural resources, elimination of environmental burdens and harming environment, limitation of economic development corresponding with natural conditions and potentials, achieving and sustaining quality environment with emphasis on endangered areas.

2.2 Tools of environmental politics applied in SR

To achieve above mentioned objectives, principles or strategies, state applies wide spectre of environmental politics tools, including economic (market oriented) tools, legislative (direct, normative) tools, voluntary (free) tools. Selection of tools is determined by extent to which goals are specified and the way to achieve them. In decision making about certain tool, it is necessary to emanate from detailed analysis of applied tools in area of protection and creation of environment. Analysis usually comes from objectives, defined by state environmental politics as well as assessment of the current conditions and development of environment protection. **Basic tools of environmental politics applied in Slovakia**, *formed by economic tools, which* impact indirectly via market and involve various fees, payments, contributions, tradable emission licenses, system of deposit containers, taxes, etc. ***legislation tools***, which

impact directly, have limiting and compulsory character, they have relatively quick impact and are easily controllable, they include laws, acts, profits, prohibitions, commands, limitations, limits, technical norms, etc. and ***voluntary tools***, which impact within framework, which states create for their functioning on market via legislation rules (law, act) or non-legislative rules (government decree). With its nature it is connected with application on a market and following self-regulation and they do not limit activities of businesses in significant way.

Voluntary tools of environmental politics are vital part of transition to circular economy. The most important are Ecolabelling,.GPP (Green Public Procurement), EMS (Environmental management system) according to ISO 14001 and EMAS (Eco-Management and Audit Scheme). Slovak agency environment takes part on their realization, Department of environmental management and Basel agreement in Bratislava, which has also function of competent authority for EMAS scheme.

Ecolabelling – environmental labelling of products and services which aims to soften negative impact of consumption and production on environment, health, climate and nature. In conditions of SR environmental labelling has been realised since 1997 throughout national scheme for awarding **national environmental brand „Environmentally suitable product" (EVP).** Conditions and steps for granting and utilisation are conditioned by act of legislation nr. 469/2002 body of laws about environmental labelling of products in a word of later regulations. To apply for granting of EVP mark asks producer, service provider, importer or business person. In Slovakia, currently there are **43 products** with right to use labelling of EVP. There belong for example different **universal sorptive materials, hydrophobe sorptive materials** – Johan ENVIRO s.r.o. Bratislava, **portland cement, blast furnace cement** – Považská cementáreň, a. s. Ladce, **Gabion building construction** BLOCK-SK – COMPAG SK s.r.o. Bratislava and others. **Since 2004, by entering of Slovak republic into European Union**, applicants have possibility to obtain also **European environmental brand „Environmental brand of EU" (previously „European flower".** Granting of European environmental brand is realized in accordance with regulations EP and R (ES) nr. 66/2010 about environmental brand of European Union. It is a supranational system, valid in all countries of EU as well as in Norway, Lichtenstein and Iceland. Flower as well as eco-brand of EU might be obtained by all producers, or service providers offering their product or service on market of EU without consideration of country origin. This program of European Union was established in 1990. To obtain this certificate was firstly possible only for products. First products obtained this certificate in 1996. In 2000, program was modified by decree of European Parliament and board of European commonwealth nr. 1980/and hence was widened for providers of services. In Slovakia it is possible to obtain this label since 2004. Granting of European environmental brand is conducted in accordance with regulation EP and R (ES) nr. 66/2010 about environmental brand of EU. **Currently, in Slovakia there are 4 businesses possessing this brand, out of which 2 are production businesses and 2 businesses provide accommodation services:**

- SHP HARMANEC, a. s. Harmanec – **toilet paper recyclable with whiteness starting from 76 % ISO,**
- SLOVENSKÁ GRAFIA, a.s. Bratislava – **products from pressed paper: advertisement materials and intelligence flyers, catalogues, flyers, brochures,**
- DAIRA, s.r.o. Košice, accommodation service - **Eco Friendly Hotel Dália – class level ***,**
- XFUSION s.r.o. Bojnice, accommodation service: **Hotel Bojnice wine house ****** (SAŽP, 2018).

Green Public Procurement represents procedure, which considers environmental impact of products, services and building jobs within their purchase and public procurement by application of environmental requirements. It is how organs of public administration integrate environmental requirements into process of procurement within technical requirements or selection criterion. First step for exercise in practice was command of ministry of environment of SR nr. 6/2001–7.1., which states that in resort of environment there were criterions for applicants for public procurement to integrate products with right to use brand Ecolabel and to prefer products labelled with brand Ecolabel in direct purchase of products for operation of ministries and organisations established by ministry (Záhoranová, 2008).

Environmental managerial system *(EMS)* according to norm ISO 14 001 belongs to important managerial tools. EMS consists of certain number of mutually connected elements allowing organisations to analyse, control and decrease negative environmental impact of certain activities, products and services as well as management of organisation higher efficiency and control. Importance of EMS lies in enabling directing environmental problems in company by planning and systematic means and help for identification of way for continual improvement of environmental business behaviour. EMS is suitable for all types of organisations without exception for their size, activities or whether they belong to public or private sector.

Eco-Management and Audit Scheme motivates organisation towards improvement of environmental efficiency above law frameworks. It is established by European Union and offers solutions to organisations in key challenges such as effective utilisation of resources, climate changes or social responsibility.

2.3 Slovakia on the way towards circular economy

Slovakia is at the bottom of the ladder out of all EU countries when it comes to recycling. In 2015, **69%** of communal waste ended at Slovak dump sites and probably only **20%** was recycled. However, European Commission requires minimal recycling of **50%** of all household waste to year 2020 from all member countries (Enviroportal, 2017). Considering Europe, implementation of circular system is logical and inevitable, especially due to dependence on resource import from abroad and continual political situation in the world. Estimations claim, that such system could save **EU annually up to 1,8 billion EUR** by 2030. In 2015 there was adopted **bundle of actions**, aimed at increasing interest for circular economy and help members of EU countries with transition. European Commission attempts to make this transition more effective, and hence regularly analyse and leads actions of individual countries. Developed countries such as Netherlands, Belgium, Sweden, France or Great Britain with financial and human capacities for research and development have become leaders of this transition. Interesting examples from practice are also offered by other countries including Slovakia. Results from application of environmental politics of EU in Slovakia state that **environmental awareness of citizens is insufficient** and term circular economy, circular management are for most of them unknown terms. However, **some individuals, companies, non-profitable organisations, villages and ministries have started preparing settings for process changes and system perceiving**.

According to RNDr. Maria Fischerova, main state advisor for section of environmental politics, EU and international relationships SR „MŽP SR is a leading organ for Operational program Quality of environment. Investment in sectors of waste and water management, energetics, atmosphere or nature protection directly supports implementation of circular economy. When it comes to waste management, there was set a hierarchy where the main task is minimisation of waste created. Currently there are realised measurements aimed at increased level of recycling and decreased level of dump sites. For area of green public procurement (GPP

– Green public procurement) (definite only for government control) there was accepted national action plan at the end of 2016, which success is still being influenced by criterion „price“. However, by the 2018 , it is planned to make criterion for procurement of three product groups – office paper, automobile transportation and computesr more definite. In the end, it is necessary to add that MŽP SR often annotates several proposals for legislation changes with an aim to include message of circular economy .“

Glass making company **Vetropack** based in the town of Nemsova uses for production of their products more than **60% used glass**. Glass can be recycled ad infinitum without decreasing its quality, and hence is considered an example production material for circular management. Vetropack saves resources also by production of lighter but still resistant glass containers. Considering paper, company **Kuruc company** from Surany produces **packages** made of **absorption cartonnage,** which means 100% of nontoxic recycled materials, which is further recyclable and easily decomposable. Factory **Mondi SCP Ružomberok** produces its own **EKO paper collection**, which is created by processing of collected paper which is whitened. Apart from this, company owns a certificate of international schemes FSC™ and PEFC™, which guarantee that their wood comes from well farmed forests. Another meaning to the wood gives young Zilina company **Pure Junk**, which turns **wood waste** into designer interesting and functional objects for interiors and exteriors. Problematic of dealing with **old tyres** is dealt by company **AVE SK,** which processes them into **rubber mats**, suitable as anti-noise screen or surface for playgrounds, or stables.

Possibilities for utilisation of unwanted **textile** in industry are not all well known, but they are very interesting. Latest research shows that textile fibres can be recycled all over again without their weakening, however these technologies have not been spread yet. Good local example of a company operating in this area is company **SK-Tex** based in Senica, which annually returns into cycle approximately 4 500 tons of textile waste and turns it into tearing or other kinds of isolations with special parameters. These products are suitable for automobile, furniture as well as building industry and are recyclable after reaching the end of their life cycle. Second company worth a mention is **PR Krajné**, which developed patent technology **Stered**, aimed at material depreciation of synthetic **textile waste from automobile industry**. Final products have number of uses. Apart from others they might be used as warmth and anti-noise isolations, tram noise absorbent, pavements, parking lots or vegetation rooftops able to detain rain water and non-accumulate warmth. Company PR Krajne attempts to function in accordance with principles of circular management. One of their initiatives was also rebuilding unused production area to base for their new factory. Processing of electro **waste** in Slovakia is main focus of company **Ekoray** from Namestovo. Results of this process are components, materials and substances aimed for repeated use and recycling. In Ekoray they produce for example **PVC paving** from waste cable isolation, as well as cement composite **plastic-beton** from blended plastics, which cannot be recycled. Trnava company **HMCon** offers unique building panels, which are created by recycling multilayer packaging and paper. They have incredible noise isolating characteristics and increased fire resistance. They are created without use of chemicals of informaldehyd and are fully recyclable. In area of building industry there also operates company **Inet Slovakia**, which sells material obtained from demolition of old buildings (Cséfalvayová et al., 2017).

An example of circular economy in Slovakia is also company U.S. Steel Košice, which uses number of additional products in production of steel and steel products. They recycle for example convertor, coke and steel gas, which are flowingly used for production of electric energy for their own consumption. In production of iron and steel every year there are produced approximately one million ton of so called panels, which are sold or repeatedly recycled in

further production. In granulated form blast furnace panel is used especially in production of portland blast furnace cement, cinder concrete and hydraulic lime. In building industry it is used as slowly hardening binder to back coats for roads and highways. In some cases it can be substituted by natural gravel whose mining is burden for environment. (Euractiv, 2015).

3 Conclusions and policy implications

Natural resources are divided into renewable and non-renewable and those non-renewable are logically also exhaustible. Currently we are oriented towards consumption: produce – use – throw out. There is produced high volume of waste, which does not only takes a lot of space and could be used differently, but also endangers environment, health of citizens of fauna, flora and cause loss of bio diversity. This way of life cannot be sustained in long term. European Union as well as Slovakia announce in their PSD announcements that PSD is development which satisfies needs of today without restricting possibilities of future generations to satisfy their needs. But in order for future generations to be able to satisfy their needs we need to start behaving responsibly. One of solutions is also circular economy. Voluntary tools of environmental politics are important part of transition towards circular economy. The most important are Ecolabelling, GPP, EMS in accordance with ISO 14001 and EMAS, which can be utilised by companies and hence declare to their partners, clients and future clients that they are responsible towards environment and thus can obtain competitive advantage.

When it comes to recycling Slovak Republic is positioned at the bottom of ladder within countries of EU and almost 70% of all waste ends at our dumping sites and this is a reason why we identify with recommendations of Slovak institute of circular economy, which should lead towards development of circular economy in Slovakia:

- strengthen politics framework with aim to accelerate enforcement of circular management in all industries, providing further help to local businesses and increase investments into public systems for research and education,
- stimulation of academia and school with an objective to support circular management, increase information level of consumers and small and medium business about advantages of circular economy ,
- increased level of recycling (including composting) and utilisation of ecodesign in sector of small and medium businesses, stimulation of measures for effective resource utilisation,
- support of ecological investments, simplification of approach towards financing, enforcement of system financing and development between small and medium businesses (Cséfalvayová et al., 2017).

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Analysis of cognitive disproportion between positive and negative response to visual marketing stimuli

Robert Šlosár, Peter Štetka

Abstract
Decision making is one of the most complex processes that are currently being assessed by researchers from all kinds of scientific fields. Our research is focused on analysing the cognitive disproportion between positive and negative response to visual marketing stimuli. This paper presents the design and final outcomes of a specific experiment, that we've conducted to verify and further analyse this disproportion. To do so, we needed to use specific neuromarketing methods, techniques and tools, incl. electroencephalography and response time analysis. The first part of this paper is focused on the brand knowledge and the analysis of responses to the question whether the brand is or is not popular within the experimental group of respondents. The second part presents respondents' responses to various price discounts.

JEL classification*: M31, M39*
Keywords*: decision making, visual stimulus, verbal answer, motoric answer, neuromarketing*

1 Introduction

Consumer behaviour with its many forms is nowadays still very important subject of extensive scientific research. This interest comes from the necessity to increase the effectiveness of marketing communication as a significant competition tool in today's highly competitive market. The major issue of consumer behaviour is its unpredictability and still insufficient research coverage. Based on these facts, we've developed a specific research to monitor and analyse verbal and motoric reactions to visual marketing stimuli. This paper presents our research outcomes tightly linked to the above mentioned issue.

1.1 Experimental research design

The general concept of this research is based on the premise that consumers' decision making process is a major determinant of the resulting consumer behaviour. Therefore, our research design is based on experimental activities focused on identifying and recognizing verbal and non-verbal manifestations of decision making process. This experiment was divided into two parts, while both these parts were concluded on the same experimental group of respondents. Both parts of experiment had the same structure, which means that respondents received an information about the beginning of the initial phase of measurements – they were presented with the acoustic and visual alert directing them to close their eyes.

During the first part of experiment, the experimental group was presented with different brand logos, shown in the same resolution, size and on the same background, to avoid interference and to get fast responses – "Yes" and "No" answers to the question: "Is this brand one of your favourites?". The experimental group was shown 20 separate brands from different sectors. After this part of experiment, respondents were asked to fill out the questionnaire, to identify the degree of presented brands' knowledge. Options used for this purpose were: „I know the brand", „I know the brand but I don't use it" a „I don't know the brand at all". The reason of implementing this questionnaire was to identify how long does it take to form a decision, where duration is a dependent variable depending on the knowledge of the brand, and to identify whether different parts of the respondents' brain were used when making the decision in *know / don't know* situations.

The second part of experiment was presented to all respondents included in experimental group. They were exposed to ten different discount offers consisting of discounts like 2+1 for free, family pack, 1+1 extra etc. The product was always offered at two different price levels: one for the single product and second for the discounted packaging. Part of the experiment was to identify the knowledge of presented product, where the same procedure as in previous task was applied. The main aim of these tasks was to identify respondents' ability to evaluate presented situations and to answer the question whether the offer could or couldn't be considered as a good deal. Of course, significant part of presented price offers was designed as misleading or disadvantageous. Our intention was also to find out which parts of the brain are taking a part during this process and if there is a difference between the cognitive process when evaluating price offers of known and unknown products.

1.2 Experimental research on cognitive processing of visual stimuli

In this part of the paper we are documenting and presenting measuring progress followed by partial research outcomes focusing on cognitive processing of visual marketing stimuli. Each measurement was documented in the form of cam recording and subsequent questionnaire, based on which individual responses were checked together with the cam recording. During each response the brain activity of respondents was measured and subsequently analysed. The following text includes only selected measurements and statistics.

1.2.1 Research outcomes

The research part focused on consumer behaviour was consisted of two parts, in which we've monitored respondents' decision making process related to questions whether the brand is their favourite and whether they consider proposed discounts to be beneficial. The first part included 160 tasks. Outcoming results are shown in following table.

Table 1
Brand popularity

Brand:	**Together**	Popular	Unpopular
Together	**160**	**59**	**101**
[N=160 úloh]	**100,0%**	**36,9%**	**63,1%**
Doesn't know	**31**	**0**	**31**
s%	***19,4%***	*0,0%*	*30,7%*
r%	**100,0%**	0,0%	100,0%
Knows but doesn't use	**67**	**14**	**53**
s%	***41,9%***	*23,7%*	*52,5%*
r%	**100,0%**	20,9%	79,1%
Knows and uses	**62**	**45**	**17**
s%	***38,8%***	*76,3%*	*16,8%*
r%	**100,0%**	72,6%	27,4%

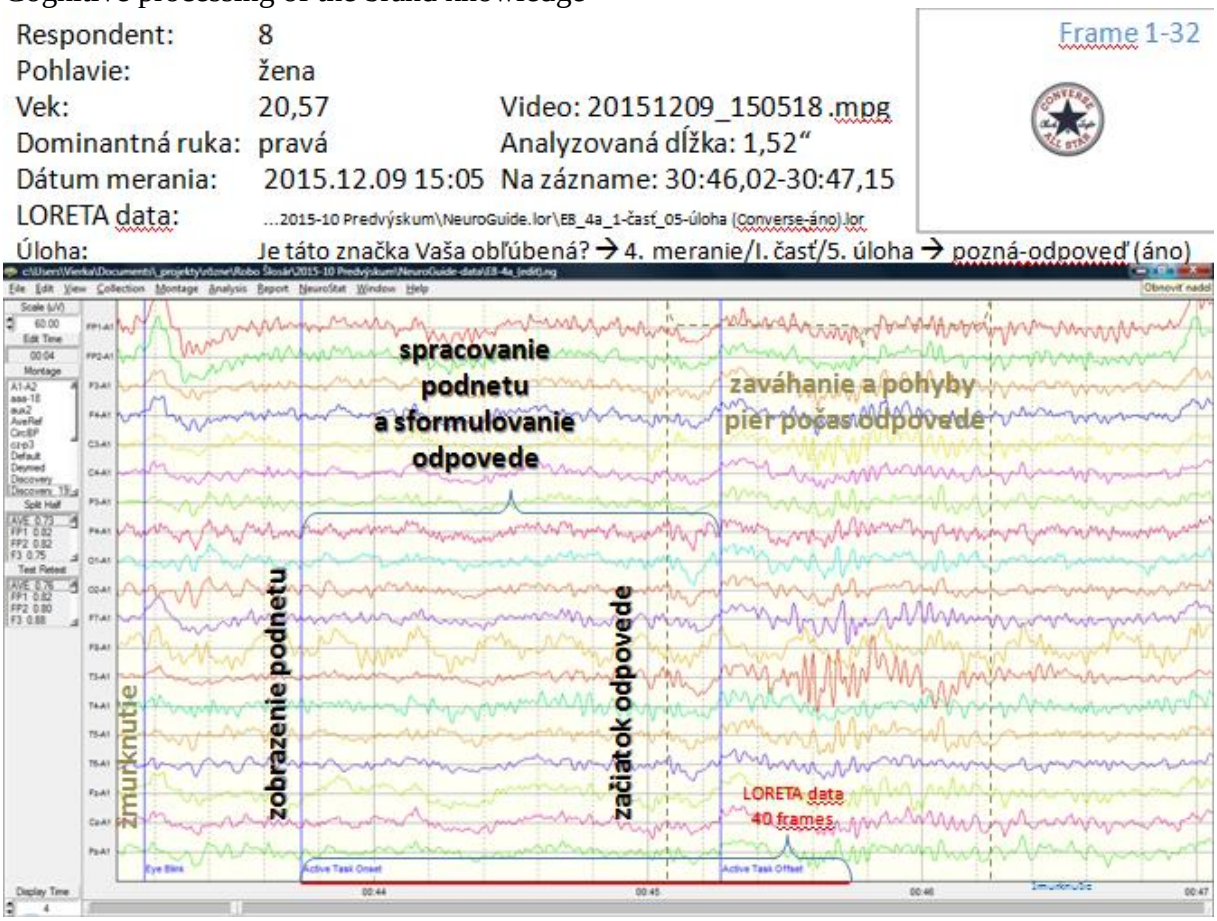
Source: Own analysis outcome

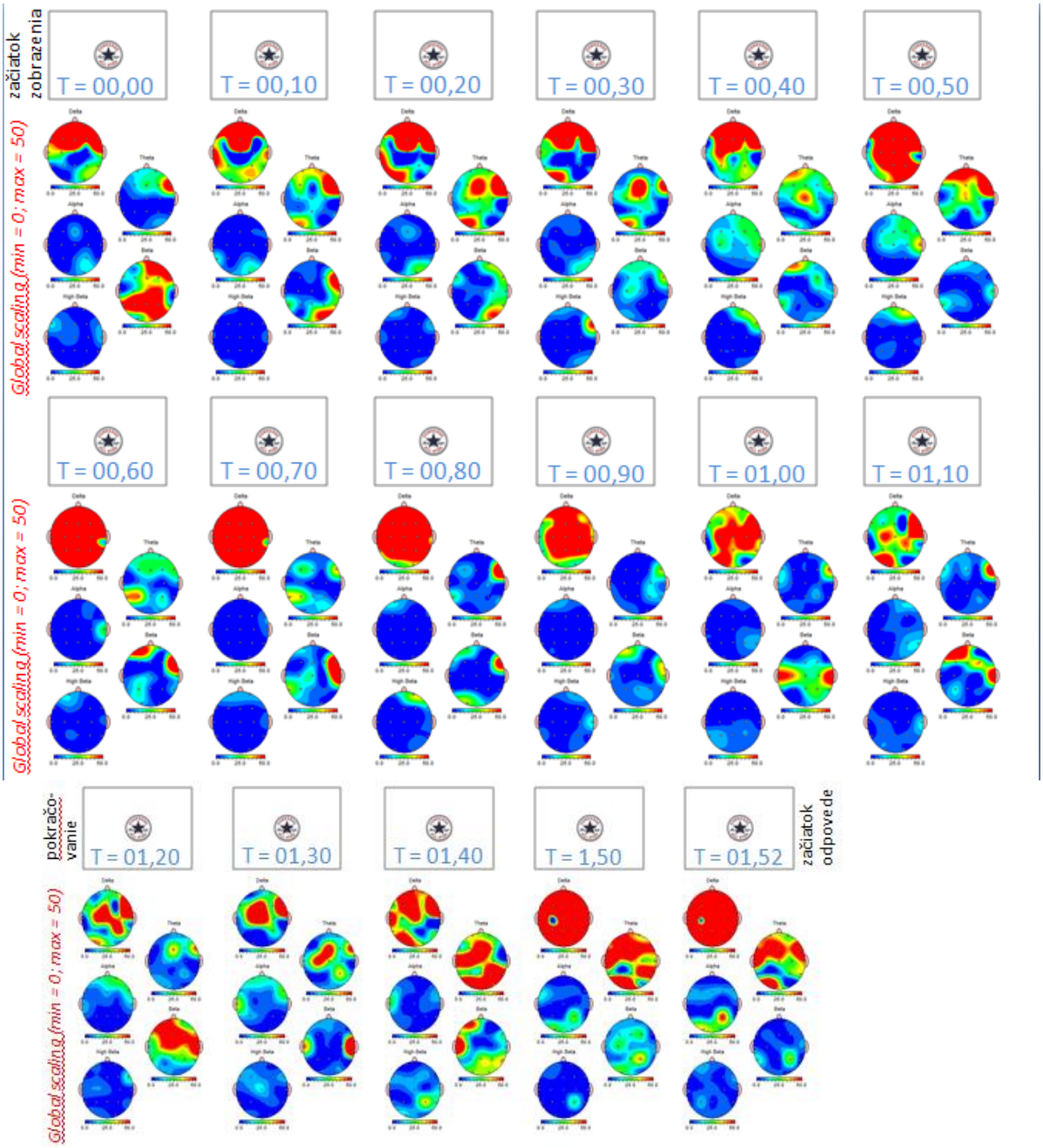
The above table shows the overall result scheme, which includes the number of answers and the evaluation of questionnaire aiming to identify respondents' relation towards the brand. The highest frequency was reported in relation to the response: I know it, but I don't use it. The second highest frequency (shown in the table above) is representing the answer "I know this brand and I actively use it". The smallest number of respondents indicated that they don't know

the brand. In this part of the research we've also carried out measurements with following outcomes.

Figure 1

Cognitive processing of the brand knowledge





Source: Own analysis outcome

The brain activity presented above clearly displays minimal activity of visual area of the brain, based on which we can assume that respondent does know this particular brand very well. This fact is supported also by the activity of the right brain hemisphere and its sleep lobe, where the already known facts are being processed. Progressing activity towards the left-hand area of the frontal lobe shows the formation of a response.

We've evaluated also the reaction time of each response made by each respondent. Our focus was mainly on the difference between the speed of "Yes" and "No" answers.

Table 2
Reaction time analysis

Task 4; Part 1.	Number of tasks	Frequency of "Yes" answers	Frequency of "No" answers	Reaction time: "Yes" answers		Reaction time: "No" answers	
				Average	Median	Average	Median
E1-a	20	6	14	0,820	0,800	0,990	1,020
E2-a	20	9	11	0,620	0,640	1,030	0,920
E3-b	20	5	15	1,220	1,240	1,430	1,280
E4-b	20	12	8	1,780	1,620	2,300	2,420
E5-a	20	5	15	1,140	0,920	1,010	0,920
E6-b	20	6	14	1,240	1,320	1,270	1,280
E7-b	20	8	12	1,080	1,040	1,340	1,340
E8-a	20	8	12	1,240	0,860	0,960	0,820
Súčet	160	59	101				
		Simple average		1,143	1,055	1,291	1,250
		Weighted arithm. mean		1,181	1,083	1,243	1,194
		Median		1,180	0,980	1,150	1,150

Source: Own analysis outcome

During the process of the reaction time evaluation we've used the average answer time of each respondent, as well as the median of the duration, for the positive and for the negative response. Subsequently, we've calculated the average, weighted arithmetical mean and median of these data to support our interpretations by multiple statistical indicators. It is clear that within the whole experimental group of respondents, the reaction times of positive responses were much shorter than the negative responses except one exception – the median of averages, where according to this indicator the response "no" was shorter by 3 hundredths of a second than the positive response. However, other indicators invalidate this deviation, so we do not consider it to be statistically significant.

Results of these measurements are presenting us with a number of factors that affect consumer decision-making, specifically:

- Knowledge of the brand does not directly mean its popularity, as evidenced by the data obtained by questioning the respondents.
- The answer "yes" to the question whether the brand is favourite is faster than the "no" response, which we've demonstrated by analysing the reaction times.
- With a good knowledge of the brand, the visual area of the brain is minimally stressed, and the centres of the left / right hemisphere are actively used to solve the new / routine issues.

The analysis of reaction times and brain activity suggests that the answer 'yes' is not only faster but also more easy to process by consumers' brain.

The second part of this experiment focused on consumer decision making was consisted of ten tasks designed in a way that respondents were pressured to decide whether the presented offer is or is not beneficial. Respondents were presented with both: beneficial and not beneficial discounts. We've used also three nonspecific products to test the difference between responses to specific and nonspecific products when evaluating its price. Altogether we've used 80 price offers presented in the form of discounts, where 56 of them were beneficial for the consumer and 24 were not. The whole structure of results is presented in the following table.

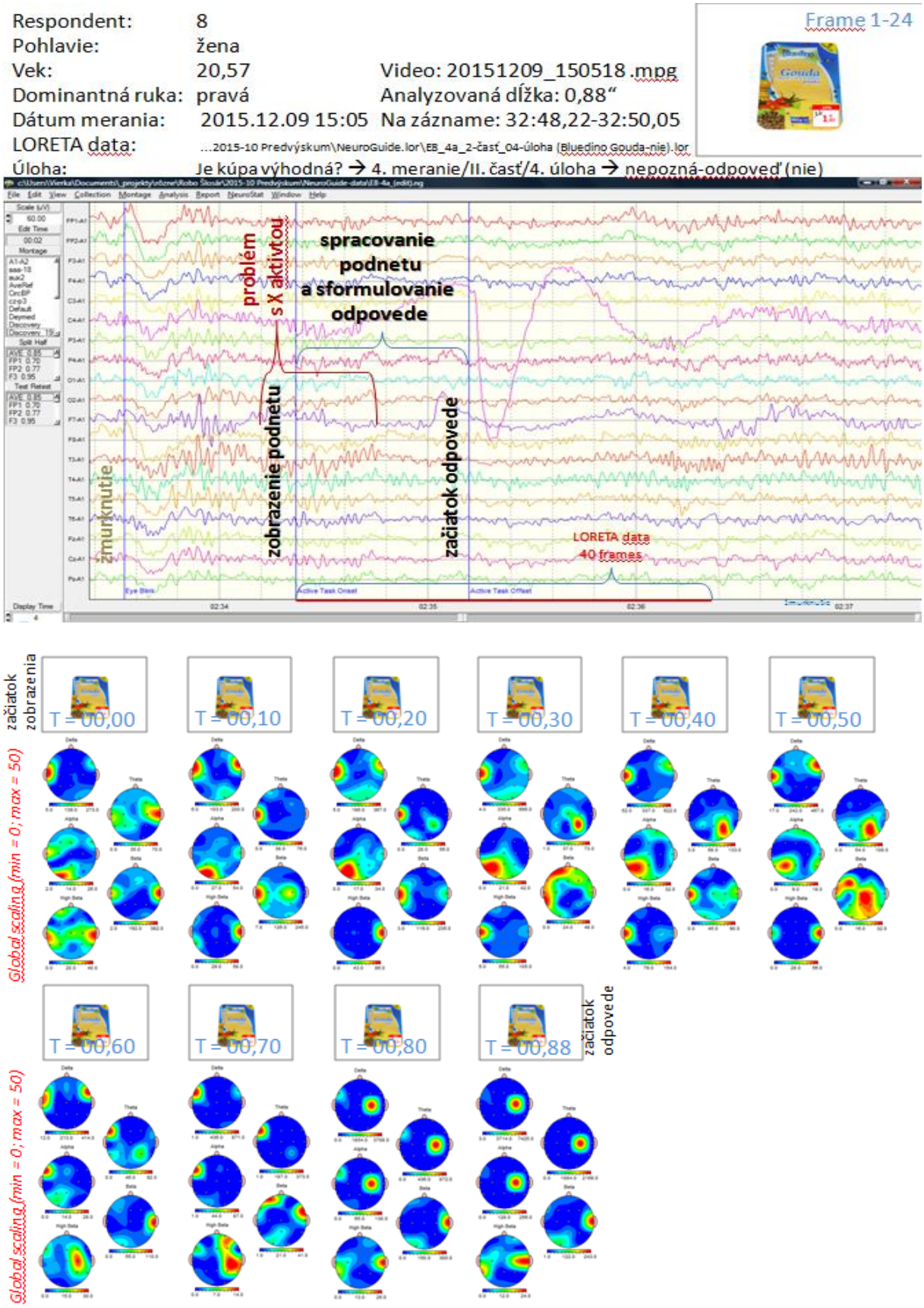
Table 3
Discounts evaluation

Beneficial discount	**Together**	Yes	No	**Not beneficial discount**	**Together**	Yes	No
Together	**56**	**44**	**12**	**Together**	**24**	**10**	**14**
[N=56 úloh]	**100,0%**	**78,6%**	**21,4%**	**[N=24 úloh]**	**100,0%**	**41,7%**	**58,3%**
Doesn't know	**15**	**12**	**3**	nepozná	**4**	**2**	**2**
s%	***26,8%***	*27,3%*	*25,0%*	*s%*	***16,7%***	*20,0%*	*14,3%*
r%	**100,0%**	80,0%	20,0%	r%	**100,0%**	50,0%	50,0%
Knows but doesn't use	**8**	**5**	**3**	pozná, nepoužíva	**9**	**6**	**3**
s%	***14,3%***	*11,4%*	*25,0%*	*s%*	***37,5%***	*60,0%*	*21,4%*
r%	**100,0%**	62,5%	37,5%	r%	**100,0%**	66,7%	33,3%
Knows and uses	**9**	**8**	**1**	pozná, používa	**11**	**2**	**9**
s%	***16,1%***	*18,2%*	*8,3%*	*s%*	***45,8%***	*20,0%*	*64,3%*
r%	**100,0%**	88,9%	11,1%	r%	**100,0%**	18,2%	81,8%
Product*	**24**	**19**	**5**	Product*	**0**	**0**	**0**
s%	***42,9%***	*43,2%*	*41,7%*	*s%*	***0,0%***	*0,0%*	*0,0%*
r%	**100,0%**	79,2%	20,8%	r%	-	-	-

Source: Own analysis outcome *product = mattress, pizza, barrel wine

The table presented above shows the structure of knowledge of each presented product identified by applying a questionnaire after finishing experimental measurements. The term 'product' represents not specifies product brands. 21,4% of 56 highly beneficial discounts was evaluated by respondents incorrectly and declared as not beneficial. More than 41% of respondents' responses, while evaluating not beneficial discounts, was classified as incorrect. In this case, respondents incorrectly believed that proposed offers were beneficial, while in fact were not. One of significant factors highly impacting the frequency of incorrect responses was the knowledge of discounted products, which is also presented in previous table. But the frequency of incorrect answers when deciding about beneficial discounts was the same, no matter the knowledge of the brand. While the frequency of incorrect answers when deciding about not beneficial discounts was differing during the evaluation of known and unknown products. Experimental group of respondents had a tendency to make much more mistakes when evaluating discounts of already known products. This part of the research included also measurements with following outcomes.

Figure 2
Discounts evaluation



Source: Own analysis outcome

It is evident from the analysis of brain activity during the processing of the stimuli, problem solving and response, that respondents were using visual centres in the back of their brain and during the processing of language information they also used the back of their left hemisphere. Activity of these brain areas takes a relatively long time, which corresponds with the fact of 'not knowing' the evaluated brand and also with the difficulty of the task being solved, what was later also confirmed by the questionnaire. We can also see in the above shown figure the activity in the right hemisphere, which is responsible for managing new and time-varying stimuli, problems and questions. With the approaching formulation of the response, activity is shifted to the foreleg areas of the right hemisphere and overall activity is gradually weakened.

Within this part of the experiment, we've also evaluated the response times of positive and negative answers. The results are presented in following table.

Table 4
Reaction time analysis

Task 4; part 2	**Number of tasks**	**Positive responses**	**Negative responses**	**Reaction time: 'Yes' answers**		**Reaction time: 'No' answers**	
				Average	Median	Average	Median
E1-a	10	8	2	2,490	2,520	2,040	2,040
E2-a	10	7	3	2,370	2,520	1,630	1,560
E3-b	10	6	4	2,850	2,680	2,240	2,180
E4-b	10	4	6	2,980	2,960	3,180	3,220
E5-a	10	7	3	2,340	2,200	2,600	2,600
E6-b	10	8	2	2,910	3,100	2,720	2,720
E7-b	10	7	3	2,200	2,280	2,610	2,720
E8-a	10	7	3	1,680	0,920	2,890	2,760
Súčet	80	54	26				
		Average		2,478	2,398	2,489	2,475
		Weighted arithm. mean		2,451	2,376	2,567	2,557
		Median		2,430	2,520	2,605	2,660

Source: Own analysis outcome

We've used the average response time for each respondent as well as the median of his responses for the "yes" and "no" variant. Subsequently, we've calculated the average, weighted arithmetical mean and median of these data so that we can base our findings on multiple statistical indicators. It is clear that within the whole experimental group of respondents, the 'yes' response times were shorter than 'no' response times. However, we must state, that as a part of this experiment design, respondents were also presented with tasks where the "no" response was the correct one. Despite such tasks, the positive response was always faster than the negative response according to all statistical indicators.

Results of these measurements are presenting us with a number of factors that affect consumer decision-making, specifically:

- Respondents are prone to falls recognition of discounts, what may lead to a disadvantageous purchase.
- The 'Yes' answer to the question whether the discount is beneficial for the consumer is much faster than the negative response, no matter the real benefit provided by the discount.
- Even with a good knowledge of a discounted product, consumers' evaluations of products' price are still incorrect.

- During the respondents' assessment of unknown products, the brain activity was recorded, especially in the left hemisphere, speech centres and visual centres.

The reaction times analysis indicates that the positive response is not only faster but also simpler for the brain to process than the 'no' answer. And the knowledge of presenterd product does not affect the assessment of the discount advantage.

Conclusion

The above presented research has been dealing with relevant visual factors affecting consumers' decision making process, which could be considered as a major determinant of subsequent consumer behaviour. In this part of research, the reaction time analysis was conducted to support and to supplement findings from electroencephalographic analysis of the consumers' brain activity. In the first part of this paper we've focused on the brand knowledge and the analysis of responses to the question whether the brand is or is not popular within the experimental group of respondents. In the second part, we've monitored respondents' responses to various discounts presented. They were answering whether the discount is or is not beneficial.

Consumer decision-making is a complex process directly affecting the resulting consumer behaviour. Therefore, we recommend marketers to respect the research findings of this experiment under the following terms. The first part of this experiment has provided us with a result that even a good knowledge of a brand is not a sufficient reason for its popularity, but when making a specific decision, a good knowledge of a brand does not require significant involvement of visual areas of the brain and the positive response is faster the negative one when evaluating the brand popularity. The second part of the experiment, focusing on consumer decision-making process analysis, allowed us to find out that respondents are prone to falsely recognize benefits of presented price discounts, which may lead to disadvantageous purchases, and also that the positive response is much faster than the negative response when deciding whether the discount is beneficial. Even with a good knowledge of products, the buying decisions are very often incorrect.

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