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INCOME TAX ASPECTS OF CRYPTOCURRENCIES – LEGAL AND YOUNG ECONOMISTS' VIEW IN THE CZECH REPUBLIC

Filip Hampl[1]

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Abstract: *Cryptocurrencies are used not only as a payment instrument but also as a speculative and investment instrument. In the context of their use, the question arises of how and whether they should be taxed. The aim of the paper is to analyse and to assess the taxation of income from the cryptocurrency operations from the perspective of a non-business natural person in compliance with the Act on Income Taxes in the Czech Republic, concurrently to find out the attitude of young future economists familiar with cryptocurrencies to this tax issue and to identify socioeconomic factors influencing their attitude. For this purpose, an online questionnaire survey was conducted among economists aged 19-35 years in May 2019. A total of 269 responses were obtained and evaluated using descriptive statistics and ordinal regression. While, according to the effective law, income from all cryptocurrency operations is to be taxed, the results show that most of the respondents (44.98%) would tax the income depending on how cryptocurrencies are used.*

Keywords: *Personal Income Tax, Act on Income Taxes, Natural Person, Survey, Thing in a Legal Sense, Virtual Currencies*

JEL Classification E64 · K40

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1. INTRODUCTION

Cryptocurrencies represent modern digital assets without physical substance existing in the form of consensually confirmed records in distributed, oftentimes publicly accessible databases called blockchains (Hern, 2018). Cryptocurrency transactions are enabled by computer cryptocurrency networks using asymmetric cryptography algorithms to secure and verify realized transactions and control generation of new cryptocurrency units (Delmolino et al., 2016). Cryptocurrencies grabbed general public attention in the course of the year 2017 in connection with the sharp rise in the price of cryptocurrency Bitcoin. For instance, the number of cryptocurrency exchange Coinbase users increased from 0.4 million in January 2017 to 11.1 million in January 2018 (Szmigiera, 2019). Since that time, many people have decided to purchase cryptocurrencies in order to utilize their potential to generate capital income. These gains are feasible due to relatively high volatility of cryptocurrencies (which was discussed by e.g. Baur and Dimpfl, 2018 or Miglietti et al., 2019). Therefore, although cryptocurrencies were intended primarily to serve as an electronic tool to make payments directly between any two willing parties without the need for financial institutions (Nakamoto, 2008), they have become rather investment or speculative assets for many users (Blau, 2017; Brauneis and Mestel, 2019). Several studies (e.g. Corbet et al., 2018) have stated that cryptocurrencies can be used as an asset for investment portfolio diversification.

For cryptocurrency users, the question arises whether income generated from cryptocurrency operations like payments, transfers etc. is subject to personal income tax. Although cryptocurrency networks do not have a central authority to oversee realised transactions (Hern, 2018), this does not mean that the transactions and their senders are anonymous. All confirmed transactions are traceable in the form of pseudo-anonymous records in publicly accessible blockchains which thus serve as the public ledgers of cryptocurrencies (Berentsen and Schär, 2018). Several studies (e.g. Kumar et al., 2017 or Khalikov and Levi, 2018) found out that the identity and the profile of a user can be revealed and cryptocurrency transactions can be traced by using combination of data from blockchain with external computer data – it follows that tax administrators may be capable to identify taxpayers and their taxable income. Thus, the first aim of the paper is to analyse and to assess the taxation of income from cryptocurrency operations from the perspective of a non-business natural person in the Czech Republic.

In addition, the question can be discussed whether income from cryptocurrency operations should be subject to personal income tax. As mentioned above, cryptocurrencies can be considered on the one hand a payment instrument like "legal" tender (according to Sabah (2019), the global number of retailers accepting cryptocurrencies is constantly increasing) and on the other hand a speculative or an investment instrument. The second aim of the paper is to find out the attitude of young future economists familiar with cryptocurrencies to the issue of their personal income taxation and to identify factors influencing the attitude. Recent surveys (e.g. Leinz, 2018; Willims, 2019 or Mrazkova, 2018) showed that young people are familiar with cryptocurrencies and purchase them more than older people. Therefore, they deal with taxation of income from cryptocurrency operations more often.

2. LEGAL VIEW ON CRYPTOCURRENCY TAXATION IN THE CZECH REPUBLIC

Taxation of income from cryptocurrency operations is not specifically regulated in the Czech Act on Income Taxes (1992), therefore general rules need to be applied. For the purposes of taxation, it is necessary to determine the legal factual nature of cryptocurrencies. Pursuant to the Czech law,

cryptocurrencies are not considered legal tender (Act on the Czech National Bank, 1993), funds (Act on Payments, 2017), investment instruments (Act on Capital Market Business, 2004) nor securities (Civil Code, 2012). They can be only subsumed into the most general legal institute of a *thing in a legal sense* which, pursuant to the Civil Code (2012, section 489), means everything that is different from a person and serves the needs of people. Legally, cryptocurrencies are construed as any other incorporeal goods, i.e. cryptocurrency payments for goods or services and mutual exchanges of various cryptocurrencies are considered barters of one thing for another thing, and exchanges of cryptocurrencies for legal tender are considered cryptocurrency sales.

Income from sales or barters of cryptocurrencies is subject to the Czech personal income tax. In fact, in accordance with the Act on Income Taxes (1992, section. 3), not only monetary but also non-monetary income generated through barter is subject to tax. However, cryptocurrency possession itself is tax neutral (Beer, 2018) – taxable income does not arise until the cryptocurrency is sold or bartered, even if the market value of the cryptocurrency increases. Due to the legal nature of cryptocurrencies, non-business persons are not allowed to exempt income from cryptocurrencies operations (barters/sales). Cryptocurrencies are not securities, therefore income from their barter or sale cannot be exempted if the 3-year time test is met, or if taxable income does not exceed 100,000 CZK (approx. 3,910 EUR) for the taxation period. Concurrently, given the fact that they are not legal tender, income cannot be considered a tax-exempted exchange gain. (Act on Income Taxes, 1992, sections 3-4) Income from cryptocurrency operations are not considered occasional, thus no tax-exemption up to 30,000 CZK (approx. 1,170 EUR) on the grounds of occasionality is allowed (Act on Income Taxes, 1992, section 10 subsection 3).

Non-business income from cryptocurrency operations is treated like any other income generated from own property management (Trnkova Kocourkova, 2018; Vodicka, 2018). The tax base from cryptocurrency operations is calculated as taxable income less tax-deductible expense. Only the acquisition price and transaction fees associated with the cryptocurrency sale/barter may be recognised as a tax-deductible expense. Gains and losses on individual cryptocurrency transactions are offset but a total loss is disregarded. (Act on Income Taxes, 1992, section 10 sections 4-5). To calculate the amount of expense, accounting methods for valuing inventories of the same kind, i.e. FIFO ("first-in, first-out") or weighted arithmetic average, can be used (Act on Accounting, 1991, section 25). The tax base calculated from cryptocurrency operations is included in the taxpayer's general tax base from all kinds of income and subject to the 15% tax rate.

The problem of the current Czech taxation method consists in the need to keep a record of each cryptocurrency transaction, even if its value is low level. It means taxpayers are obliged to record each barter of cryptocurrencies for goods and services (each cryptocurrency retail payment), each barter of a cryptocurrency for another cryptocurrency and each cryptocurrency sale for legal tender. For every single transaction, taxable income, which arises if there is a value increase between the cryptocurrency purchase and its sale/barter, needs to be de jure determined. To sum up, the Czech taxation method can be considered inconsistent with taxing principles of ease of compliance, minimizing of compliance costs and tax efficiency (Mooij and Keen, 2014).

The Case Study 1 illustrates the complicatedness of the income tax base calculation from the perspective of a non-business natural person realising cryptocurrency operations.

Case Study 1. Calculation of non-business person tax base from cryptocurrency operations

A non-business natural person purchased on the cryptocurrency exchange 10 units of cryptocurrency Litecoin (LTC) for 60 EUR/LTC. These units were used to the three transactions listed below. A transaction fee of 0.01 LTC was associated with each transaction.

Transaction no. 1:
Barter of merchandise valued 15 EUR for 0.25 LTC, exchange rate 60 EUR/LTC.

Transaction no. 2:
Barter of the same merchandise valued 15 EUR for 0.20 LTC, exchange rate 75 EUR/LTC:

Transaction no. 3:
Sale of 0.50 LTC for legal tender EUR, exchange rate 75 EUR/LTC.

Table 1 shows the calculation of the tax base from the transactions mentioned above. Taxable income is both monetary (transaction no. 3) and non-monetary (transactions no. 1 and 2 in value of bartered merchandise). Litecoin acquisition price and transaction fees represent tax-deductible expenses (valued at the purchase exchange rate).

Table 1. Calculation of the tax base from the cryptocurrency transactions
Source: author's own calculations

Trans.	Units in transaction	Transaction fee	Exchange rate	Taxable income	Tax-deductible expense	Amount added to the tax base
Purchase	10.00 LTC	--	60 EUR/LTC	--	--	--
no. 1	0.25 LTC	0.01 LTC	60 EUR/LTC	15.00 EUR	15.60 EUR	- 0.60 EUR
no. 2	0.20 LTC	0.01 LTC	75 EUR/LTC	15.00 EUR	12.60 EUR	+ 2.40 EUR
no. 3	0.50 LTC	0.01 LTC	75 EUR/LTC	37.50 EUR	30.60 EUR	+ 6.90 EUR
Total tax base (taxable income – deductible expenses):				**67.50 EUR**	**58.80 EUR**	**8.70 EUR**

Total tax base taxed at 15% is 8.70 EUR.

Source: author's own processing

2.1. Comparison with Neighbour States

In the neighbour states, i.e. the Slovak Republic, the Republic of Poland and the Federal Republic of Germany, income of non-business natural persons from cryptocurrency operations is taxed in the same method like in the Czech Republic. In all mentioned neighbour countries, the tax base is also determined as the difference between the income from cryptocurrency operations and cryptocurrency acquisition price plus transaction fees (Slovak Act on Income Taxes, 2003; Polish Act on Income Taxes, 1991; German Act on Income Taxes, 1934). However, in the Republic of Poland, income from barters of a cryptocurrency for another cryptocurrency is not subject to personal income tax, i.e. trading with cryptocurrencies on cryptocurrency exchanges is not taxable (Polish Act on Income Taxes, 1991, article 17 subsection 1f; Ciszewski, 2018). Besides, in the Federal Republic of Germany, cryptocurrencies in possession of non-business natural persons are considered private money and operations with these cryptocurrencies are considered private business transactions. Income from such transactions is tax-exempt if the cryptocurrencies are held for at least one year (time test), or if

the tax base from all private business transactions does not exceed 600 EUR for a taxation period (Zitzmann, 2017). These differences in the Republic of Poland and the Federal Republic of Germany make tax administration there easier and reduce costs of taxpayers to comply the tax law.

3. YOUNG ECONOMISTS'S VIEW

Cryptocurrencies are relatively new financial assets which can serve as payment, speculative or investment instrument. Therefore, the question arises whether cryptocurrencies should be subject to personal income tax or more precisely whether they should be taxed regard to their use. The answer to this question and the attitude to taxation of income from cryptocurrency operations were investigated among young future economists aged 19-35 years.

3.1. Methodology and Data

In order to find out the attitude of young future economists on cryptocurrency taxation, an online questionnaire survey among students of the Faculty of Economics and Administration of Masaryk University located in Brno (Czech Republic) was conducted in May 2019. Young people-students (i.e. the age group 19-35 years) were chosen for the research because they are more interested in new technology innovations, are more willing to try them and as students of economics, they may become tax policymakers in the future. Recent studies confirmed that young people are familiar with cryptocurrencies. A survey conducted by an online Bitcoin marketplace Paxful among young people aged 18-42 years in August 2019 showed that 98.4% of respondents were familiar with Bitcoin, 77.4% with Ethereum, 71.6% with Litecoin and 47.6% with Ripple (Willims, 2019). In addition, according to a joint SurveyMonkey and Global Blockchain Business Council poll, 58% of cryptocurrency investors are young people aged 18-34 years (Leinz, 2018).

A total of 2,677 students of the Faculty of Economics and Administration were contacted via e-mail. A total of 269 responses were obtained, i.e. response rate was 10.05%. All respondents (100%) stated that they are familiar with cryptocurrencies like Bitcoin, Ethereum or Litecoin. Table 2 shows the profile of the survey participants. The questionnaire contained close-ended questions and one open-ended question and was created in LimeSurvey software.

Table 2. Characteristics of survey participants (n = 269)
Source: author's own processing

Characteristics	**Number of responses**	**Number of responses in %**
Gender:		
Male	147	54.65%
Female	122	45.35%
Education:		
Student of bachelor study programme	141	52.42%
Student of the follow-up master's study programme	116	43.12%
Student of the doctoral study programme	12	4.46%
Nationality:		
A resident of the Czech Republic	189	70.26%
A resident of the Slovak Republic	80	29.74%
Resident of other countries	0	0.00%

The close-ended questions were used in the survey to collect socioeconomic data and to find out whether income from cryptocurrency operations should be in respondents view taxed by personal income tax. The open-ended question was intended to provide the respondents with the option to explain their attitude and to propose changes to the current method of taxation. Obtained responses were evaluated in case of close-ended questions using descriptive statistics and ordinal regression. The open-ended question was evaluated qualitatively.

Ordinal regression estimated by maximum likelihood method was employed due to the dataset structure to identify statistically significant socioeconomic factors influencing respondents' attitude to the taxation. The following socioeconomic factors were employed as independent variables: *age*, *gender*, *nationality* (Czech or Slovak), *education*, *size_town* (the size of the town of respondents' origin), *study_stay*, *practical_train* and *job* (the last three variables were employed to express respondents' working/foreign study experience). All assumptions were met.

MS Excel was used to descriptive evaluation of responses and R Programming Language was used to perform statistical tests.

3.2. Results and Discussion

Table 3 presents respondents' answers to the question "Do you think that income from cryptocurrency non-business operations should be taxed by personal income tax?" Therefore, the results show their attitude to the cryptocurrency income taxation from the perspective of non-business natural persons.

Table 3. Respondents' attitude to the cryptocurrency income taxation (number of responses in the absolute and relative expression)
Source: author's own calculations based on the results of the survey

Do you think that income from cryptocurrency non-business operations should be taxed by personal income tax?								
	YES		**YES, but depends on the use**		**NO**		**NO OPINION**	
Total (n = 269)	**35**	**13.01%**	**121**	**44.98%**	**85**	**31.60%**	**28**	**10.41%**
Responses by gender:								
Male (n = 147)	23	15.65%	67	45.58%	40	27.21%	17	11.56%
Female (n = 122)	12	9.83%	54	44.26%	45	36.89%	11	9.02%
Responses by education:								
Student of bachelor programme (n = 141)	18	12.77%	60	42.55%	45	31.91%	18	12.77%
Student of the follow-up master's programme (n = 116)	12	10.34%	57	49.14%	37	31.90%	10	8.62%
Student of doctoral programme (n = 12)	5	41.67%	4	33.33%	3	25.00%	0	0.00 %
Responses by nationality:								
Resident of the Czech Republic (n = 189)	26	13.76%	78	41.27%	63	33.33%	22	11.64%
Resident of the Slovak Republic (n = 80)	9	11.25%	43	53.75%	22	27.50%	6	7.50%

The obtained results show most young future economists (57.99%) believe that income from cryptocurrency non-business operations should be taxed by personal income tax. But only 13.01% of respondents agree with the current method of cryptocurrency income taxation in the Czech Republic – they would like to continue to tax all income from all cryptocurrency barters or sales.

The prevailing number of respondents (44.98%) would tax income from cryptocurrency operations depending on cryptocurrency purpose of use. Students suggested that income from cryptocurrencies should have been treated like securities. It means it would be possible to exempt income generated by a non-business person in case that the 3-year time test is met, or income does not exceed 100,000 CZK (approx. 3,910 EUR) for a taxation period. Therefore, short-term speculative cryptocurrency trades would be taxed but long-term investments not. If cryptocurrencies are used as payments for goods or services, non-monetary income from these transactions should not be according to respondents taxed at all, i.e. it should be fully tax-exempted or not subject to personal income tax. This attitude is in compliance with the tax principle of tax administration simplicity.

On the other hand, 31.60% of respondents do not consider cryptocurrencies to be subject to personal income tax. Based on their provided explanation, it can be concluded that they regard cryptocurrencies as something like "legal" tender (traditional currency) which is not taxed in case of non-business natural persons. Some of students do not want to tax income from cryptocurrency operations because they believe in unregulated, distributed and state-independent nature of cryptocurrencies. In their opinion, potential taxation would violate one of the main ideas of cryptocurrencies – the absence of state intervention.

The results show that larger proportion of females (36.89%) than males (27.21%) holds the view that income from cryptocurrency operations should not be taxed. With respect to education, students of doctoral study programme are much more supportive of taxation of income from all cryptocurrency operations in comparison with students of bachelor and the follow-up master's study programmes.

However, age, education and other socioeconomic factors are not statistically significant (t-test values are lower than the value of 2). Table 4 shows the results of ordinal regression and statistical significance of socioeconomic factors influencing the young economists' attitude to the taxation of income from cryptocurrency operations.

Table 4. Results of ordinal regression
Source: author's own calculations

Variable	Value	Standard error	t-value	Significance
gender	-0.2631	0.2556	-1.0293	ns
age	-0.0612	0.0450	-1.3584	ns
nationality	0.4096	0.2818	1.4536	ns
size_town	0.0054	0.0877	0.0616	ns
education	0.2757	0.2561	1.0764	ns
study_stay	0.2023	0.3322	0.6090	ns
practical_training	0.3662	0.5419	0.6758	ns
job	0.4041	0.3820	1.0578	ns
intercept 0|1	-1.2119	0.9202	-1.3170	ns
intercept 1|2	-0.5988	0.9175	-0.6527	ns

Note: "ns" indicates no statistical significance.

Recent studies tend to think that income from cryptocurrency operations should be subject to income tax (e.g. Akins et al. 2015; Xu, 2019 or Kjærsgaard and Arfwidsson, 2019). Pursuant to the current Czech tax legislation, income from all cryptocurrency operations has to be taxed. On the contrary, the conducted survey among young future economists showed that most of the respondents would tax income from cryptocurrency operations based on whether the cryptocurrency is used as payment, investment or speculative asset. Therefore, Czech legislators should make several changes to the current Act on Income Taxes (1992). They should extend the provisions relating to securities in order to be applicable on cryptocurrencies as well. Concurrently, a new provision about the tax treatment of cryptocurrency payments for goods and services should be added. Income for these transactions should not be subject to personal income tax or should be fully tax-exempt. Due to the proposed changes, cryptocurrencies used as a payment instrument would be treated like "legal" tender. Speculations with cryptocurrencies (exceeding 100,000 CZK for a taxation period) would be still taxable. Long-term cryptocurrency investments would be tax-exempt. This taxation method would respect the different options of using cryptocurrencies and would not put the cryptocurrencies at a disadvantage compared to other assets (i.e. legal tender and securities).

4. FUTURE RESEARCH DIRECTIONS

This paper analysed and assessed the taxation method of income from cryptocurrency operations in the Czech Republic and found out the attitude of young future economists to this tax issue. Future studies could extend the research by adding a comparison of cryptocurrency tax treatment in other European and Non-European countries and extend the data sample by natural persons aged 36 and older. Besides, future studies could examine factors influencing the attitude of natural persons to cryptocurrency taxation in more detail. Papers taking into account the attitude of legal persons to the taxation of cryptocurrency income would also be of importance.

5. CONCLUSION

The paper deals with the taxation of income from cryptocurrency operations (barters of cryptocurrencies for goods or services, barters of a cryptocurrency for another cryptocurrency and sales of cryptocurrencies for legal tender) from the perspective of non-business natural persons in compliance with the Czech Act on Income Taxes. Pursuant to this Act, all monetary and non-monetary income generated even through barter from all cryptocurrency operations regardless its amount is subject to personal income tax. No tax-exemption is possible due to legal nature of cryptocurrencies. Therefore, taxpayers are obliged to record each cryptocurrency transaction which may be demanding and costly for them. Current taxation method of cryptocurrency income violates the tax principles of ease of tax compliance, minimizing compliance costs and thereby tax efficiency. Due to the complicatedness of the taxation method, taxpayers may not tax all their cryptocurrency income properly.

Regard to current legal tax treatment, the paper found out the attitude of young future economists aged 19-35 years to the taxation of income from cryptocurrency operations and their suggestions for taxation changes. From a total of 269 respondents, 13.01% would tax income from cryptocurrency operations just like the current Czech Act on Income Taxes, 44.98% would tax income depending on how cryptocurrencies are used and 31.60% would not tax income at all. Socioeconomic factors do not have a statistically significant influence on the respondent's attitude. Based on the prevailing attitude, cryptocurrencies used as a speculative and investment instruments should be tax-treated like securities. It means the tax-exemption of income generated by a non-business person would be possible if the 3-year time test is met, or income does not exceed 100,000 CZK

(approx. 3,910 EUR). Cryptocurrencies used as a payment instrument for goods or services should be considered "legal" tender. Income from these transactions should be fully tax-exempt, or not subject to personal income tax at all.

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ASSESSMENT OF DISTRESSED, PROACTIVE AND MANIPULATIVE SELLERS' BEHAVIOR IN TERMS OF THEIR GENERATION AND GENDER

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Abstract: *Sellers' behavior is an important part of trading effectiveness. The objective of the presented research, which included participation of 208 sellers, was to identify and specify differences among the selected generations (Baby Boom, X, Y, Z generations) of sellers in the context of gender. The data were collected by TBQ-T(r) (Trading Behavior Questionnaire – Traders – revised form). The paper presents the results of the multivariate analyses, which confirmed statistically significant differences among generations of sellers from the point of view of the Distressed behavior attribute. At the same time, these results confirmed statistically significant interactions between the generations and gender in assessing the Distressed, Proactive and Manipulative sellers' behavior. Limitations of this research are the limited sample size and focusing attention only on the selected factors of sellers' behavior.*

Keywords: *Seller, Behavior, Baby Boom, X, Y, Z Generations, Gender.*

JEL Classification J16

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1. INTRODUCTION TO DISTRESSED, PROACTIVE AND MANIPULATIVE SELLERS' BEHAVIOR

As reported by Glazer & Liu (2017), work-related stress has a negative impact on individuals and their productivity. As Kożusznik, Rodriguez and Peiro (2015) state, there are many aspects that affect the level of stress. According to Oksanen and Ståhle (2013), a pleasant work environment has a great impact on welfare, creativity, attitudes, perceptions, but also interactions of individuals with others. Selling is generally ranked at the top of the list of stressful jobs and there are plenty of stress-triggering factors in the daily life of a seller. Sellers are put in situations that create a high-stress environment (Johannson, 2018). According to Kemp et al. (2013), stress that affects sellers has both a positive and a negative side and every seller perceives a different situation as a source of stress. As Johannson (2018) points out that demanding situations should be a challenge and an opportunity for sellers to grow and learning how to cope with stress and with severe situations is an essential skill in the workplace.

Proactive sellers' behavior is manifested by an assertive, committed approach of dealers, effective, pleasant and courteous communication, attention, respect and mutual trust of the customer and the seller (Štefko et al. 2019). Committed and assertive behavior is part of the concept of positive occupational psychology in view of their content, which is defined by Seligman & Csikszentmihalyi (2000) as a scientific study of optimal employee performance, aimed at discovering and supporting factors that enable employees and organizations to prosper. Joy (2016) claims that engagement has a positive effect on both productivity and well-being at work, resulting in a positive attitude of sellers towards customers. Medhurst and Albrecht (2016) define assertiveness as an effort to address situations that arise from customer requirements. Assertiveness of sellers brings about increased sales, happiness, satisfaction, fulfillment, well-functioning teams, confidence, trustworthy sales demonstration, creativity, customer service quality, less stress. Garner (2012) adds that assertive, passionate, honest and humble sellers work on customer loyalty.

Manifestations of manipulative behavior can be observed in the field of business behavior. A variety of tools, principles, and approaches are used in the business environment to influence and manipulate customers (Sunstein, 2016). Manipulation is a universal social phenomenon, a part of persuasive communication through which, according to Štefko & Gallo (2015), the source seeks to deliberately influence the addressee in order to change their mental state in an atmosphere of free choice. Braiker (2004) sees manipulation as a social impact which aims to change customer decisions through different tactics. This may include misrepresenting information about products and services, unclear arguments, unfair compliments, and unwillingness to help. Unethical practices are reported by dissatisfied customers and cause greater damage than the short-term benefits of one-off sales (Dooley 2011).

2. BABY BOOM, X, Y AND Z GENERATIONS

Strauss & Howe (1991) define generation as a large group of people and internally differentiated delineated population that grew up in a certain time period, which is connected by a similar way of behavior, thinking and acting. Troksa (2016) says that the major events often impact the culture within each generation and in every generation, there are social, political, and economical events, which can shape the ways that a generation is perceived. For the purpose of this research, we used the time periods of generations as defined by Horváthová & Čopíková (2015), which are in the Slovak conditions as follows:

Following World War II, the number of children increased dramatically, what made the Baby Boom generation substantially larger. The concept of **The Baby Boom generation** (1946 – 1964) has showed as a significant theme within social gerontology, increasingly in a European context (Phillipson, 2008). This generation values precious work and strenuousness. They are independent, confident, achievement-oriented, dedicated, career-focused, extremely hardworking and motivated by position, perks or prestige. They are not afraid of confrontation and do not hesitate to challenge established practices (Kane 2019). **The Generation X** (1965 – 1981) is a small, highly educated and widely diverse group of individuals, which values freedom and independence, they are competitive, individualistic, self-assertive, hardworking, and less loyal. As Appelbaum et al. (2005) state, this generation is more productive and motivated, easily trainable, and reflects high job satisfaction levels. According to Shen Kian, Yusoff & Rajah (2013), individuals from this generation are independent, technologically skilled and very good multi-taskers. They are motivated by an extra time off rather than money, and they place a high value on their personal lives. **The Generation Y** is the most technologically savvy generation in the workplace. They tend to need more feedback, prefer to work in teams, and are highly adaptable. As Cogin (2012) claims, they like candor, openness, transparency, flexibility of time and try to be polite. On the other hand, they don't like rules and bureaucracy. According to Shen Kian, Yusoff & Rajah (2013), they are friendly, positive, interactive, entertaining, and strongly team-oriented. They are open to education, challenges, development, and require a positive work climate as well. Members of the **Generation Z** (1993 – 2010) are just entering workforce and for them, technologies are a natural part of life. For Gen Z, the technological sophistication in the workplace is an important part of their decision-making process when considering job offers. For sales teams, this means the latest sales tech is necessary for attracting the top talent (Quan, 2019). According to Csobanka (2016) this generation can find and check the information they need. Communication among them is continuous because of social media, but personal meetings are also important to them.

3. RESEARCH METHODOLOGY, SAMPLE AND RESULTS

The main aim of the research was to find out whether there exist any statistically significant differences in assessing the distressed, proactive and manipulative sellers' behavior and specify differences among the selected generations (Baby Boom, X, Y, Z) of sellers in the context of gender. Data obtained from the respondents were analyzed by the mathematical-statistical method of Multivariate analysis of variance (MANOVA) in the statistical program IBM SPSS 22.00. For the purpose of assessing the sellers' behavior by the sellers, the original TBQ-T(r) questionnaire was used which was developed on the basis of the TBQ-T methodology (Štefko et al., 2019). The questionnaire TBQ-T(r) contains 19 items designed for the participants-sellers and enables assessment of three factors specified according to their content as follows: **F1: Distressed sellers' behavior -** is saturated with 8 items that specify the factor content in terms of customers' willingness to tolerate stress manifestations in sellers' behavior. A higher score also represents a higher rate of this tolerance. **F2: Proactive sellers' behavior -** is saturated with 16 items and is aimed at assessing the engaged, committed and assertive behavior of sellers. The content context is related to the awareness of the relationship between the seller's proactive approach and the positive customer response in the form of product selection. A higher score also represents a higher degree of this awareness. **F3: Manipulative sellers' behavior -** is saturated with 5 items and is aimed at the use of manipulative sales techniques. It focuses on whether sellers feel that they manipulate customers, or accept manipulative behavior as part of the sales process. A higher score also represents a higher degree of manipulation.

The respondents were to respond on a 6-point Likert scale from 1 to 6 to what extent they agree with the given statement (1 – definitely no/ 6 – definitely yes). The time periods for individual

generations were set in accordance with Horváthová and Čopíková (2015) as follows: 1946-1964 Baby Boom, 1965-1981 Generation X, 1982-1992 Generation Y, 1993-2010 Generation Z. To the fore came the analysis of the interaction relationship between generations and gender.

The research sample consisted of 208 respondents, 106 (51.0%) of which were men and 102 (49.0%) were women aged between 19 and 61 years, with an average age of 37.77 years (SD=13.017 years). The Baby boom generation (1946-1964) was represented by 44 (21.2%) respondents, the Generation X (1965-1981) by 52 (25.0%) respondents, the Generation Y (1982-1992) by 64 (30.8%) respondents, and the Generation Z (1993-2010) was represented by 48 (23.1%) respondents.

The research is aimed at finding statistically significant differences in assessing the Distressed, Proactive and Manipulative sellers' behavior by the selected generations of sellers: Baby boom (BB), X, Y and Z in the context of gender. The multivariate analysis results did not confirm statistically significant gender-related differences but confirmed the existence of statistically significant differences in the analysis of generations (F – 3.850, sig. – .000) and the gender-generation interactions (F – 3.606, sig. – .000).

The tests of Between-Subjects Effects confirmed the existence of statistically significant differences in the analysis of gender in the Manipulative sellers' behavior factor (F – 3.587, sig. – .049) (Table 1) and generation in the Distressed sellers' behavior factor (F – 6.830, sig. – .000) (Table 2 and Table 3).

Table 1. Assessment of the Manipulative sellers' behavior factor by male and female sellers
Source: own processing

Gender	M	SD
male	3.3653	1.28882
female	3.6220	1.16650

In the assessment of the Manipulative sellers' behavior factor, female sellers scored higher than the male sellers. The male sellers expressed a greater degree of disagreement when assessing this factor, which means that they assess their behavior as less manipulative than it was among the female sellers (Table 1).

Table 2. Assessment of the Distressed sellers' behavior factor by different generations
Source: own processing

Generation	M
Baby Boom (1946-1964)	3.3651
X (1965-1981)	4.0272
Y (1982-1992)	4.1333
Z (1993-2010)	4.0109

In terms of assessing the manifestations of stress in sellers' behavior, the respondents from the Baby Boom generation (1946-1964) had prominently the lowest scores (Table 2). In the Tukey test results, they were a separate subset of respondents (Table 3). It means that they did not agree with the expected tolerance of stress manifestations in the behavior of sellers by customers. Respondents of the other three generations have expressed some degree of agreement with the tolerance and acceptance of these manifestations in the behavior of sellers.

Table 3. Assessment of the Distressed sellers' behavior factor
by different generations – Post hoc Tukey HSD test
Source: own processing

Dependent Variable			Mean Difference (I-J)	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Distressed	1946-1964-BB	1965-1981-X	-.6620	**.001**	-1.1225	-.2016
		1982-1992-Y	-.7682	**.000**	-1.2037	-.3327
		1993-2010-Z	-.6457	**.002**	-1.1062	-.1853

At the same time, these tests confirmed the existence of statistically significant differences in the analysis of gender-generation interactions in the Proactive sellers' behavior (F – 6.851, sig. – .000) (Figure 1) and the Manipulative sellers' behavior factors (F – 2.616, sig. – .049) (Figure 2).

In assessing the Proactive sellers' behavior factor, the Baby Boom generation male respondents expressed a higher level of agreement than the female representatives of this generation. On the contrary, the Generations X and Z females expressed a higher level of agreement than male representatives of these generations. In terms of the Generation Y respondents, the recorded gender-based differences were not significant (Figure 1).

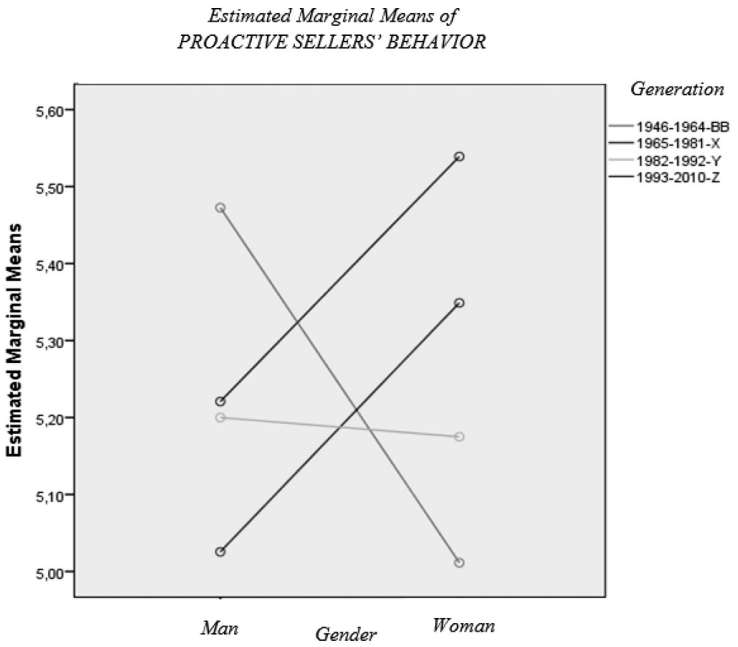

Figure 1. Proactive sellers' behavior factor – the gender and generation interaction
Source: own processing

In assessing the Manipulative sellers' behavior factor, the Generation Y males expressed a higher level of agreement than females of that generation. On the contrary, the Baby Boom, X and Z generation females expressed a higher level of agreement than the male representatives of these generations (Figure 2).

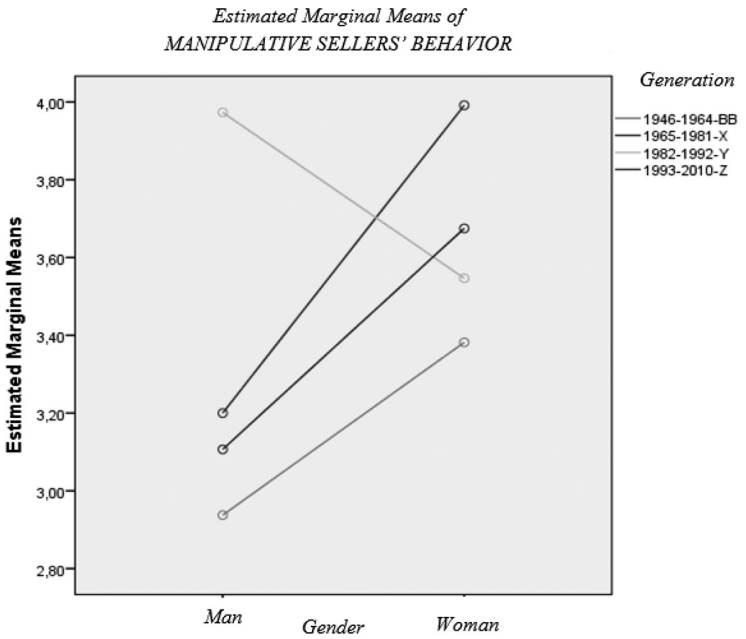

Figure 2. Manipulative sellers' behavior factor – the gender and generation interaction
Source: own processing

4. FUTURE RESEARCH DIRECTIONS AND CONCLUSION

The shop is a place where sellers' behavior is affected by sellers' gender-based and generational differences. The generational differences in the context of gender were confirmed from the point of view of Proactive sellers' behavior and Manipulative sellers' behavior. In assessing the Proactive sellers' behavior factor, the Baby Boom generation males expressed a higher level of agreement than the females of this generation. The males of this generation are more marked by the characteristics of the Baby Boom generation, which is extremely hardworking and motivated by position, benefits and prestige (Kane, 2019). They are more aware of the importance of the relationship between a proactive seller's approach and a positive customer response. On the contrary, females of the Generations X and Z expressed a higher level of agreement in assessing the importance of Proactive sellers' behavior than males of these generations. In terms of the Generation Y respondents, the differences between the male and the female sellers were not significant. These results confirm the adequacy of considerations about the interaction effects of generational differences and gender in the context of the assessment of Proactive sellers' behavior. The results of the assessment of Manipulative sellers' behavior also support the considerations about the interaction effects of generational differences and gender. In assessing this factor, males of Generation Y expressed a higher level of agreement than females of this generation. They have a stronger feeling that sellers manipulate customers while taking the manipulative behavior of the seller as part of the sales process. Contrarily, in this context, the female representatives of the generations Baby Boom, X and Z expressed a higher level of agreement than males of these generations.

Based on the results obtained, it is possible to discuss the question of to what extent is the assessment of Distressed, Proactive and Manipulative sellers' behavior universal, or what is the meaningful level of generalization in analyzing these manifestations. The above findings point to the necessity of accepting the minimum interaction effect of generational differences and gender.

At the same time, it is possible in the future research within this context to pay attention to the positions of sellers, customers and their personality characteristics, or other socio-demographic characteristics. These findings should also be interpreted in the context of the cultural, social and historical conditions in which these generations lived. Simultaneously, this issue represents also a possible orientation of the future research, which presupposes cooperation of several scientific disciplines and is obviously of an inter-disciplinary nature.

The main aim of the research was to find out whether there exist any statistically significant differences in the assessment of the Distressed, Proactive and Manipulative sellers' behavior from the perspective of the Baby Boom, X, Y and Z generations of sellers in the context of gender. The presented results of the analyses support the considerations about a broader concept of examining generational differences in assessing sellers' behavior as such. The findings suggest that there is a need to discuss a meaningful level of generality in identifying and specifying intergenerational differences. This discussion does not only concern the differences examined in terms of assessing the behavior of sellers, but also relates to the concept of examining intergenerational differences as a whole.

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GENDER PAY GAP: EVIDENCE FROM THE CZECH PRIVATE COMPANY

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Abstract: *The aim of this article is to find out if in the analyzed company there exists a pay discrimination between women and men. If so, how big it is and what impact it has on real salaries. In the analyzed company the survey was focused on the salaries' differentiation of random sample of 30 women and 30 men working on the same or similar positions, enrolled in the same pay scales and working full time. The prerequisite for the distribution of salaries in the population was a normal distribution. The construction of two-sided confidence interval for estimating salary variation in the population was based on $\chi 2$ distribution and give us a reply on the question at what interval the standard deviation of salaries in the population of all men and women in the company can be expected with 95% probability. For this purpose, there was used the estimate of variance of the population. Findings show a still occurring gender pay gap.*

Keywords: *Equal Pay, Sex Bias, Gender Discrimination, Salaries Differentiation, Estimate of Variance of the Population.*

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1. INTRODUCTION

As Armstrong (2005) has stated: "discrimination arises when equals are treated unequally" (p. 131). Historically, the position of women and men on the labor market has changed and is related to the social status of women, the possibility of obtaining and then apply their education and the legitimacy of being economically self-sufficient and independent of men. First women obtained work based on their care skills. Already here we can see the beginnings of the gender segregation of labor which is still a significant cause of unequal pay. During the war, women were pragmatically allowed to enter the labor market and were recruited into the male professions because of the lack of male labor. After the war, the economic emancipation of women and their participation in the labor market was generally supported. However, family and household care still remain the domain of the woman till today. Historically, inequality between men and women has concerned segregation into different occupations as well as unequal pay. The Czech labor market has retained these specifics even after the revolution in 1989 till today. Economic theories monitor the influence of gender, age, education, the number of years of work, the influence of maternity and career breaks, the influence of market segregation, the influence of legislative activities and legal norms, the institutional influence of trade unions and so on. Maternity has a major impact on women's wages and careers. There are still lots of employers who perceive parenthood as incompatible with careers or full-time job based on statistically unsubstantiated assumptions of frequent absence of mothers at work or false unsubstantiated assumptions about the lack of leadership and management skills which are assessed as psychologically demanding and very time-consuming and therefore gender predetermined for men. According to Armstrong et all (2005), "Extended pay ranges, especially where progression is based on length of service, will favor men who are much less likely than women to have career breaks and may therefore progress further and faster" (p. 133). According to the research made by Hodges et all (2010), fathers in the labor market receive the so-called paternal bonus (i.e. higher wages) compared to mothers and childless men on the assumption that they are a stable and loyal workforce in connection with fulfilling a breadwinner role. Hultin and Szulkin (2003) confirm that where are more women managers, there is a lower level of internal gender segregation and women managers pay more attention to gender equality issues, including equal pay. According to Song et all (2019), "Gender pay equity is a desirable social value and an important strategy to fill every organizational stratum with gender-diverse talent to fulfill an organization's goals and mission." (p. 830). Yamamoto et all (2019) investigates how educational attainment affects occupational choice for men and women in urban and rural areas. Rafferty (2019) examines the effects of discrimination based on race, ethnic background, nationality, religion, sex, age, disability and sexual orientation on skill underutilization and under-skilling in 30 European countries. He stated, "People who experienced a variety of forms of workplace discrimination were more likely to report over-skilling, defined as having skills for more demanding roles than required for their job." Kronberg (2019) found "men often receive greater merit rewards than women for the same performance." He also stated, "gender disparities are significant only when supervisors have discretion over merit increases." According to Larraz et all (2019), "As long as men earn more per hour on average than women, gender wage inequality (understood as the differences on wage between each man and each woman will remain)" (p. 18). They stated, „vast majority of directors and senior executives working for big companies are men is at the root of the problem" (p. 19). Sato et all (2019) stated, "job segregation by gender is one major cause of the widely observed gender pay gap and that there are also gender differences in developmental job assignment for broader job experience". Bargain et all (2019) found evidence that the gender wage gap at the bottom of the wage distribution may be effectively reduced by a national minimum wage. (p. 532) According to Maume et all (2019), "As European countries have mandated quotas for women's representation on boards, and as women have increasingly

entered the ranks of management, a persistent gender gap in managerial pay remains." Cook et all (2019) stated, "the more direct influence women have over compensation decisions, the smaller the compensation gap." (p. 1292). The Ministry of Labor and Social Affairs on the official webpage informs that the gender pay gap was 21,1 %. Krizkova et all (2018) found "comparing internationally, the Czech Republic ranks among the countries in which wage variability, or more precisely wage inequality, significantly increased between 2002 and 2016 (p. 9). She stated, "The Czech Republic is a country with one of the highest levels of gender pay inequality." (Krizkova et all, 2018, p. 99).

2. METHODOLOGY

The estimate of variance of population σ^2 is a sample variance which is a distortion-free and consistent estimate, i.e.

$$\sigma^2 = s'^2_x \tag{1}$$

where sample variance is calculated according to the relationship:

$$s'^2_x = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1} \tag{2}$$

In constructing the confidence interval, we assume that the quantity

$$\frac{(n-1)s'^2_x}{\sigma^2} \tag{3}$$

has χ^2 distribution with $v = n - 1$ degrees of freedom. The confidence interval is derived from the relationship

$$P\left(\chi^2_{\frac{\alpha}{2}} < \frac{(n-1)s'^2_x}{\sigma^2} < \chi^2_{\frac{1-\alpha}{2}}\right) = 1 - \alpha \tag{4}$$

Adjusting the inequality in parentheses we get a two-sided 100(1 − *α*)% confidence interval for variance in the population

$$\frac{(n-1)s'^2_x}{\chi^2_{\frac{1-\alpha}{2}}} < \sigma^2 < \frac{(n-1)s'^2_x}{\chi^2_{\frac{\alpha}{2}}} \tag{5}$$

Where $\chi^2_{\frac{\alpha}{2}}$ and $\chi^2_{\frac{1-\alpha}{2}}$ are quantiles of the distribution with $v = n - 1$ degrees of freedom. For more information please see (Hindls et all, 2006).

Hypothesis testing used in this paper is based on a random sample, there was verified if the average of the population μ is equal to a certain value of μ_0. The null hypothesis is formulated H_0:$\mu = \mu_0$. Alternative hypothesis is in the following practical case formulated H_1:$\mu < \mu_0$. Assuming that the variance in the population is known, we select the following formula as the test criterion

$$U = \frac{\bar{x} - \mu_0}{\sigma}\sqrt{n} \tag{6}$$

If we do not know the variance of the population, we estimate it by the sample variance

$$U = \frac{\bar{x} - \mu_0}{s'_x}\sqrt{n} \tag{7}$$

3. SURVEY OF MEN´S AND WOMEN´S SALARIES IN THE CZECH PRIVATE INDUSTRIAL COMPANY

The survey on differentiation of women´s and men´s salaries was focused on target group of technical economic employees who work in the same or in the similar position and are included in the same pay scale. According to information received from HR their salaries differ by personal bonuses, commute surcharges, long-term loyalty bonuses etc. Totally 816 employees in the technical-economic professions work in the company. 60 employees working in the same or similar position were randomly selected. 30 salaries of women were compared with 30 salaries of men. There was studied if there is any influence of parenting on salaries of women and men in this random sample. The assumption is that the distribution of salaries in the population of all technical-economic staff is normal. On the random sample there were calculated average salaries and standard deviations of both group and compared together. In the following Table 1 "X" represents salary "f(x)" represents distribution function of the normal distribution and "F(x)" represents the probability density function of the normal distribution both graphically shown on Figure 1.

Table 1. Salaries of women and men and calculations of distribution functions of the normal distribution
Source: own calculations

Women				Men			
X	**Mother**	**f(x)**	**F(x)**	**X**	**Father**	**f(x)**	**F(x)**
28121	NO	0,0564683	0,0000645	31150	NO	0,0375458	0,0000435
28453	NO	0,0812507	0,0000854	31630	NO	0,0636644	0,0000663
28479	NO	0,0834932	0,0000871	32080	NO	0,0993112	0,0000928
28970	YES	0,1349503	0,0001232	32110	NO	0,1021247	0,0000947
29150	YES	0,1583808	0,0001372	32730	NO	0,1736279	0,0001364
29340	YES	0,1858474	0,0001519	32856	NO	0,1913479	0,0001449
29340	YES	0,1858474	0,0001519	32890	NO	0,1963131	0,0001472
29460	YES	0,2046294	0,0001611	33450	NO	0,2887123	0,0001816
29589	YES	0,2260296	0,0001707	33543	YES	0,3058288	0,0001864
29609	NO	0,2294572	0,0001721	33550	NO	0,3071352	0,0001868
29780	YES	0,2599217	0,0001841	33680	NO	0,3318266	0,0001930
29805	YES	0,2645441	0,0001857	33750	NO	0,3454401	0,0001960
30035	YES	0,3089373	0,0001999	33890	NO	0,3732597	0,0002013
30210	YES	0,3447455	0,0002090	33910	YES	0,3772924	0,0002020
30345	NO	0,3733747	0,0002149	34230	YES	0,4433515	0,0002099
30760	NO	0,4651765	0,0002256	34580	YES	0,5173859	0,0002119
30990	NO	0,5172022	0,0002262	34596	NO	0,5207755	0,0002118
31020	NO	0,5239855	0,0002260	34670	NO	0,5364288	0,0002112
31098	NO	0,5415847	0,0002252	34750	YES	0,5532874	0,0002102
31150	YES	0,5532745	0,0002244	35134	YES	0,6323629	0,0002003
31240	NO	0,5733922	0,0002226	35469	YES	0,6971478	0,0001856
31280	NO	0,5822756	0,0002216	35509	YES	0,7045320	0,0001836
31295	NO	0,5855964	0,0002212	35958	YES	0,7811795	0,0001569
31709	NO	0,6740744	0,0002045	36449	YES	0,8501820	0,0001239
31790	YES	0,6904627	0,0002001	36587	YES	0,8666253	0,0001145
31879	NO	0,7080418	0,0001949	37239	YES	0,9274699	0,0000734
32020	NO	0,7348984	0,0001859	37432	YES	0,9405974	0,0000628
32352	YES	0,7927837	0,0001623	37591	YES	0,9499468	0,0000549
33467	NO	0,9263203	0,0000793	37628	YES	0,9519446	0,0000531
34468	NO	0,9781536	0,0000296	38514	YES	0,9836209	0,0000217

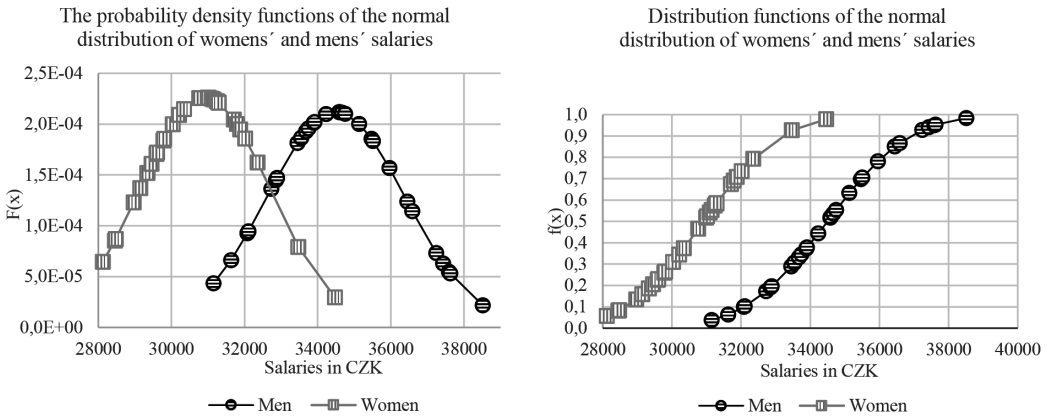

Figure 1. Distribution of women´s and men´s salaries in the random sample
Source: own calculations

Table 2. Gender statistics calculated from the random selected population in the analysed company
Source: own calculations

Statistics	Women	Men	Ratio	Differences		All
				Rel.	Abs.	
Average	30573	34585	88%	12%	4012	32579
Median	30553	34405	89%	11%	3853	32095
Max	34468	38514	89%	11%	4046	38514
Min	28121	31150	90%	10%	3029	28121
Standard deviation	1451	1902	76%	24%	451	2624

The median salary is the real salary of the employee in the middle of the salary distribution. The average salary is the sum of all earnings in the population under review divided by the number of women and/or men in the population. The average has the advantage that it counts all the earnings in the sample, but it is disadvantageous in that it is influenced by limit values that distort it to some extent. In the random sample the average gross salary in 2019 was 32.579 (men: 34.585 CZK; women: 30.573 CZK). The median gross monthly salary in the sample in 2019 was 32.095 CZK (men: 34.405 CZK; women: 30.553 CZK). It is possible to say that men earn in average 4.012 CZK a month more than women. The average monthly salary of women is 88 % of the average monthly salary of men. In other words, women are remunerated on average 12 % less per month than men.

Table 3. Gender comparison with focus on an influence of parenthood on salaries
Source: own calculations

Average salary	Women		Difference		Men		Difference	
	Mother	Childless	Abs.	Rel.	Father	Childless	Abs.	Rel.
	30075	30955	-880	-3%	35908	33074	2834	9%

The data in Table 3 show that mothers earn monthly less compared to childless women (abs. -880 CZK, rel. -3 %). In contrast, fathers earn monthly more than childless men (abs. 2.834 CZK, rel. 9 %).

The next task is to find out at what interval the standard deviation of the salaries of technical-economic workers in the whole analyzed company could be expected with 95% probability. For this

purpose, a two-sided confidence interval was used for estimating the salary variance of technical-economic workers in the company which is compiled according to Formula 4.

Table 3. Gender estimation of salary variance - all female and male population in the company
Source: own calculations

Women	Men	All
$\frac{(30-1)1451^2}{45,7} < \sigma^2 < \frac{(30-1)1451^2}{17,7}$	$\frac{(30-1)1902^2}{45,7} < \sigma^2 < \frac{(30-1)1902^2}{17,7}$	$\frac{(30-1)2624^2}{45,7} < \sigma^2 < \frac{(30-1)2624^2}{17,7}$
1156 <σ <1857	1515 <σ <2435	2090 <σ <3359

The standard deviation of salaries in the company can be expected with 95% confidence at the interval of 1156 < σ < 1857 for women, at the interval of 1515 < σ < 2435 for men and at the interval of 2090 < σ < 3359 for both sexes.

According to published information on the website of the Czech Ministry of Labor and Social Affairs the difference between the average salary of a woman and the average salary of a man is almost CZK 7.000 per month. The total pay gap in the Czech Republic is 21.1% which has been stable in the long-term since 2002. Comparing with findings in the random sample in the analyzed company the difference looks better: abs. CZK 4.012 and rel. 13 %. Can the difference be attributed to chance, or is there a sign of an improvement in the gender pay gap in this company? Let´s make a testing hypothesis. The null hypothesis in this case is H_0: $\mu = 7000$. Unilateral alternative hypothesis H_1: $\mu = 4012$. The test is performed at the significance level $\alpha = 0,05$. The test criterion value is calculated using the Formula 7.

$$U = \frac{4012 - 7000}{2624}\sqrt{60} = -8,8205$$

In the one-sided test and the given level of significance $\alpha = 0,05$, the critical range is given by a set of values lower than -1.645, i.e. $W = \{U; U \leq -1,645\}$. The null hypothesis is rejected in favor of the alternative hypothesis at the 5% significance level because the test criterion value $-8,8205 < -1,645$. Thus, with a 5% risk of error, it can be argued that the gender pay gap in the analyzed company is lower than Czech national one and the difference found between the national gender pay gap and the company gender pay gap found in the random sample cannot be attributed to chance.

4. FUTURE RESEARCH DIRECTIONS

Fair pay, flexible working conditions, seeking work life balance are key issues especially for women with children. Gender stereotypes are still deeply rooted in the Czech society. A next future research could be directed to answer a question: “Why Czech women (or women generally in the west type of culture) are not usually able to negotiate the same wages as men”. The next efforts could be focused on finding ways to minimize wage inequalities, wage discrimination and strengthen employment protection in the form of law and also in the form a stronger role of trade unions to eliminate specific negative gender stereotypes and promote fair pay and work-life balance free of sex bias. Using a regression analysis, it is possible to determine how much of the total value of the gender pay gap can be explained by sub-factors such as length of work experience, age or education etc. Unexplained value will than represent a value of direct discrimination. It would be also interesting to research what average wage cuts a Czech woman will have for each of her new-born child as a result of her career break and the related maternity penalization.

5. CONCLUSION

There is still a significant gap nationally between the earnings of men and women. According to government information, the gender pay gap has consistently been around 21 % since 2002.

In the analysed company the gender pay gap calculated on the random sample is 12 %. The hypothesis test determined that the difference between the company and national gender pay gap can be considered as significant in terms of improving the gender pay gap. Analysis shows that earnings increase with higher percentage of men in a given job and decrease with an increasing proportion of women. Looking at the performance of individual employees' gender pay inequality rates vary without directly correlating with productivity as well as human capital-related characteristics. Focusing on women, the so-called motherhood penalty still works, women with children achieve lower incomes than childless women and women (with or without children) achieve less than men in the analyzed company. In the random sample men on the same job earn more than women (abs. 4.012 CZK, rel. 12 %). The comparison of mothers and childless women shows that mothers earn less compared to childless women (abs. -880 CZK, rel. -3 %). In contrast, fathers earn more than childless men (abs. 2.834 CZK, rel. 9 %). In the random sample men with higher salaries were fathers. It can be argued, therefore, that male salaries were increased for their role as breadwinners, while the employer froze women's salaries during their career breaks due to their maternity leave and mothers are then penalized for their maternity. Even though mothers can reduce their income tax by claiming a tax relief to a dependent child, as well as men, but it can be claimed by only one of parents, they still do not equal the salary of childless women working in the same position. Even in the analyzed company, trade unions focus on wage increases, but they do not pay attention to gender inequalities and wage discrimination against women. Woman 's efforts to negotiate individual pay and rewards could be an example of what is not expected of women based on gender stereotypes. A woman can more often face negative reactions if she goes beyond what is understood as usual, normal and legitimate for women in a given society and culture, because according to gender stereotypes a such behavior is not expected of her. On the contrary, the negotiations on pay and rewards is expected to man as a breadwinner and is therefore generally understood as an acceptable behavior.

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INVESTIGATING SELECTED GASTRONOMIC TRENDS FROM DEMAND AND SUPPLY SIDE

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Abstract: *The study aims to identify the role of the selected gastronomic trends in the Czech gastronomic establishments. The study highlights the key findings of quantitative and qualitative research provided with the focus on both the demand and the supply side. It is focusing on the dispute between guests' opinions and entrepreneurs' views based on few variables for gastronomic trends. Entrepreneurs' and guests' views in three Czech Regions were studied in one set with notes incorporated on possible mutual differences between them. The partial least squares variant of linear discriminant analysis (plsLDA) and partial least squares (PLS) was applied as they give a clear superiority due to both, interpretational and stability property. It was proven that the partial least squares variants lead to direct answers to questions in the studied field. Participation/organization of food festivals and slow food are positively related. The significant tasks emerge to a great extent covering differences between guests´ and entrepreneurs´ opinions. On the other hand, the connection of economic interest to gastronomic trends is relatively weak.*

Keywords: *Gastronomy, Czech Republic, Regions, Tourism, Gastronomic Establishments, Restaurants, SME, Destination, Guest, Visitor, Entrepreneur.*

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1. INTRODUCTION

Gastronomy and food tourism are factors of the regional economic growth through the development of small and medium-sized enterprises and contributes to the development of the regions (Kiráľová & Hamarneh, 2016). In certain types of special interest tourism, food becomes a central motivation for travel (Hall & Mitchell, 2001). Indeed, Hashimoto & Telfer (2003) describe how food in tourism has developed from being a necessity to become an additional „tourist experience" that may enhance the overall evaluation of the travel experience. Food tourism can be a tool for the economic development of the region with high unemployment and low socioeconomic status. Specialized local traditional food and beverages create the opportunity for the development of rural tours, direct purchasing from the farms, and specialized restaurant menus (Bessiere, 1998). The main advantage of the gastronomy and food tourism is its ability to adapt and respond to the effects of phenomena such as globalization, localization, or creolization, mainly because living culture-related changes (Richards, 2002).

The growing interest and demand from destinations visitors for local products are very much rooted in the changing patterns of tourism, particularly the growth of „special interest „(Hall & Mitchell, 2001) and „new" tourism (Poon, 1993). According to Poon (1993), new tourists are searching more for real and authentic cultural and natural experiences. As food has been recognized as an essential part of local culture and identity (Richards, 2002), trying out local food specialties may serve to enrich the overall experience of tourists seeking to learn more about a different and authentic culture. Through the growing demand for regional food, an increasing number of destinations use cuisines as their major tourism attractions (Enteleca, 2001, Karim, 2006).

Tourism is traditionally made up of small and micro enterprises and linking consumers to producers (Enteleca Research, 2001). Gastronomy is a combination of the knowledge, experience, art, and craft, which provides a healthy and pleasurable eating experience, forms part of the country's identity, and is an essential component of the Czech cultural heritage. Gastronomy is one of the most important cultural expressions of human beings. The purpose of the study is to identify the moderating effect of selected gastronomic trends on the relationship between guest intention to visit the gastronomic establishment and the product based on the selected gastronomic trends.

According to the objective of the study, the research questions are formulated as follows:

Research Question 1: What is the difference between guests' and entrepreneurs' opinions for selected gastronomic trends?

Research Question 2: What is the relationship between the selected gastronomic trends and the guests' intention to visit?

The study hypothesis is set as follow:

Hypothesis: Application of selected trends in gastronomy has a significant effect on the development of enterprises.

From the reason of near-collinearity within the sets, the partial least squares variants of standard multivariate techniques are applied in this study. The plsLDA and PLS approaches were used. Such types of techniques are marginally used in the economy even though they reveal excellent asymptotic properties and straightness of solution. The covariance is to be maximized in PLS (Wegelin, 2000) instead of correlations for a more traditional canonical analysis. A functional link between both methods is discussed by Malec (2016). The input variables are standardized due to equal significance in statistical processing methods.

2. DATA AND METHODS

The data source covers three NUTS3 regions of the Czech Republic as the representative for the whole area, i.e., Praha (PHA), Středočeský (STC) and Ustecký (ULK) regions based on questionnaire survey realized in 2017. The random samples cover both the restaurant guests and entrepreneurs to reveal disputes in their opinions covering the fundamental part of the study. The survey was distributed to guests via the selected social media platform. The number of guests was 611 with shares 40.84% for Praha, 40.57% for Středočeský Region, and 18.59% for Ustecký Region. In total, 150 completed questionnaires were received for restaurant entrepreneurs based on known spatial proportions of individual establishments (PPM Factum, 2014). The stratified sampling based on experts' opinion was the method of choice to gather data. The Likert scale is used to examine the data using a 5-point approach from 1 – strongly disagree to 5 – strongly agree. There were revealed high skewed data for questionnaire survey outputs. For this reason, the transformations are used $y = \log(x) + 1$ for sample skewness > 2 on input variables (asks) and similarly using natural logarithm on a reversed scale for negatively skewed data.

Due to the collinearity measured via determinant of sample correlation matrices ranged below 10-25 within the individual sets, the multivariate partial least squares variants are utilized to process the data. The plsLDA and PLS are the methods of choice using the linear combinations of original variables in the form of latent variates (LVs). Used PLS technique is also abbreviated PLS-SVD and called intercorrelations analysis or canonical covariance, which, on the contrary to more common canonical correlation analysis, examines the covariance between LVs (Wegelin, 2000). Similarly, partial least squares analogy of discriminant analysis to encompass differences between the sets was applied in this study. Malec and Kiráľová (2018) describe the considerable transformation in the case of two-set, where such approaches can be considered as an alternative to other regression techniques (Bílková, 2019). The eigenvalues express the significance of individual LVs, coefficients of linear combinations serve to investigate the relational pattern between variables, and the score is the latent variable plot. The eigenvalues are scaled using sample size. The t-tests were used to reveal the significance of the differences between entrepreneurs' and guests' sets, as well as for examining the correlation coefficients.

3. RESULTS AND DISCUSSION

Food is a vital part of culture and creativity, a significant element of intangible heritage, and an increasingly important attraction for tourists. Food is a shift from the „must-see" to „must experience." Experiences are linking global and local cultures, creating food narratives, co-creation by guests, and collaborative gastronomy. Products around food events, routes, trails, and new cuisines support place branding and serve as a powerful vehicle to reflect the uniqueness of a destination (Dupeyras, 2015).

Gastronomy is a combination of knowledge, experience, art, and craft, which provides a healthy and pleasurable eating experience, forms part of the country´s identity, and is an essential component of the Czech cultural heritage. Czech regions have a long-lasting tradition of preparation of food and culture; however, the structure of growth regarding regional distribution in the Czech Republic is problematic. The regions that can offer food and beverages prepared and served in a typical way, followed by a unique consumption culture, can develop food tourism (Hall & Mitchell, 2002). The relationship between food and tourism promotes policies that improve economic and social well-being and as such, enhance the regional development. Studies provided in this field confirmed that local food increases the capability of sustainable tourism, reinforces the local

economy, supports the environmentally friendly infrastructure, and is part of the originality of a destination (Du Rand et al. 2003).

In order to find out the answer of the set research questions and in order to confirm or refute the defined hypothesis, the following gastronomic trends were selected: (1) open space kitchen, (2) slow food, (3) participation/organization of food festivals, (4) authentic traditional food offer, (5) connection between food and wine offer, (6) mobile application, (7) Wi-Fi, and (8) sustainable and ecological behavior of gastronomic establishments.

It should be noted covering input data that participation/organization of food festivals and slow food are strongly and positively related covering this area. The dispute between selected guests' and entrepreneurs' views based on few variables for gastronomic trends was studied. The tasks sound, „Which current gastronomic trends are interesting for you" opposite to „To what extent do you apply current trends in gastronomic tourism." Table 1 introduces the means (Mean) and coefficients of variation (Var) covering descriptive statistics as well as the discriminant coefficients. The most demanded from guests are the variables offer of authentic traditional food and the connection between food and wine opposite to slow food. In the case of entrepreneurs, the most important are considered mobile applications and Wi-Fi opposite to open space kitchen, participation/organization of food festivals, and slow food. The most variable in the guest view is slow food and mobile application and Wi-Fi. For the entrepreneurs, the open space kitchen is the most variable.

In the dispute between guests' and entrepreneurs' opinion, the measure of dissimilarity given by eigenvalue 4.444, is demonstrated in Table 1. All asks are significantly distant for the p-value < 0.001 with one exception sustainable and ecological behavior of gastronomic establishments for high p-value > 0.2. The most different covering the plsLDA coefficients are open space kitchen and participation in food festivals, where the guests' opinion outperforms the entrepreneurs' offer. Covering mobile applications and Wi-Fi, the entrepreneurs overestimate the demand for this service.

Table 1. Descriptive statistics and results of plsLDA for individual asks
Source: Authors

	Open space kitchen	**Slow food**	**Food festivals**	**Authentic traditional food**	**Food and wine**	**Mobile application**	**Ecological behavior**
Guests opinion descriptive statistics							
Mean	3.332	2.835	3.213	3.542	3.515	3.100	3.293
Var	0.380	0.435	0.407	0.336	0.353	0.422	0.367
Entrepreneurs descriptive statistics							
Mean	2.101	2.126	2.123	3.133	3.092	3.626	3.220
Var	0.619	0.546	0.532	0.380	0.422	0.373	0.389
Discriminant coefficients							
LV	0.628	0.362	0.557	0.209	0.216	-0.269	0.038

The sets are variable covering individual regions (see Fig. 1). Ustecký Region is relatively distant in both cases due to high guest demand for current trends in gastronomy except for slow food and authentic traditional food offer, which are relatively equal between regions. In the entrepreneurs set, the slow food and authentic traditional food offer are generally overestimated from the entrepreneurs set in the Ustecký Region opposite to mobile applications and Wi-Fi, which is slightly underrated there. Vertical lines mark the location of the sets separately for visitors (V) and entrepreneurs (E).

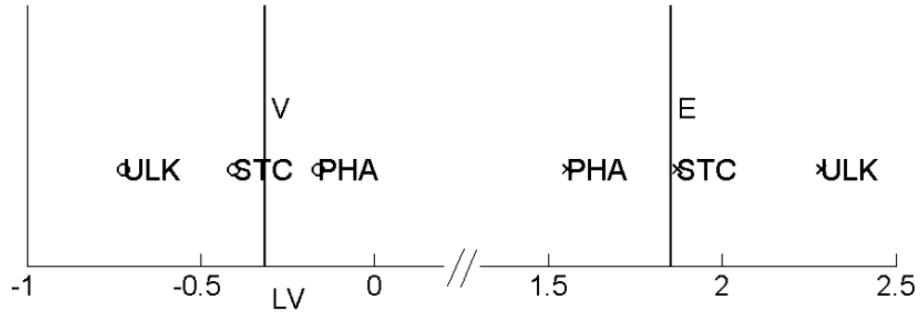

Figure 1. Position of centroids for individual regions
Source: Authors

Covering guests' side, the second area of study is economic interest asks supported by the national gastronomy using the PLS algorithm. It deals with: „Which current gastronomic trends are interesting for you" and „If the gastronomic establishments apply new trends, it will affect my behavior as follows" covering „I come more times", „willingly pay more", „I visit the restaurant with friends", and „I will spread the goodwill of the restaurant".

For the first latent variable, it gathers 48.7% of the variance, while the second one 23.9% (Table 2). Here, especially authentic traditional food offer is positively related to „I visit the restaurant with friends," and „I will spread the goodwill of the restaurant." The negative relation of sustainable and ecological behavior of gastronomic establishments to all the guests' interests can be seen. The correlations between authentic traditional food offer and „I visit the restaurant with friends" are moreover analyzed for the significance by simple t-test, where the corresponding p-value is 0.085. Due to this is only the one value below 0.1, covering the pairs of variables for both sets, such relations are expected relatively weak, and we examine only the first LVs within this study.

Table 2. First PLS coefficients
Source: Authors

	Open space kitchen	**Slow food**	**Food festivals**	**Authentic traditional food**	**Food and wine**	**Mobile application**	**Ecological behavior**
LV	-0.200	0.210	-0.362	0.653	-0.334	0.181	-0.464
	More times	**Willingly pay more**	**Friends visit**	**Good name**			
LV	0.426	0.276	0.690	0.517			

4. FUTURE RESEARCH DIRECTIONS

In the future, the authors will concentrate on the identification of the effect of using regional and seasonal ingredients for preparing meals and dishes on the guests' intention to visit the gastronomic establishment. The trend to use local and regional ingredients refers to the distance of the place of production to the place food is eaten. Preference to eat food produced in the vicinity supports the locavorism (De Azevedo, 2015), which promotes the sale and consumption of products that are characteristic of the territory. Consuming local products is advantageous because it contributed to environmental sustainability, promotion of the region's heritage, and guarantee that the products offered are fresh.

5. CONCLUSION

It was proven that the partial least squares variants behave usefully and lead to the direct answer to questions in the field of gastronomy. Participation/organization of food festivals and slow food are positively related. When covering differences between guests' opinions and entrepreneurs, the significant tasks emerge to a great extent. On the other hand, the connection of economic interest to gastronomic trends is relatively weak. Covering Research Question 1, the application of selected trends in gastronomy emerges the significantly different opinions of guests and entrepreneurs. Guests are especially interested in the offer of authentic traditional food and connection with food and wine offer opposite to slow food. The most different between both sets are open space kitchen and participation in food festivals where the guests' opinion outperforms the entrepreneurs' offer. The entrepreneurs overestimate mobile applications and Wi-Fi. In the scope of the Hypothesis, overcoming such discrepancies has a significant moderating effect on the economic behavior of gastronomy establishments and its future process.

Moreover, the regions are mutually relatively variable. Ustecký Region is distant for visitors due to high demand generally on current trends in gastronomy tourism excepting slow food and offer of authentic traditional food. There, the slow food and offer of authentic traditional food are moreover overestimated from the entrepreneurs set; this indicates that the new trends are being promoted in the Ustecký Region as a whole and, for the current time, they suppress the original directions given, for example, by traditional cuisine.

It was revealed that for current gastronomic trends, the guests' intention to visit is proven not very significantly associated with Research Question 2 and Hypothesis. Here, the offer of authentic traditional food is positively related primarily to visit a restaurant with friends. Interesting is the adverse relation of the sustainable and ecological behavior of gastronomic establishments to all the guests' interests. Nevertheless, due to the weak relationship, this would deserve a more in-depth investigation covering this topic.

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RANDOM STRATEGY VERSUS TECHNICAL ANALYSIS STRATEGY: THE CASE OF EUR/USD INTRADAY TRADING

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Abstract: *This paper provides a comparison between the strategy based on technical analysis and the strategy based on random trading on a highly liquid EUR/USD foreign exchange market. The authors analyze three years of data, and in every intraday trading session. Technical analysis strategy uses essential indicators such as moving averages (MA). Every trading position will have the risk-reward ratio (RRR) 3 to 1. In addition, another trading positions on the EUR/USD currency pair will be opened at the same time each day, without technical analysis. The time of entry into position will be indicated by past high liquidity on a given currency pair at a given time with a similar risk-reward ratio (RRR) 3 to 1. This paper aims to compare the strategy of technical analysis and the random strategy in intraday trading concerning the profitability of these trades.*

Keywords: *Investment Decisions, Foreign Exchange Markets, Currency Markets, Moving Average, Backtesting, Intraday Trading.*

JEL Classification F13

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1. INTRODUCTION

Technical analysis deals with making decisions of investors based on the historical price and other readily available market data. Use of the technical analysis in FX markets has been confirmed by many surveys like Taylor and Allen (1992), Menkhoff (1997), Lui and Mole (1998), Oberlechner (2001), Gehrig and Menkhoff (2004), and Menkhoff and Taylor (2007).

A trading strategy based on technical trading rules that is profitable in the long term is inconsistent with the weak form of the efficient market hypothesis. Some earlier studies supporting the profitability of technical analysis in the foreign exchange markets (Sweeney 1986; Levich and Thomas, 1993; Neely, 1997; LeBaron, 1999, 2002). In theory, the foreign exchange market should be efficient because of very high turnover and domination of professional traders that should not be influenced by the sentiment of retail investors (Sager and Taylor, 2006; Menkhoff and Taylor, 2007).

Some of the recent studies like Hsu and Taylor (2013) and Coakley, Marzano, and Nankervis (2016) analyze technical trading rules of large samples in the foreign exchange market applying stepwise-SPA test. They also include transaction costs and control for data snooping bias, and they found little or no evidence of profitability of these rules. On the other hand, Coakley, Marzano, and Nankervis (2016) found that relatively new trading indicators like Bollinger bands, RSI and MACD remains robustly profitable even after controlling for data snooping bias. Zarrabi, Snaith and Coakley (2017) used FDR analysis and concluded take over 20 years up to 75% from 7650 trading rules have predictive ability. However, it is necessary to update portfolio at least monthly because no set of trading rules holds for a long time.

The paper aims to test selected strategy based on technical analysis and compare the results with simple random strategy. Authors try to show that on the foreign exchange market the most straightforward strategy is usually able to provide better results than more sophisticated ones, at least in the long term. Moreover, we want to motivate our future research in this field that will use more currency pairs.

The rest of the paper is organized as follows. Section 1 contains methodology and data. Section 2 presents results and discussion, and another section conclusion.

2. METHODOLOGY AND DATA

For our research, we use two investing strategies on the forex market (FX). The first strategy (SMA strategy) is based on one of the most popular indicators of technical analysis – Simple Moving Average (SMA). The second strategy (Random strategy) does not use any indicator of technical analysis.

For backtesting, we choose currency pair EUR/USD from 1/2/2015 to 11/11/2019. Risk-reward-ratio (RRR) has been set to 3 to 1. It means that stop-loss was set to 20 pips under the opening price and target was set to 60 pips above the opening price. We executed both types of orders, such as buy orders and sell orders. We compare two investment strategies, so there is no need to include commissions and spreads. We used a 1 pip fee for a better demonstration. In real trading, our strategies would be less profitable. The fees would be around 1-2 pips per position according to the rules of a particular broker. The following Table 1 shows the basic characteristics of our analysis.

Table 1. Basic characteristics both strategies
Source: Author´s calculations

	Term	Value
1.	• Currency pair	• EUR/USD
2.	• Time frame	• H1
3.	• Time period	• 1/2/2015 – 11/11/2019
4.	• Spread	• 1 pip
5.	• Currency of the account	• USD
6.	• Demonstrative account value	• 10 000 USD
7.	• RRR	• 3
8.	• Profit (target)	• 60 pips
9.	• Loss (stop loss)	• 20 pips
10.	• Time zone	• UTC + 1

2.1. SMA Strategy

A simple moving average is one of the most popular technical indicators for determining if an asset price will continue or reverse a bull or bear trend. The SMA is calculated as the arithmetic average of an asset´s price over some period and determine trend direction. For SMA strategy we use 100 moving period. Our SMA strategy is summarized in the Table 2.

Table 2. Characteristics of SMA strategy
Source: Author´s calculations

	Term	Value
1.	• Period of SMA	• 100
2.	• Signal to buy	• First closed candle after candle rise above SMA
3.	• Signal to sell	• First closed candle after candle drops below SMA
4.	• Close position	• Break through stop loss or target

The following Figure 1 demonstrate the signal to open the position (sell position in this example) and signal to close the position for our SMA strategy (break through target).

Figure 1. Signal to sell, close position
Source: Author´s calculations, tradingview.com

1.2. Random Strategy

Our random strategy is based on trading without technical and fundamental analysis. We choose random parameters to enter trading positions. Trading positions are executed at 2 p.m. (UTC

+1) every trading day (without weekends). The trading hour was selected so that it is close to the opening hour of the US market. That is why we expected a higher rate of currency pair deals. We have entered the sell position and the buy position at random. The Table 3 sums up the rules for opening and closing random strategy.

Table 3. Characteristics of Random strategy

	Term	Value
1.	• Period of trading	• Every day, without weekends
2.	• Signal to buy and sell	• First closed candle after 14:00, UTC + 1 (at random)
4.	• Close position	• Break through stop loss or target

Source: Author´s calculations

The Figure 2 shows an example of opening and closing position according to our random strategy (buy position in this example) and signal to close the position for our random strategy (break through stop loss).

Figure 2. 14:00, UTC + 1, buy position (at random), close position
Source: Author´s calculations, tradingview.com

2. RESULTS AND DISCUSSION

We use almost 5 years of data and backtest our strategies presented in the previous Chapter 1. In the Table 4 are our result for both strategies. The random strategy opened one position every trading day, and it resulted in 1261 positions in total. For SMA strategy we have 1299 observations.

Table 4. Results
Source: Author´s calculations

	SMA strategy	Random strategy
Number of open positions	• 1299	• 1261
Number of long positions	• 647	• 598
% of success – long positions	• 27,51	• 26,76
Number of short positions	• 652	• 663
% of success – short positions	• 26,99	• 26,09
Number of profitable positions (60 pips profit)	• 354	• 333
% of profitable positions (60 pips profit)	• 27,25	• 26,41

Number of loss positions (20 pips loss)	• 945	• 928
% of loss positions (20 pips loss)	• 72,75	• 73,59
% total profit	• 20, 92	• 12,95
Total profit	• 2091,57	• 1295,43

The SMA strategy was more profitable in our research. On the other hand, the random strategy also showed a profit balance that approached the SMA strategy. Above we see that it is necessary to set up the right money management. There is a large share of loos positions in the research (72,75 % SMA strategy, 73,59 % Random strategy), but the right RRR has been able to compensate for losses. Interestingly, both strategies show similar results.

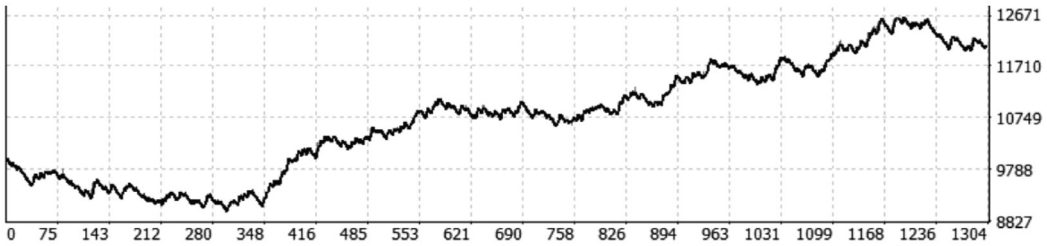

Figure 3. Total profit SMA strategy
Source: Author´s calculations, MetaTrader

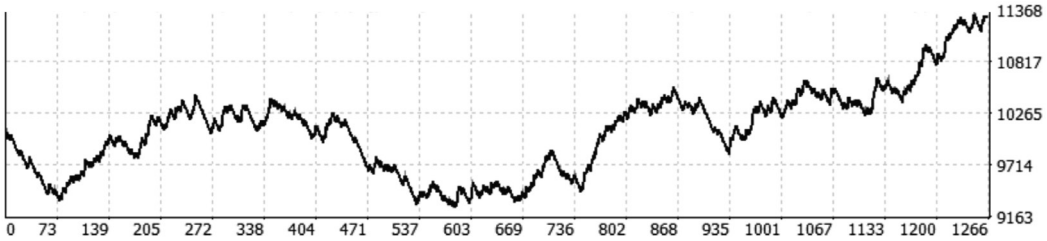

Figure 4. Total profit Random strategy
Source: Author´s calculations, MetaTrader

3. FUTURE RESEARCH DIRECTIONS

For future research, it is important to answer the question whether the effectiveness of technical analysis is significantly higher than effectiveness of random strategy. Whether it is effective for an investor to develop sophisticated strategies based on technical analysis or set the right risk-reward-ration and run a random strategy. Our results in this paper only suggest, that there is more potential for random strategy and it could be interesting to investigate this issue more deeply with regard to the effectiveness of technical analysis.

4. CONCLUSION

In this paper, we compared two trading strategies. The first one uses SMA technical indicator and the second one was randomly opened every day at the same time. We tested both strategies on EUR/USD currency pair for almost five years from 1/2/2015 to 11/11/2019 and set risk-reward-ration to 3 to 1.

According to our results, both strategies were profitable with 1 pip spread (fee), but SMA strategy performs a little better. However, it will be the objective of our future research, when we want to focus more on a comparison of simple random trading strategies with more sophisticated trading rules. Our results in this paper only suggest, that there is more potential for random strategy and it could be interesting to investigate this issue more deeply with regard to the effectiveness of technical analysis.

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EFFECTS OF ACHIEVING SUPPLY CHAIN FLEXIBILITY

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Abstract: *This research study focuses on the current topic of supply chain management which serves as a tool for manufacturing enterprises to cope with pressure put on them by continuously changing market conditions and the global economy itself. Paper presents the results of research conducted on the sample file of Slovak production enterprises. The main aim of this research study is to explore the extent of achieving agility, adaptability and alignment as secondary effects of supply chain flexibility in Slovak manufacturing enterprises. Representativeness of the sample file was confirmed by the application of Pearson´s chi-squared test (χ2 - test) due to the criterion of an enterprise's size. The results of this research provide a clear image of business reality in terms of supply chain organization and therefore have implications for business practice which may serve managers in their decision-making process in supply chain management.*

Keywords: *Flexibility, Supply Chain Management, Agility, Adaptability, Alignment.*

JEL Classification M11

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1. INTRODUCTION

In the 21st century manufacturing enterprises face severe competition which puts that much pressure not only on their production process requirements but also on their supply chain activities. It is the main aim of every enterprise's management to ensure the best possible outcome and gain the competitive advantage which enables an enterprise to establish a desirable market position. However, nowadays it is not just a simple competition among various individual enterprises, but their supply chains as whole systems.

The premise of this study is that both partner collaboration and flexibility are multidimensional concepts; managers must understand how various supply chain activities correspond to different dimensions of flexibility and what the possible outcomes are. An extensive review of the secondary effects of supply chain flexibility increase is a natural extension of existing studies on the topic of supply chain flexibility and development. Given these problems, we undertook an empirical study among manufacturing enterprises in Slovakia to determine the effects of achieving supply chain flexibility in practice through the lens of supply chain agility, adaptability and alignment. Research results on the topic are presented in an attempt to gain a better understanding of current business reality and provide an insight into outcomes of supply chain flexibility in terms of secondary effects.

2. LITERATURE REVIEW

The ability to respond to external and internal stimuli decides an enterprise's development and economic outcomes. Such flexibility is now one of the strategic goals of significant amount of enterprises. On an even higher level is the supply chain flexibility which can be considered as "the ability of a supply chain to respond to market changes in order to gain or maintain competitive advantage" (Moon et al., 2012). Gong (2008) found that flexibility, cost, quality, and technology are considered as the strategic core areas of the enterprise and therefore are a significant focus of research (Gaimon & Singhal, 1992; Chuu, 2011; Púchovská et al., 2017; Bartková, 2017; Mackelprang et al., 2014).

Effective supply chain management is an essential part of an enterprise's integrated management especially in the manufacturing industry. It focuses on aiding enterprises to avoid losses resulting from information asymmetry, unnecessary increases in inventory turnover and logistics costs. The most important sources of successful and well-organized supply chain management originate from measures designed to improve supply chain flexibility. However, such methods also provide many side-effects that can be both beneficial and threatening for enterprises. No tool should be applied without knowing precisely what outcomes to expect and how to avoid unnecessary risks. On the other hand, positive outcomes can help an enterprise to further increase its performance. Several authors focused on evaluating the negative outcomes of supply chain flexibility (Yee, 2007; Sodhi & Tang, 2012; Sodhi & Lee, 2007; Cantor et al., 2014). However, there is a lack of scientifically verified information on positive outcomes of supply chain flexibility in terms of its secondary effects.

Furthermore, a great deal of attention has also been assigned to the creation of measures designed to achieve the flexibility of supply chain (Das, 2011; Chopra & Sodhi 2004, Stevenson & Spring, 2007; Závadský & Závadská, 2014; Akyuz & Erkan, 2010). Aside from an increase in flexibility, such measures can also aid in strengthening the enterprise's position in the supply chain and provide support for the entire supply chain to gain other abilities that make it more competitive. Agility is

one of these possible outcomes. It provides the ability of a supply chain to respond rapidly to quick changes in both demand and supply on the market. Furthermore, agility also strengthens the ability of the whole supply chain to successfully deal with unanticipated external disruptions efficiently and to rapidly recover from shocks with the minimal cost increase. The biggest challenge in terms of agility is to apply such flexibility measures that enable an enterprise to gain the ability to respond to short term changes in demand and supply quickly. Another effect of making the supply chain more flexible can lead to its ability to evolve over time as economic progress, political shifts, demographic trends and technological advances reshape markets. This is frequently referred to as supply chain adaptability. It can also be achieved by adjusting the supply chain design to accommodate market changes, however, this process of redesigning the supply chain can be challenging. The highest level of cooperation in the supply chain can lead to its alignment. This term stands for the ability of a supply chain to coordinate and align the interests of all participating enterprises. As a result, as each enterprise maximizes its own interests, it optimizes the chain's performance as well. The main challenge in terms of alignment is to establish incentives for supply chain partners to improve performance of the entire chain (Lee, 2004; El Mokadem, 2016; Blakyta et al. 2017; Bartková, 2019).

3. AIMS AND METHODS

The main aim of this research study is to explore the extent of achieving agility, adaptability and alignment as secondary effects of supply chain flexibility in Slovak manufacturing enterprises. In order to fulfill this objective empirical research used data provided by selected enterprises via survey which was conducted in a period between May 2018 and August 2018.

The research sample file was created as a representative sample of the base file (Table 1). The criterion of the size of company was taken into account. The focus of this research was on all enterprises in this sector of economy, since the assumption was that they had a higher extent of flexibility measures applications. The decisive criterion was set according to the European Standard No. 2003/361/EC. To verify the representativeness of the sample Chi-square test was used. The test was performed at a significance level of 95 %. The verification proved that this sample file is representative. A number of statistical methods were used to analyze the data. Pearson correlation test and factor analysis were used to examine relationships among selected variables. In order to describe significant relationships in detail correlation coefficients were used. Particular correlation coefficients were also calculated.

Table 1. Structure of base file based on the size of company

Number of employees	Number of companies	Percentage
0 - 9	201	62.42%
10 - 49	78	24.22%
50 - 249	31	9.63%
over 250	12	3.73%
Total	**322**	**100.00%**

4. RESULTS AND DISCUSSION

Firstly, the relationships between flexibility types and various factors were explored. The correlation coefficient was used to evaluate these relations and to discover significant dependences between factors (Table 2). We examine these flexibilities types: contract flexibility (CFL), volume flexibility (VFL), product mix flexibility (PFL), delivery flexibility (DFL) and manufacturing flexibility (MFL).

Table 2. Dependences between flexibility types and various factors

Flexibility types	No. of suppliers	No. of customers	Size of enterprise	Supply chain structure	Position in supply chain
CFL	0.091	0.137	0.128	0.107	0.137
VFL	0.741	0.386	0.422	- 0.151	0.186
PFL	- 0.316	- 0.091	- 0.440	0.018	- 0.091
DFL	0.728	0.753	0.177	- 0.196	0.153
MFL	0.603	0.568	0.855	0.364	0.268

These results indicate there is no significant dependence between any of the examined flexibility types and the enterprise's position in the supply chain. However, the size of the enterprise proofs to be different. There is a medium-strong direct dependence between size and volume flexibility. This result indicates that larger Slovak enterprises are more likely to achieve a significant level of volume flexibility throughout their supply chain. Furthermore, according to the data provided, there is a significant indirect dependence between product mix flexibility and both the enterprise's size and the number of suppliers. This means that smaller enterprises with fewer suppliers are more likely to achieve the ability to make rapid changes in their products than larger enterprises. This is an interesting finding. However, the nature of the product has to be taken into consideration. Smaller enterprises usually manufacture products with fewer components and fewer activities in their manufacturing process, which makes it less difficult to make rapid changes. On the other hand, manufacturing flexibility is easier to achieve by larger enterprises that operate with more recourses available for redeployment when necessary. An interesting finding is a fact that delivery flexibility is not dependable neither with the size of enterprise not its position in supply chain and contract flexibility has essentially no relationship with any of the examined factors.

Secondary effects in terms of agility, adaptability and alignment were also examined. Firstly, we take a closer look at the levels of these three supply chain characteristics in relation to levels of supply chain flexibility. Table 3 provides data about the percentage of enterprises with certain levels of supply chain agility structured by levels of supply chain flexibility. Data indicates that 13.66 % of all manufacturing enterprises consider their level of supply chain agility as high. Furthermore, only 8.70 % of all enterprises in the sample file consider both their level of supply chain flexibility and level of supply chain agility as high. On the other hand, only even fewer enterprises (5.90 %) perceive both their level of supply chain flexibility and supply chain agility as low. Almost one-third of all enterprises (29.19 %) consider their supply chain agility to be low.

Table 3. Levels of supply chain agility

Level of SC agility	Level of SC flexibility		
	high	**medium**	**low**
high	8.70%	4.66%	0.31%
medium	26.09%	24.53%	6.52%
low	5.90%	17.39%	5.90%

Table 4 provides information about levels of supply chain adaptability in relation with levels of supply chain flexibility. According to the data, overall levels of supply chain adaptability are considerably lower that levels of supply chain agility. This finding is especially obvious in group of enterprises with high level of supply chain flexibility. Overall less than 10 % of all manufacturing enterprises consider their level of supply chain adaptability high. On the other hand, 42.55 % of

enterprises have low level of supply chain adaptability. Furthermore, levels of supply chain alignment were examined. According to the data provided in Table 5, it is obvious that this secondary effect of supply chain flexibility is achieved by very few enterprises. Only 18.01 % of Slovak manufacturing enterprises have medium or high levels of supply chain alignment. Moreover, less than 1 % of enterprises with high levels of supply chain flexibility are able to also achieve high levels of supply chain alignment. Even more concerning is the finding that 35.71 % of Slovak manufacturing enterprises have high supply chain flexibility, but only low levels of supply chain alignment.

Table 4. Levels of supply chain adaptability

Level of SC adaptability	Level of SC flexibility		
	high	medium	low
high	4.35%	4.97%	0.31%
medium	17.70%	25.47%	4.66%
low	18.63%	16.15%	7.76%

Table 5. Levels of supply chain alignment

Level of SC alignment	Level of SC flexibility		
	high	medium	low
high	0.62%	2.17%	0.00%
medium	4.35%	6.52%	4.35%
low	35.71%	37.89%	8.39%

Since it was discovered that different flexibility types can have different effects on overall supply chain performance, a more detailed examination of relationship between flexibility types and levels of agility, adaptability and alignment was conducted. Table 6 provides data about such relationships expresses by calculated correlation coefficients. It is important to explore which flexibility type or types have significant effect on achievement of secondary effects such as supply chain agility, adaptability and alignment. According to the data the majority of significant relationships with secondary effects can be found in correlations with delivery flexibility. Volume and manufacturing flexibility also have some significant dependences with levels of supply chain agility, adaptability and alignment. It was discovered that the weakest relationship is between product flexibility and level of both supply chain adaptability and alignment.

Table 6. Dependences between flexibility types and levels of supply chain agility, adaptability and alignment

Flexibility types	Level of SC		
	agility	adaptability	alignment
CFL	0.473	0.469	0.365
VFL	0.801	0.681	0.572
PFL	0.497	0.318	0.295
DFL	0.839	0.791	0.652
MFL	0.740	0.637	0.611

5. CONCLUSION

The main aim of this research study is to explore the extent of achieving agility, adaptability and alignment as secondary effects of supply chain flexibility in Slovak manufacturing enterprises. Achieved results provide a current image of Slovak business reality in its production industry through the lens

of supply chain flexibility as one of the current trends. There had not been similar studies covering the Slovak reality in the last decade. Previous results do not consider a wide use of computers as support systems for flexibility achievement and therefore any comparison with our achieved results would not provide significant conclusions. Moreover, the attitude towards supply chain management has evolved significantly. Consequently, our findings can only be compared to similar studies conducted in other business sectors or economies and therefore, detailed comparisons cannot be provided.

Garo and Guimarães (2018) focused their research on competitive priorities and strategic alignment as mediators in the relationship between companies in the Brazilian automotive supply chain. They discovered that there is a strategic alignment in the chain, mainly driven by the automaker and the systems suppliers and that competitive priorities shape the forms of the relationships between companies in the automotive supply chain. Similar results were achieved in this study in terms of the relationship between the level of supply chain alignment and the enterprise's position in the supply chain. Dubey et al. (2018) examined supply chain agility, adaptability and alignment in the Indian auto components industry. This research study provides the best possible option for comparison since both the object and the subject of research are similar to this study. It was discovered that when and how organizations create agility, adaptability, and alignment differs depending on distinct supply chain properties. Their statistical analyses suggest that information sharing and supply chain connectivity resources influence supply chain visibility capability, which enhances supply chain agility, adaptability, and alignment. Our findings are similar in terms of the effects of various factors such as position in the supply chain, the structure of supply chain and enterprise's size. The finding of a significant relationship between the level of alignment with supply chain structure is consistent with its direct relationships with delivery flexibility and with manufacturing flexibility. Findings from other studies provide further evidence to support these findings (Kabra & Ramesh, 2016; Tan et al., 2010; Agarwal et al., 2006).

Limitations of this research and consequently also achieved results lie in the lack of focus on measures applied to increase flexibility and their relationship with examined secondary effects. Therefore, this limitation provides several ideas for further research on this topic. One of the possible extensions of this study lies in creating a holistic study of the antecedents of agility, adaptability, and alignment under the scrutiny of applied flexibility measures. This study provides significant implications for both practice and researchers that could lead to the increased competitive advantage of enterprises and their supply chain. Achieved results can serve as a premise for further exploration of the examined topic by researchers and enrichment of information concerning the topic of supply chain flexibility.

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INCOME INEQUALITY AS A RESULT OF THE DIFFERENT SECTORAL STRUCTURE AT THE LOCAL LEVEL

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Abstract: *Long-term income differences between regions are undesirable from an economic and social point of view. Nevertheless, they are a long-term phenomenon in many countries. Although comparing the countries with each other, the situation appears to be similar. The assumption of reducing the differences in the size of household income is to identify objectively the determinants of wages. According to published opinions, the difference in labor income is due to the different value of the marginal product of labor and thus the resulting wage. Alternative views associate wage size with market factors - the labor market situation, the overall wealth of households, the location of the region, the increase or dampening of the economic activity of the system. The aim of this paper is to analyze and quantify the influence of different branch structure on the regional nominal wage. The model change estimates the possible change in the regional wage caused by the change in the representation of individual sectors in the regions of Slovakia. The factors considered for regional disparities are the representation of the manufacturing sector, sectoral labor productivity and labor market participation.*

Keywords: *Income, Inequality, Regional Disparities. Sectoral Structure, Slovak Republic.*

JEL Classification O15 • P44

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1. INTRODUCTION

Income inequality has an economic and social dimension. Low incomes reduce the purchasing power of households and the economic power of other economic entities. This reduces the ability of business entities to generate capital over a longer period of time, weakens the region's economic performance and jeopardizes the ability of these regions to develop independently. In order to prevent such a situation, the state also has an economic interest in addressing the problem of income disparities. This means applying tools in national economic policy to eliminate inequalities in income between regions. The solution requires to know the causes of this state, i.e. identify the factor (group of factors) that has a decisive influence on the size of work income.

The issue has long been of interest. The published work shows the diversity of opinions on determinants of wages and on determinants of regional differences. The authors apply the approaches of classical, neoclassical and contemporary wage theories. Suhányi et al. (2016), Pasquazzi and Zenga (2018), German-Soto and Brock (2020) confirmed the dependence of labor price on the size of supply and demand in the labor market. Chua et al. (2017) found a positive long-term relationship between labor productivity and wages by examining the relationship between labor productivity, wages, working time, foreign direct investment, human capital and inflation. Gali (1999), Feldstein (2008), Salvatore (2008), Zenou (2011), Xu et al. (2015) note the significant impact of frontier productivity on labor costs in the short run. The impact of the sectoral structure on wages was monitored by Rajčáková a Švecová (2009). On the basis of the identified regional differences, it notes the link between economic growth, sectoral structure and the social situation. Similarly, Giacinto a Nuzzo (2005), Adamczyk-Łojewska (2013), Amara and Thabet (2019) found that differences between regions are mainly due to differences in the level of labor productivity in individual regions, to a lesser extent in sectoral structure. International comparisons conducted by Esteban (2000), Ezcura et al. (2007), Policardo et al. (2019), Adamczyk-Łojewka (2013) at different times showed a reduction in labor productivity gaps while widening regional and sectoral disparities at national level.

The findings of significant differences in both sectoral labor productivity and sectoral employment indicate the concurrent, complex impact of several factors, the limited impact of different sectoral structures on spatial diversity of labor productivity and wages. This is in contrast to the expectation of differences in labor productivity across sectors, not between regions. The observed situation may therefore be due to the labor market situation or other endogenous factors, e.g. factors determining the competitive advantage (Esteban 2000).

In the labor market, the value created by labor is the subject of exchange. The payment for this value is the wage paid to the worker. From the company's point of view, the benefit gained from the employment of another employee is the additional product that this employee creates. The damage is represented by the cost of employment of that worker, that is, his wage. Therefore, in order to maximize profits, a firm will only require additional factors of production if the marginal product of the production factor does not fall to the level of the actual price of that factor.

The value of the marginal product differs in different productions (sectors). This means that labor costs also differ in different productions (industries). In sectors with higher labor productivity, wages will be higher than in less productive sectors (Amara a Thabet 2019; King 2019). Increasing labor productivity will increase wages. However, this effect is only short-lived (Gali 1999, Feldstein 2008, Salvatore 2008, Zenou 2011, Xu et al. 2015). A longer-term higher wage level in the higher productivity sector may not be sustainable, as the workforce from low-wage sectors will

migrate to more attractive wage sectors. Thus, the mechanism for determining wages solely by the value of the marginal product of labor ceases to apply.

Bruce (2002), Huizinga a Broer (2004) consider wages to be the result of a complex effect of several factors (Esteban 2000). In particular, the demand for production factors is derived from the demand for products in which this labor force is involved. The decline in demand for products will reduce their market price, and will also cause wages to decrease without changing labor productivity. Another example is the situation that results from an increase in labor productivity and a consequent increase in production in the sector. Increased supply will reduce prices in the sector, resulting in a decrease in incomes per worker, secondary as well as a decline in wages. The logical conclusion is that there can be only a partial, time-limited link between sectoral labor productivity and wages (Hannan a Kleinsorge 2018). At the same time, other endogenous factors are also affecting the price of labor, for example, there may be a constant downward pressure on agricultural production prices that hinders wage growth in agriculture despite productivity increases.

It can therefore be assumed that labor market pricing is a multi-stage process that partially respects two principles:

1 Value-based principle: based on a comparison of labor cost with the contribution of labor to product value. this means that higher wages will be in productions with higher labor productivity. Logically, in regions with a high proportion of high-productivity sectors, the average wage will be higher than in regions with a high proportion of low-productive sectors.
2. Market principle: based on the correction of the price of labor formed on the value principle due to the influence of several endogenous and exogenous factors.

The first step in the wage pricing process is to determine the price of labor on the basis of the value of the labor contribution to the value of the product.

In this paper we analyze whether the reason for the income differences between the regions of Slovakia results from the different sectoral structure of the economies of these regions, or the differences can be considered as a result of the influence of other determinants of wage size. The material is logically divided into three parts. The introduction is based on the research of published findings on wage determinants. In the analytical part, in order to answer the question of what are the causes of regional differences in the average wage, we use regional and sectoral approach. The impact of the branch structure on average wages is monitored on the basis of their differences in the regions of Slovakia at the NUTSIII level. The last part presents the main findings.

2. METHODOLOGY

Differences between regions are tested by a non-parametric set of methods with the intention of identifying differences in range and mean. The impact of the sectoral structure on the average wage in the regions is analyzed by means of a multiple regression model. The dependent variable is the nominal wage of an employee in the region and independent variables are the regional shares of sectors in regional gross value added. Generally, it is possible to describe the model used for individual regions as follows:

$$salary = r_A \times A + r_{(B-E)} \times (B-E) + r_F \times F + r_{(G-I)} \times (G-I) + r_J \times J + r_K \times K + r_L \times L + r_{(M-N)} \times (M-N) + r_{(O-Q)} \times (O-Q) + r_{(R-U)} \times (R-U) \quad (1)$$

where:

salary - measured value of the dependent variable,
A-U - independent variables, shares of sector in GVA of region,
$r_{\_ij}$ - regressors of the industry's impact on regional wages.

The informative ability is verified by the coefficient of determination:

$$R^2 = \frac{\sum_{i=1}^{n}(y_i - \hat{y}_i)^2}{\sum_{i=1}^{n}(y_i - \bar{y}_i)^2} \quad (2)$$

where:

y_i – measured value of dependent variable,
$\hat{y}_i$ – estimated value of the dependent variable,
$\bar{y}_i$ – average value of dependent variable.

The classification criterion describing the sectoral structure was the valid classification of sectors according to the NACE nomenclature. The criterion describing the territorial structure was the current classification of territorial units at the NUTS 3 level (Table 1). In order to express the structure of the economy of the region, the shares of sectors in the total regional gross value added were calculated.

Table 1. Territorial units of Slovakia at NUTS 3 level

Code	Name NUTS3	Abbreviation	Code	Name NUTS3	Abbreviation
SK010	Bratislava region	SK-BL	SK031	Žilina region	SK-ZI
SK021	Trnava region	SK-TA	SK032	Banská Bystrica region	SK-BC
SK022	Trenčín region	SK-TC	SK041	Prešov region	SK-PV
SK023	Nitra region	SK-NI	SK042	Košice region	SK-KI

The data sources were DATAcube databases and STATdat of the Statistical Office of the Slovak Republic. Data were analyzed for the period 2002 - 2017. All analyzes were processed in MS-Excel and statistical programs Statgraphics XVIII and Statistica 13.4.

3. RESULTS AND DISCUSSION

In the first step of the analysis we focus on demonstrating differences in average wages in individual regions of the SR, the occurrence of which is long-term and unchangeable. For the whole reporting period, i.e. years 2002 - 2017, we can observe the highest measured values in the Bratislava self-governing region (SK-BL). In the Bratislava region, the average and median value was higher than EUR 1000, and the second was the Trnava Region (SK-TA), which lags more than EUR 300 ($\widetilde{x_{SK-TA}}$ = 770.50 EUR). In terms of regions, the lowest rating of employees was found in the Prešov region ($\overline{x_{SK-PV}}$ = 637.37 EUR).

The above structure caused the rejection of the null hypothesis of the Kruskal-Wallis test and thus the confirmation of differences between individual regions ($Q = 31.478$; $p < 0.05$). The reason can be found in highly above-average values in SK-BL, which statistically significantly differed from all self-governing regions with the exception of Košice region (SK-KI).

The significant difference in wages in SK-BL and SK-KI is obviously influenced by the location of two major metropolises (Bratislava - the capital, Košice - the second largest seat in the SR in terms of population concentration and economic activities). According to statistics, it is a com-

mon phenomenon that in regions where is a capital seat or a large settlement, the wage is usually up to 130% of the national average.

It is interesting to note that these differences are long-term, with the average wage dispersion in regions being constant and equal (LE = 0.539; p = 0.803), which is also evident from the graphical comparison (Figure 1).

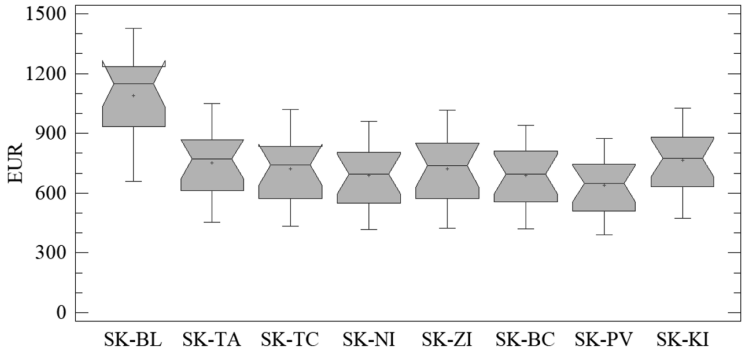

Figure 1. Comparison of the average wage in the regions of Slovakia for the years 2002 - 2017 (in EUR)

It can be concluded that changes in time, respectively, the size and nature of the year-on-year change in the average wage in individual regions can be observed mainly until 2012. Later, the development in individual regions is comparable and shows the same trend. Based on this fact, i.e. there is no reason to assume a decrease in the identified regional differences in the average wage.

It must be assumed that the resulting differences are due to other endogenous factors. Given the diverse structure of the sectors, respectively economic activity, which is dominant in individual regions, it is appropriate to consider as such a factor of different structure of sectors, especially different shares of high and low productive sectors in the creation of regional gross value added. For the whole monitored period 2002 - 2017, a stable structure of the share of sectors in the creation of regional added value was found in all regions (Figure 2).

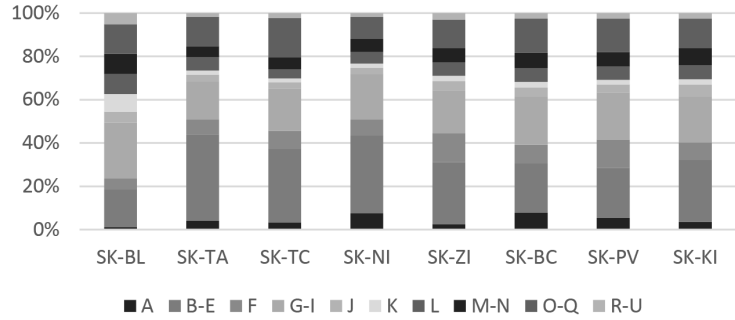

Figure 2. Share of sectors in gross value-added creation in individual regions of the SR

Comparison between regions showed:

- the specific position of SK-BL with a high representation of the most productive and thus above-average sectors and a low share of agriculture and industry in the region compared to other regions,

- among all regions, the highest share of agriculture in the creation of gross value added in SK-BC, while at the same time was showed a low share of industries, including construction in this region,
- low share of agriculture in the creation of gross value added in SK-BC, and at the same time a high share of industries in SK-TC and SK-ZI, similarity of regional structure of economic activities in SK-KI to national structure of economic activities.

The aim of further analysis was to determine the significance of the impact of the sectoral structure on the nominal wage. This was analyzed by multiple regression individually for each assessed region. The models developed shall quantify the impact of the sector's contribution to nominal wage as shown in Table 2.

Table 2. Quantification of the impact of the sector on the average wage according to NUTS 3

	NUTS 3	R^2	Positive impact	Negative impact
SK-BL	Bratislava region	0.9989	B-E; G-I; J, M-N; R-U	A; F; K; L; O-Q
SK-TA	Trnava region	0.9977	B-E, F, J, K, O-Q	A, G-I, J, M-N, R-U
SK-TC	Trenčín region	0.9987	A, B-E, F, G-I, K, M-N, O-Q	J, L, R-U
SK-NI	Nitra region	0.9924	B-E, F, K, M-N, O-Q, R-U	A, G-I, J, L
SK-ZI	Žilina region	0.9995	B-E, F, J, K, M-N, O-Q	A, G-I, L, R-U
SK-BC	Banská Bystrica region	0.9992	A, B-E, F, M-N, R-U	G-I, J, K, L, O-Q
SK-PV	Prešov region	0.9990	B-E, F, G-I, L, M-N, R-U	A, J, K, O-Q
SK-KI	Košice region	0.9996	A, J, K, M-N	B-E, F, L, O-Q, R-U

Almost perfect predicative value of all models, verified by the coefficient of determination, allows the obtained results to be considered as sufficiently representative of the variability of the dependent variable, i.e. average gross nominal wage by using a set of independent variables (shares of individual sectors in regional gross value added). This makes it possible to identify the sectors that have a negative (positive) impact on wages in most instances, and to specify for each region sectors with a negative (positive) impact on the wage in the region.

Based on these findings, we can conclude that:

1. Sectors which had a positive impact on wages include industry (B-E), construction (F) and activities classified in the NACE group (M-N).
2. Agriculture (A) and real estate activities (L) had the most negative impact on wages. Trade, transport, accommodation and food services (G-I), information and communication sector (J), financial and insurance activities (K), public administration, education and health sector (O-Q) and arts, recreation and other activities (R-U) had also often the negative-impact on wages.
3. The sector's wage impact in the region shows signs of similarity only when determining the nature of the impact (positive, negative). The intensity of the sector's influence depends on the size of the sector's share of the structure of economic activities, as well as on the proportions of the share of the entire set of sectors in the region.

4. CONCLUSION

This document examined spatial variability of wages in regions of Slovakia. Our approach was based on the use of multiple regression models, which made it possible to quantify the sources of spatial heterogeneity of wages often reported in the current literature. The first finding is the spatial diversity of wages caused by the localization of a metropolis or a significant economic settlement in

the region. Also, the comparability of wage trends and the resulting relative stability in the size of wage differences between regions. Another finding is the positive impact of sectoral diversification: in individual regions, the negative impact of one of the sectors on the average nominal monthly wage was weakened in each region by the positive effect of also under-represented, but wage-favorable sectors. In regions with a low share of low-wage sectors (e.g. agriculture in SK-BL, SK-TC, SK-ZI), the intensity of impact is weakened by the high proportion of better-valued wage sectors (in the mentioned SK-BL, SK-TC and SK-ZI mainly sectors in the B-E group or service in the J-M group). The findings of the analyzes also confirmed the effect of labor market supply and demand on the wage level and the weakened relationship between labor productivity and wages.

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ANALYZING THE MARKETING MODEL OF KRISHNA CONSCIOUSNESS IN HUNGARY

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Abstract: *The aim of this paper is to analyze the marketing activities of Krishna Consciousness as a new religious movement in Hungary. Observations and in-depth interviews were carried out in different Krishna-conscious communities in Europe concerning the means they apply to gain followers. The three-year-long qualitative research phase has revealed a two-phase model, in which Krishna-conscious villages are promoted as touristic destinations providing a cultural experience; and only in the second phase, when people already visit one of these places, are they introduced to the religion, which feels more like learning, not promotion. In the second research phase a questionnaire was used to evaluate the recognition and the efficiency of the two-phase model. In this paper the research results concerning Krisna Völgy in Hungary are introduced, which is currently the biggest village in Europe and also one of the most developed ones concerning tourism and cultural experiences.*

Keywords: *Religious Marketing, Marketing Religions, New Religious Movements.*

JEL Classification M31

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1. INTRODUCTION

When talking about religion and marketing, researchers usually have significantly different opinions. While for some it is obvious that religious groups – just like other entities – need to make efforts to attract people; many still claim it is inappropriate to talk about religion and marketing in the same context. However, the number of researches in the field has grown significantly in the past decades, especially since the emerging of new religious movements, many of which are not originally from the Western cultures, so they needed to take actions to gain followers in Europe and overseas. Krishna Consciousness is one of those movements, which are originated in the East, but managed to gain a significant number of followers in the Western world in the past decades. Krishna consciousness was one of those new religious movements, which conquered the Western world around the 1960's. Originating from India, the religious movement had reached the United States of America during the era of the Vietnamese War, spreading all over Europe as well during and after the Communist Era. After the fall of Communism in Eastern-Europe, and the consolidation of the post-World War II. situation, when practicing religions had become more free and new religious movements could also gain more place in the life of most of the European countries, Krishna consciousness was one of the first ones to spread; and soon communities started to form all over the continent (Harvey, 2000; Isvara, 2002; Kamarás, 1998; Klostermaier, 2000; Rochford, 2007).

Also, Krishna consciousness was – and still is – one of the best-known religions of their promotional activities, which were initiated by people stopping pedestrians on the streets, telling them all about the teachings of their Lord Krishna. Nowadays ISKCON (International Society for Krishna consciousness) has numerous churches, villages and visitors' centers all over the world, hosting a large number of festivals, and engaging themselves in charitable activities, while communicating actively online and using the social media. Being are able to raise the attention of more and more people in countries far away from India, having barely no cultural similarities with this Eastern country and its traditions is an achievement suggesting a carefully set strategy of reaching and targeting people, which has received surprisingly small attention in the past decades. The aim of this research is to analyze the marketing activities taken by Krishna-conscious groups to gain followers, identify the strategic elements of their marketing concept and analyze the efficiency of it among the general public. (Bence, 2014; Goswami, 2001; Harvey, 2000; Isvara, 2002; Kamarás, 1998; Klostermaier, 2000; Rochford, 2007; Wuaku, 2012).

2. RESEARCH BACKGROUND

The appearance of new religious movements and the presence of multiple religions within small geographical areas has led to a competition between the different churches and religious communities in order to keep and gain followers. The pool of potential followers is given, since the Earth has a limited – though increasing – number of inhabitants; and churches aim to win the largest possible proportion of this pool. This means both gaining new followers, who may not have been religious before, but also attracting people belonging to different religious groups previously. Many researchers have described this competition for members as a market situation similar to those studied in relation to products and services, which has created debates concerning whether or not religions may be approached this way and what kind of effects religious markets may have on the nature and development of religion (Becker, 1986; Crockett, 2016; Culliton, 1958; Einstein, 2008; Iyer, Velu & Mumit, 2014; Kedzior, 2012; Kuran, 1994; McAlexander, Dufault, Martin & Schouten 2014; Shaw & Thomson, 2011; Stark, 1997; Wijngaards & Sent, 2012).

Once the religious market theory is accepted, it raises the attention to the importance of religious marketing as well, on which numerous different approaches may be found. According to Abela (2014) marketing of religion falls into the category of social marketing. Social marketing means those forms of marketing activities, where the focus is not on selling a product or service, but on spreading certain ideas, beliefs or worldviews among the public, which 'may involve modifications in their attitudes, values, norms, and ideas' (Brenkert, 2002, p. 16). This definition fits religion as well, which suggests that social marketing may be applied to market religions. Fine (2009) also included religions in his book of Marketing the Public Sector, and proposed an expanded marketing model of the 7P's of social marketing, changing three of the original 7Ps: 'people', 'process' and 'physical evidence' are replaced by 'producer', 'purchaser' and 'probing'. The social marketing approach focuses on the intangible part of religion by including the human side of both parties: producer and purchaser. This model raises the attention to the importance of the churches offering religious services and the nature of people potentially receiving it; however, probing or market research is less applicable to religions than the 7P of service marketing. Another weakness of the social marketing approach is the lack of the focus on physical evidences, which play important role in characterizing religions (e.g. design of churches and sacred items). Bence, 2014; Hashim & Hamzah 2014; Iyer et al, 2014; Kuran, 1994; and Shaw & Thomson, 2013 took a different approach and focused on the resemblance of religions to services, being intangible, not measurable, perishable and heterogeneous as well, therefore pressed the applicability of the 7P of service marketing for religions. On the other hand, many have found that though religions may resemble to the categories mentioned above, they are special in many senses, which requires unique marketing strategies, rarely studied so far (Bence, 2014; Hashim & Hamzah 2014; Iyer et al, 2014; Kuran, 1994; Shaw &Thomson, 2013).

3. MARKETING MODEL OF KRISHNA-CONSCIOUS COMMUNITIES IN EUROPE

This research focused on Krishna Consciousness from marketing perspective, aiming to find out what kind of marketing strategy the community applies and how efficient it can be on the religious market. As the secondary data available concerning Krishna-conscious communities and their activities in Europe is limited, I initiated my work by combining different qualitative research methods in order to gain a general overview of the situation of the religion on the continent. The most comprehensive information was provided by the official website of the International Society for Krishna Consciousness (ISKCON) and ISKCON Desire Tree, the official multimedia social network of the religion, where all the communities, farming communities, temples and other institutions are registered. The content analysis of the two sites has shown that the Krishna-conscious institutions all over the world – and also in Europe – may be categorized into four main types, which are:

Category 1: Temples or centers,
Category 2: Rural or farming communities,
Category 3: Educational centers,
Category 4: Restaurants (ISKCON, 2019, ISKCON Desire Tree, 2019).

These labels provided the basis for my further analysis, where I analyzed the presence of the religion in the European countries by the number and variety of the Krishna-conscious institutions existing within their borders. In the next research phase I carried out a content analysis on the online presence of these four categories of institutions, including websites and any forms of social media applied. Following the content analysis, the molecular model – created by Shostack (1977) and applied by Srinivasan (2012) – was used to evaluate and summarize the most impor-

tant characteristics of each country. This research applies an altered molecular model (based on the original work of Shostack) in order to distinguish and visualize the marketing activities of communities devoted to Krishna conscious and to identify the subject of each marketing activity (Shostack, 1977; Srinivasan, 2012).

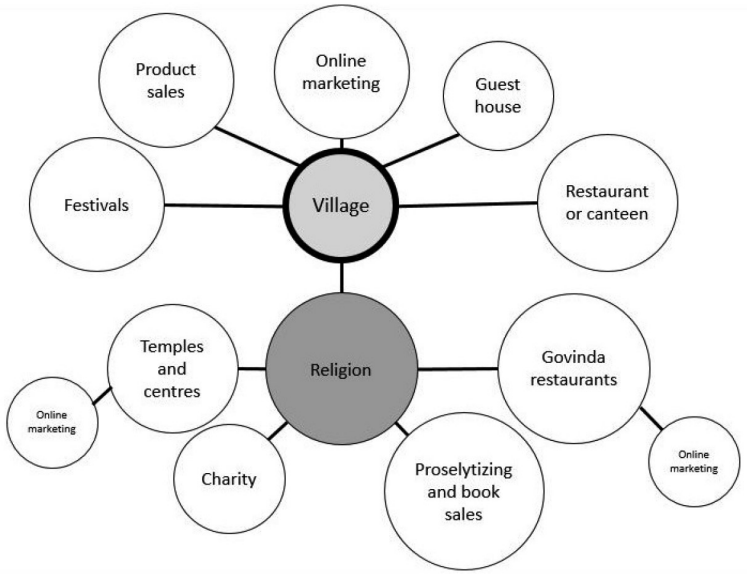

Figure 1. Molecular model of marketing Krishna-consciousness in Europe
Source: own edition, based on Shostack, 1977, and Srinivasan, 2012.

Figure 1 shows an aggregated molecular model of the marketing activities carried out by the Krishna-conscious communities in European, exhibiting the most commonly appearing features in the different countries. The molecular model shows that three out of the four main categories of institutions are present in most of the countries: temples and centres, restaurants and rural or farming communities are present is most cases, whereas educational institutions were more rarely present. However, the content analysis had shown that in those countries, where farming communities are present, the activities are more enhanced around these, than any other institutions of the religion.

The content analysis has further shown that while the communication of the temples and centres targets mostly the people already involved in the religion and the restaurants focus on those already following a vegan diet, the rural and farming communities call out to the wider public. Besides providing services for the members of the religious community, the rural communities seek to attract people unfamiliar with Krishna Consciousness as well, offering different cultural opportunities and free time activities for them. Another important feature of the online presence of the rural communities is that they approach the visitors from not religious, but a touristic perspective, putting more emphasis on the leisure activities and the experience. This has led to the next research phase of field observations in the rural communities. As Figure 1 shows, besides applying a set of marketing activities, the majority of the communities also operate a guest house and a restaurant or a canteen to facilitate overnight stays and serve the visitors. They also organize at least one huge and a couple of small festivals throughout the year, welcoming hundreds of visitors and providing a wide range of programs, enjoyable not only for the members of the religious community, and often introducing the religion itself. Some communities offer workshops

and different educational sessions too, which are open to anyone interested. In some countries, such as Hungary and Belgium the communities are so large that we can even speak about villages, hosting thousands of visitors a year. In these entities guided tours are also available, which provide visitors with a general overview on the religious beliefs, traditions and the lifestyle devotees follow. The field researches have shown that these villages and rural communities – especially the larger ones -, besides giving home to over one hundred devotees, also serve as a living exhibition of Krishna Consciousness and the Krishna-conscious lifestyle in Europe, where devotees can introduce their religion to the public.

Following the content analysis and the field researches, in-depth interviews were carried out with devotees responsible for the marketing and quest management of the communities examined. In the time period of June 2017 to June 2019 fifteen in-depth interviews took place in eight different European communities. Besides supporting the results of the content analysis and the field researches, the interviews have highlighted another important fact. Even though Krishna-conscious communities apply a wide range of marketing tools to gain more public knowledge, the traditional form of promoting the religion by devotees talking to people, proselytizing and selling books on the streets is still a common mean of promotion, in spite of the criticism this form of promotion usually generates according to the interviewees. The reason they gave for still applying this form of promotion is the tradition and the religious principles, which have always put an emphasis on proselytizing.

The results of the content analysis, the field researches and the interviews have outlined a two-phase marketing model, focused on the rural communities, where in the first phase visitors are attracted to a touristic destination offering a wide range of cultural activities; whereas the second phase is the introduction of the religion via interactive programs, which guests perceive as learning, rather than promotion.

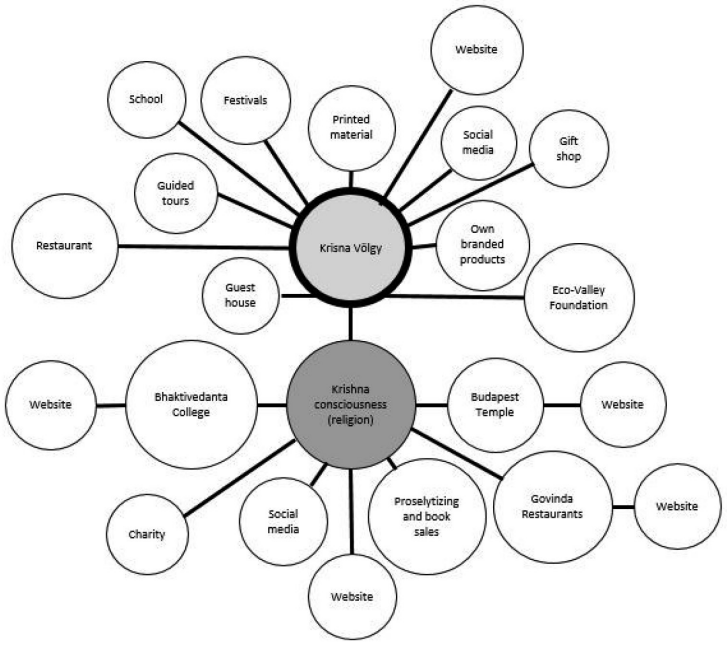

Figure 2. Molecular model of marketing Krishna-consciousness in Hungary
Source: own edition, based on Shostack, 1977, and Srinivasan, 2012.

Figure 2 shows the molecular model of the marketing of Krishna Consciousness in Hungary drawn based on the content analysis and the field research results. We can see that in this case all the four types of institutions are present, however, as the two-phase model suggests, the activities are more dense in the case of Krisna Völgy, the local farming community, than any other institution. Krisna Völgy is one of the most active farming communities in Europe concerning tourism, offering a wide range of services and leisure activities and promoting them with the help of an elaborated and professional set of marketing tools, including touristic agencies, online and offline presence and social media. As it could be seen on the aggregated model as well, just like many others, the Hungarian community puts efforts into promoting the religion personally, through proselytizing and book sales too.

4. ANALYZING THE EFFICIENCY OF THE TWO-PHASE MARKETING MODEL

The second research phase aimed to identify, which are the most efficient marketing tools the Hungarian Krishna-conscious community applies. In this, quantitative research phase questionnaires were applied to find the means people get acquainted with Krishna Consciousness and the forms of communication they notice the most often.

The data collection happened in two phases, the first phase in July and August of 2019 and the second during the fall of 2019. Since the second phase has not been closed yet, this paper analyses the research results of the first two months of data collection, during which 280 valid responses have arrived. The inquiry happened both via online questionnaire in Google Forms and paper-and-pencil format to ensure the largest possible response rate, the only criteria for being applicable to the sample was to have heard about Krishna Consciousness before. In the first question the respondents had to say where they have heard of Krishna Consciousness for the first time. After testing the questionnaire, the opportunity of giving more than one answers had to be introduced, as many respondents emphasized being exposed to different sources of information almost at the same time, or not being able to recall the first moment of exposition clearly. Figure 3 shows the 295 responses of the 280 respondents, which make it clearly visible that the strongest mean of promoting the religion is the word of mouth. 48,41% of the responses (144 mentions) have heard of Krishna Consciousness from another person for the first time, 28,47% (84 mentions) from devotees and 20,33% (60 mentions) from friends or relatives.

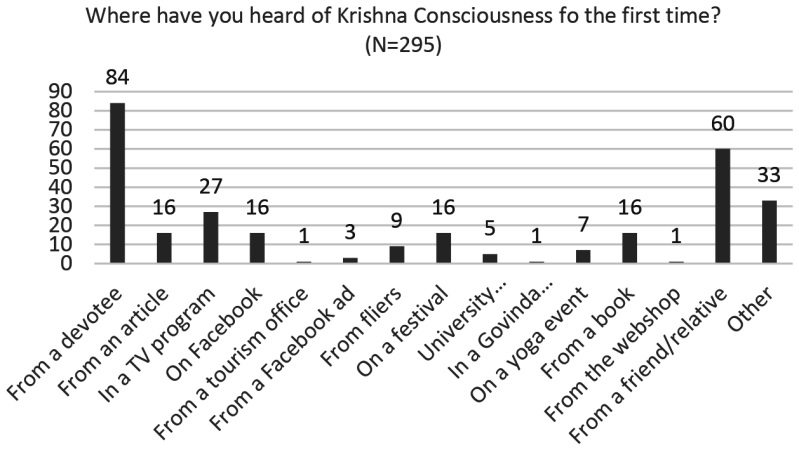

Figure 3. The most common forms of getting acquainted with Krishna Consciousness
Source: own edition

When talking about the communication tools other than word-of-mouth, television programs were mentioned most often, (9,15%, 27 mentions), followed by newspaper articles, Facebook posts, festivals and book releases, all achieving 5,42% (16 mentions). In spite of the huge focus on tourism by the community, touristic agencies and touristic advertisements on Facebook have gained the lowest percentage of mentions, while Instagram and other forms of social media achieved no mentions at all. However, 74,91% of the respondents (221 person) have already visited Krisna Völgy, which means that even though this was not the first form of getting to know the religion, most of the respondents have already participated in the touristic activities as well.

5. FUTURE RESEARCH DIRECTIONS

This is just the initial phase of the larger quantitative research, therefore most of the responses for the questionnaire are still to be analysed. The questions cover more detailed information about the exposure of the respondents to the different marketing tools and it also covers the topic of the general acceptance of religious communities engaging in marketing and commercial activities. The research seeks to identify, which marketing tools other than the word of mouth may be applied the most efficiently and with the least resistance of the audience.

6. CONCLUSION

The qualitative and quantitative analysis of the marketing activities of Krishna-conscious has shown that there is a two-phase model of promoting the religion, where the main focus is on the touristic aspect and attracting the visitors to a rural or farming community operating as a touristic destination. However, the quantitative research has shown, that the touristic advertisements are not the primary sources of information for getting acquainted with the religion. The largest proportion of the respondents have gained knowledge about Krishna Consciousness vis word of mouth, but this was in a significant percentage of the cases (74,91%) followed by a visit to Krisna Völgy, where they gained further knowledge of the religion. This suggests a third phase of the model created so far, where personal interactions on various locations raise the attention to the touristic destination, which then is an important part of the educational process. This is the most important result of the research so far, which requires further analysis.

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REAL OPTION ANALYSIS OF VENTURE CAPITAL INVESTMENTS

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Abstract: *Venture capital investments play an important role in the development and growth of start-up companies that are characterized by a high degree of uncertainty and growth potential, and venture capital is also one of the major sources of financing for entrepreneurial businesses. In the case of venture capital investment, staging has a huge potential, so the venture capitalists keep the right to participate in further financing rounds. The real option approach as an evaluation method provides an opportunity to evaluate this kind of investment with the help of flexibility in the case of a high degree of uncertainty. The paper puts the emphasis on the evaluation and the effectiveness of venture capital investments primarily from the aspect of real option theory tested on Hungarian venture capital cases. The paper concludes that the option-based valuation methods are more suitable for evaluating venture capital investments than others, especially the discounted cash flow method.*

Keywords: *Real Option Theory, Strategic Flexibility, Uncertainty.*

JEL Classification O16

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1. INTRODUCTION

This study attempts to analyze the valuation of venture capital investments and to explore links to real option theory. Venture capital is one possible form of private equity financing (Landström, 2007; Metrick-Yasuda, 2011) and a significant financial source for innovative and high-risk start-ups (Cassar, 2004; Ko et al., 2011) or from another aspect for high-tech, new or young SMEs (Chotigeat et al., 1997; Gompers-Lerner, 1999). In the case of venture capital, the investor appears as a financial intermediary of a non-financial corporation (Maula, 2007), the primary reward available to the investor are the capital gains (Lorenz, 1989). Moreover, venture capital investment is not limited to ensure financial sources, but venture capital investors are also involved in running and managing the businesses. According to Karsai (2006), venture capital investors aim to promote business growth and value creation through capital provided by a multi-year special investment arrangement (incentives, advice, networking, and knowledge). Gompers and Lerner (1999), Steier and Greenwood (1995) have also argued that venture capital investors can provide young firms not only with money but also with other added value, which is expressed in the form of a strategic and supportive role and social network. (Bygrave-Timmons, 1992).

The venture capitalist's investment activity is described as a five-step sequential, systematic process according to Tyebjee-Bruno (1984), which includes investment origination, screening, valuation, structuring, and post-investment phases. Fried-Hisrich (1994) described this process in six stages, distinguishing two filtering and evaluation phases instead of structuring. It is important to emphasize that the investment can be rejected at any stage in the case of both process models. In the approach of Tyebjee-Bruno (1984), the venture capitalists first recognize an investment opportunity, and in the second step, filter potential investments, focusing primarily on those that belong to their field in terms of technology, product and market. According to Gompers (1995), venture capitalists review the business plan of their young venture at this stage. In the third evaluation phase, future returns and risks are estimated based on financial and accounting information (Wright-Robbie, 1996), and other qualitative and relevant information. The fourth stage occurs when the valuation has led to a positive outcome and venture capital investors begin the process of negotiating with the potential entrepreneur regarding the amount invested, its form, and price, and then the contract is concluded. The final phase is the post-investment activity, which is a formal representation of the company owner and coordination with the company management. In the final stage, venture capitalists help entrepreneurs find exit opportunities through acquisitions, mergers or exchanges and IPO (Lee, 2018)

The study is focusing on the valuation of venture capital investments, which is also an essential and critical part of the entire venture capital investment operating process. The assessment of venture capital investments can be divided into qualitative and quantitative approaches. In a qualitative approach to evaluating venture capital investment, Tyebjee-Bruno (1984) considers management as the most critical factor, that is followed by market growth, while Ray (1991) examines the entrepreneur's personality and experience. Kaplan-Stromberg (2000) complements Tyebjee-Bruno 's (1984) approach with corporate strategy, as well as technical competitiveness. Besides, Fried and Hisrich (1994) emphasize the viability of the project, the unity of the management team, business performance and leadership capabilities, and the likelihood of an easy exit to obtain high returns.

From a quantitative point of view, the valuation procedures that are used for the assessment of venture capital investments come to the front. Wright et al. (2004) consider the used valuation procedures and the related information that is available to venture capital companies crucial. The

traditional venture capital valuation process involves analyzing future cash flows, stock prices and stock market performance of comparable companies, and calculating P/E (Price-to-Earnings) or P/S (Price-to-Sales) ratios (Seppä-Laamanen, 2001). According to Karsai et al. (1998), discounted cash flow (DCF) based procedures may raise valuation problems in uncertain environments. DCF methods can only handle the value determination process in a deterministic way (Takács, 2014).

When a venture capitalist invests in a sustainable and profitable company, their investment creates value for investors, entrepreneurs, and society too (Rosenbusch et al., 2013). High growth potential and the high variance potential of enterprises can be seen as drivers of economic growth by promoting and sustaining economic growth and renewal as a fundamental value generator and as a catalyst for new industrial development (Bygrave-Timmons, 1992). The venture capital financing process is continuously influenced by idiosyncratic uncertainties (Davis et al., 2004; Li, 2008; Pennings-Lint, 1997; Wang-Zhou, 2004).

Venture capital investment is, therefore, characterized by a high degree of uncertainty and, according to Seppä and Laamanen (2001), can be divided into options. Risk and uncertainty make it difficult for venture capitalists to identify innovative startups' sustainable and profitable investment opportunities (Gerasymenko-Arthurs, 2014; Lukas et al., 2016). The entrepreneurial, market, and economic uncertainty can influence venture capitalists to become risk-averse to innovative startups (Smith-Cordina, 2014). Option theory can provide an answer to the valuation challenges of venture capital investments with high growth potential and uncertainty. This study seeks answers to research questions on whether and how the real-option theory provides an appropriate framework for evaluating venture capital investment.

2. LITERATURE REVIEW OF REAL OPTIONS AND VENTURE CAPITAL

A real option is „*an investment in physical assets, human resources, and organizational capabilities that respond to future potential events*" (Kogut-Kulatilaka 2001, p. 3). The real options are similar to financial options because these give also a right but not obligation to buy or sell the underlying asset for a prescribed price at a predetermined time (Copeland-Antikarov, 2001). In the real option approach, uncertainty has value due to the ability of managers to actively manage uncertain projects (Boyer et al., 2003; Herder et al., 2011), that is, to incorporate flexibility into the managerial toolbox.

According to Hommel-Pritsch (1999) and Pritsch (2000), the real option theory can be interpreted on two levels, which also appears in their real option management model, that it manifests itself as a tool or qualitative evaluation method of the option. Triantis-Borison (2001) has a similar idea since they believe that the use of real options can be divided into three groups, such as the *way of thinking*, the *analytical tool,* and the *organizational process*. In the first case, it is primarily viewed as a language that qualitatively frames decision-making problems. In the second case, the real option valuation procedures are used to evaluate projects, and the third option is the organizational process, in which it plays a role as a management tool that defines and exploits strategic options as part of a broader process.

Real option types provide a framework for analyzing real options, which help to operationalize and support decision thinking. Trigeorgis (1996) differentiated the option to defer, option to reject, option to alter (expand or shutdown), option to switch, growth option, and compound real options. The value of the *option to defer* is derived from providing the company with the ability to shift the investment decision over time to obtain new information that may remedy or reduce

existing uncertainty (Rózsa, 2004). The *option to reject* is the abandonment of all or part of the project and the permanent liquidation of the investment if the market situation turns unfavorable. According to Huang-Chou (2006), the real option of dropping an investment project is being protected against future operating losses. *Option to switch* (shutdown and restart options) allow market management to decide to stop production in adverse market conditions but do not rule out the possibility of a restart (Csapi, 2018). *Option to alter* includes two options, including the *option to expand* and *option to contract* that can be used in the event of a permanent and significant improvement or deterioration in market conditions. *Growth options* are similar to the option to expand, but the difference lies in their place within the corporate strategy. Growth options provide project-wide flexibility, while expansion and staging options appear as project-wide options. In the case of *staging (time-to-build) option*, project managers can split investment projects into phases and then transfer the experience from the earlier periods to the later phases. Each stage of the project is evaluated, and management can decide whether to continue or reject the project (Scialdone, 2007).

For large investment projects, staging provides management the right to design the following project phases, depending on how uncertain future revenues and costs from project development may be. The project is implemented in phases, thus eliminating the technical uncertainty as well as the uncertainty of demand for products or services included in the project (Adetunji-Owolabi, 2016). The option price or premium, in the form of first-stage development costs, gives the right to incur development costs in the next stage. The strike price is the development cost of the subsequent phases, while the expiration date is the time at which the staging option is incorporated into the project and the date of the call of the staging option. Staging options are valuable for infrastructure projects (ports, power plants, water utilities, telecommunications, etc.) and R&D in intensive industries, such as the pharmaceutical industry, biotechnology, and venture capital investment (Majd-Pindyck, 1987; Trigeorgis, 1993; Rodrigues-Armada, 2007). The last type of real option, the compounded real option, involves the real options described above, and their combination. Sahlman (1993) identified three types of options from the foregoing that are inherent in venture capital investment, such as the option to reject, the project revaluation option (staging option), and the capital increase option (growth option).

Venture capital investments are characterized by a high degree of uncertainty and risk, which can also be traced back to the provision of financing to innovative, early-stage companies. Real option theory offers a way to address this by providing venture capital investors with professional experience through their active role in decision-making (Carvalho et al., 2005). Venture capital projects are characterized by significant market uncertainty (Bygrave et al., 1989). However, these uncertainties allow venture capital investors to postpone or delay their investments, i.e. to apply real option logic (Trigeorgis, 1996).

Determining how to make a successful decision in a venture capital project is a complex investment problem that also arises from the characteristics of funded companies (Miltersen-Schwartz, 2002). Venture capital projects are sequential investment decisions in which the venture capital investor has to decide whether to continue investing in the project or not (exit) (Sahlman, 1990; Gompers, 1995; Gompers-Lerner, 1999, Dahiya-Ray, 2010). According to Landier (2002), staging is one way to protect an investor from risk when entrepreneurs have an exit option. Sahlman (1990) notes that regular venture capital staging is the most effective control mechanism for venture capitalists as it provides periodic reassessment. Bergemann and Hege (2005) show that the duration of funding, but not necessarily its extent, increases in later stages. Early-stage companies require periodic investments, which can be considered as a multi-phase (compounded) call option.

The stages of venture capital investment, according to Cumming-MacIntosh (2001), are seed, startup, early-stage, expansion, acquisition, and turnaround, while Gong et al. (2006) investigate the seed, start-up, growth, expansion, bridging, and listing (exit) stages. Investments along these stages can be examined and real options can be identified. Venture capital investors have the right to choose the time and phase of the investment, i.e. they have a (call) timing (deferral), growth and staging option that allows the investment to be shifted over time. In addition, based on the information available, they have the right to suspend the project, which is a real option to reject (put option). Staged financing also provides real options for rejecting the project, which reduces the principal-agent problem too (Hsu, 2002; Hege et al., 2009). The higher frequency of milestones and funding rounds should result in a more practical application of disclaimers and, consequently, lower agency costs and better investment performance (Gompers, 1995).

3. METHODOLOGY

In general, the choice of the appropriate valuation method requires consideration of its conditions of application, which, in the case of real option theory, result from the examination of uncertainty, flexibility, reversibility, and exclusivity. When evaluating strategic investments with high levels of uncertainty, the use of the DCF method may result in limited or misleading values (Adler, 2000; Park-Herath, 2000; Yeo-Qiu, 2003; Pless et al., 2016). The combination of the four characteristics results in a better result for strategic investment valuation than the real option methodology, where the word better is generally meant to identify an adequate degree of value creation. Each evaluation process has both advantages and disadvantages, so it is essential to choose the method that best supports decision-making for the project.

Real option valuation procedures fall into two major analytical and numerical categories (Schulmerich, 2010). Analytical methods include closed-form models and approximation methods. Closed-form models use formulas to value an option, thus simplifying the procedure (Adetunji-Owolabi, 2016), but the relationship between the valuation parameters needs to be examined (Hartmann, 2006). Analytical methods include the Black-Scholes model, which is widely used to evaluate real options. Numerical methods lead to solutions through the underlying stochastic process or partial differential equations. Frequently used methods for estimating stochastic processes are Monte Carlo simulations, binomial pricing models, and decision trees.

Willner (1995) was one of the first to model the value of startup companies, concluding that many startup companies have the characteristics of a growth option. Jägle (1999) proposes binomial pricing for the evaluation of sequential processes, and Smith-McCardle (1998) also emphasizes that decision trees are most capable of displaying the flexibility of decision making.

3.1. Black-Scholes model

The Black-Scholes model was a breakthrough in economics, being the first one-period model to price European options. The model is deterministic, and it does not assume the presence of stochastic elements in the variability of volatility, that is, it assumes constant volatility of returns over a short period. There are some conditions for applying the Black-Scholes model that makes it challenging to apply in practice.

The model gives the value of a European call option:

$$c = S * N(d_1) - X * e^{-rt} * N(d_2) \quad (1)$$

$$d_1 = \frac{ln\left(\frac{S}{X}\right)+(r+\sigma^2/2)T}{\sigma\sqrt{T}} \quad (2)$$

$$d_2 = d_1 - \sigma\sqrt{T} \quad (3)$$

where c is the current value of the call option, S is the current price of the stock (underlying asset), $N(d_i)$ is the probability that the value of a randomly selected number from a set of normally distributed numbers is less than d_i, C is the strike price of the option, r is the risk-free interest rate, T is the maturity of the option and σ^2 is the variance of stock (underlying asset)'s yield (Rózsa, 2007).

The similarities have already mentioned between financial options and real options. The financial option parameters described by Black and Scholes (1973) correspond to the factors of the real option theory, first summarized by Luehrman (1998), and the analogy between these two option theories is shown in Table 1.

Table 1. The analogy between financial and real options
Source: Own construction according to Luehrman (1998)

Financial option	Variable	Real option
Stock price	S	Present value of project's operating assets to be acquired
Strike rice	X	Expenditure required to acquire the project assets
Time to expiration	t	Length of time the decision may be deferred
Variance of returns on stock	**σ**	Riskiness of project assets
Risk-free rate	r	Time value of money

3.2. Binomial Pricing Model

Cox, Ross, and Rubinstein (1979) introduced the binomial pricing model as a numerical approximation method that became widely used in European and American-type option valuation. To determine the value of options with the binomial option pricing model actually means a process of solving a decision tree (Brealey-Myers, 2005), and that estimates the value of an option at time t=0.

This paper is focusing on how to construct a lattice for a European call option. The binomial tree uses a discrete-time framework. Aligning the branches of the tree, we count backward from the future appointment, while considering the optimal procedure at each decision nodes (Brealey-Myers, 2005).

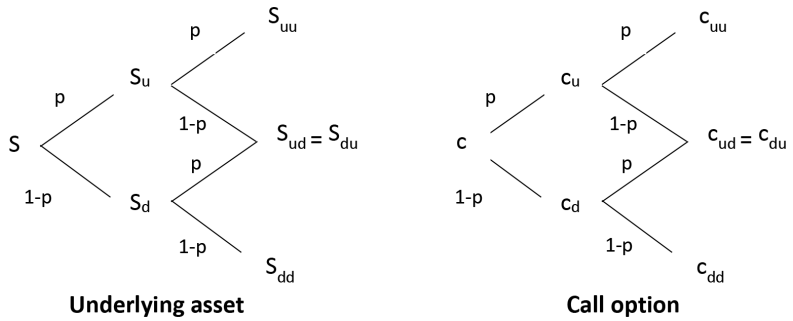

Figure 1: Two-step binomial tree
Source: own construction

At the final node of the decision tree, the option value is equal to the intrinsic value, so in the case of a call option c = max [S – X; 0]. The life of the option (T) is divided into Δt discrete periods, and the price of the underlying asset (S) can make a single move, either up or down. These movements are given by u and d multiplicative parameters (u>1; d<1). The probability of an upward movement is denoted by p and the one-period risk-free rate is nominated by r parameter (Breen, 1991). Figure 1 illustrates a two-step binomial tree where

$$u = e^{\sigma * \sqrt{t}} \tag{4}$$

$$d = \frac{1}{u} \tag{5}$$

If the value of the underlying asset grows to $S_{u,}$ the call option value is $c_{u,}$ and when the underlying asset value decreases to S_d, the call option value changes to $c_{d.}$ When we constructed the binomial tree of the underlying asset and the option value, we have two opportunities to calculate the option value: with the *replicating portfolio* and *risk-neutral probability pricing.*

Copeland-Antikarov (2001) assumed that the project value without option is the best unbiased estimation of the project's market value, and it serves as an underlying asset within the *replicating portfolio*, which means that markets are complete with option extended projects. In the case of the replicating portfolio, a synthetic option is constructed from the option and a bond. The underlying assets values replicate the payoff of the call option, that is called the hedge ratio (Δ or option delta) that is calculated with the following formula:

$$\Delta = \frac{c_u - c_d}{S(u-d)} \tag{6}$$

In addition to this, the investor needs to put in his portfolio Δ number of underlying assets, and B invested in a risk-free bond that pays interest r ($1+r_f$).

$$B = \frac{u * c_d - d * c_u}{r * (u-d)} \tag{7}$$

The portfolio values replicate the value of the project. The present value of the call option is equal to c = Δ × S + B and in the next period on the upside with p probability, the call option value is equal to $\Delta \times S_u + r \times B$ and on the downside with (1 − p) probability $c_d = \Delta \times S_d + r \times B$. With the help of Δ and B parameters, the value of the call option can be determined. The assumption of no arbitrage situation leads to *the risk-neutral valuation*. In this case,

$$q * S_u + (1-q) * S_d = S * e^{r * \Delta t} \tag{8}$$

where

$$q = \frac{e^{r * \Delta t} - d}{u - d} \tag{9}$$

After the calculation of probability, the call option value can be determined by the following equation:

$$c = \frac{q * c_u + (1-q) * c_d}{r} \tag{10}$$

4. ANALYSIS AND RESULTS

The real option theory can be interpreted not only in theory but also in practice, which has been illustrated through a case study. Every semester, the Simonyi Business and Economic Development Center of the Faculty of Economics of the University of Pécs announces the "5LET OUTLET" idea competition, which is open to university citizens with their business ideas, and then marketable projects can be included in the Simonyi Incubation Program. In February 2017, an application-based business idea focused on networking and getting to know applied for the competition. The potential and scalability of the idea, as well as the personality and dedication of the idea host convinced the jury and the project could enter the business incubation program. During the 14-week program the idea owner developed a business idea and business model with the help of a student team and a mentor. In this phase, growth opportunities led the idea creator to shape the concept, while uncertainties (technology, market, region-specific) about the project also presented themselves. During mentoring and counseling, they sought answers to address the uncertainties, for which the idea host conducted environmental, market and industry analysis with the brainstorming team. The team played a significant role in the idea formation and progress during the incubation process. In the incubation program, the idea host had to invest the time, energy, and private capital needed to develop the idea to achieve development and growth. In order to obtain a source of funding, the business idea had to reach a stage that would convince capital providers that the concept had a viable and promising future. For development, it became clear that capital involvement was needed but thanks to the brainstorming opportunity the solution was found through the incubation program. The company was founded in February 2018, and after the viability of the project had been examined by a venture capital investor, the company first received a venture capital investment of 9,000,000 HUF, and a year later, another sum of 30,000,000 HUF. In this case study, a venture capital investment of 39,000,000 HUF is valued. Venture capital investment is thus a two-tier investment that can be interpreted as a compounded call option. However, the growth plans of the company are surrounded by considerable uncertainty the project carries the potential for postponement and staging, which means with enough managerial flexibility, the plans can be feasible.

At first, venture capital investment was evaluated using the traditional DCF method. The Free Cash Flow to Firm (FCFF) value is 65,951,000 HUF (assuming a 10% cost of capital), which can be used to calculate the value of the company by taking into account two stages of venture capital investment (39,000,000 HUF), so in this case, it is 26,951,000 HUF.

Table 2. Input parameters of the real option valuation
Source: own construction

Input parameters	Variable	Values
Underlying asset value (PV(FCFF))	S	65,951,000 HUF
Exercise Price (venture capital investment)	X	39,000,000 HUF (X_1=9,000,000 HUF, X_2=30,000,000 HUF)
Time to expiration	t	1.5 year
Volatility	**σ**	64.46%
Risk-free interest rate	r	2.5%

According to the parameters of Table 2, the call option value with Black-Scholes model is 33,641,000 HUF that shows the embedded flexibility in the model that is equal to the difference between the call option value and FCFF value, so 6,690,000 HUF.

The other frequently used real option evaluation method is the binomial pricing model that was also calculated in the case of the venture capital investment. The calculated parameters of the model can be seen in Table 3.

Table 3. Calculated parameters of the binomial pricing model
Source: own construction

Parameters	Variables	Values
Number of periods	Δt	0.25
Upside parameter	u	1.38
Downside parameter	d	0.72
Risk-neutral probability	q	0.46

With the help of the input and the calculated parameters, the underlying asset values and the call option values were computed, then the two binomial trees were drawn (Figure 2 and 3). The first value in Figure 3 is the call option value that is equal to 32,837,370 HUF.

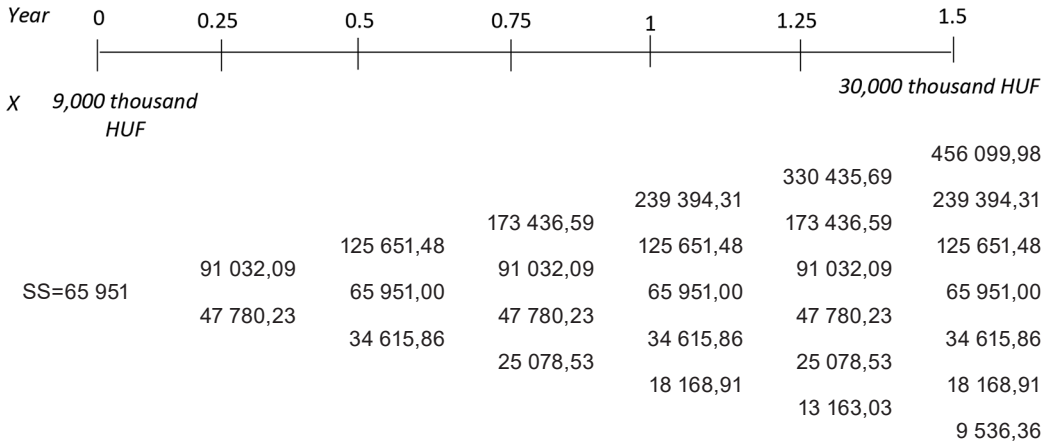

Figure 2: Binomial tree of the underlying asset (values in thousands HUF)
Source: Own construction

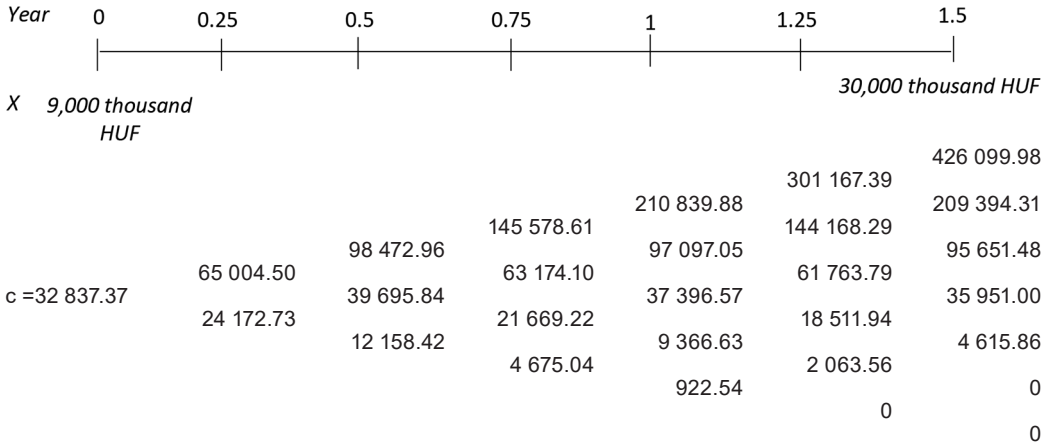

Figure 3: Binomial tree of the call option (values in thousand HUF)
Source: Own construction

The result shows that the DCF method gave the lowest company value in the case of venture capital investment that is followed by the binomial pricing model value and the highest value was generated by the Black-Scholes model with 33,641,000 HUF (Table 4). The difference between the result of the DCF and option valuation methods shows the value creation of the uncertainty and the embedded strategic flexibility. The binomial option pricing model demonstrates a higher level of strategic flexibility as the literature review also certified staging advantages and value-creating role. When we would like to detect the effect of staging in the binomial pricing model, it can be assumed only one portion of venture capital investment that results in a lower option value after the calculation (27,294,770 HUF). It emphasizes the importance of investment timing and staging investment.

Table 4. Result of the venture investment valuation
Source: Own construction

Model	Company value
DCF model (FCFF)	26,951,000 HUF
Black-Scholes model	33,641,000 HUF
Binomial pricing model	32,837,370 HUF

5. CONCLUSION

The paper focused on the evaluation of venture capital investments with the help of real option theory. The literature review showed that venture capital investments have the characteristics that require the application of real option logic and analyzing tool. Venture capital investments can be described with a high degree of uncertainty, partial irreversibility and these need to have active management. Staging serves as a control mechanism for venture capitalists because it provides a periodic reassessment of venture capital financing.

The most accepted evaluation methods, the Black-Scholes model and the binomial pricing model, were tested on venture capital investments in a Hungarian start-up company. The Black-Scholes model generated the highest option value with 33,641,000 HUF. The case study certified that real option valuation methods are more appropriate for evaluating venture capital investments and young, early-stage companies because of these high degrees of uncertainty and the strategic flexibility than the traditional valuation methods.

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EUROPEAN FINANCIAL MARKET INTEGRATION: A CLOSER LOOK AT GOVERNMENT BONDS IN EUROZONE COUNTRIES

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Abstract: *This research aims to test the interdependencies between the Eurozone, US and Japanese debt markets, through the yields of 10-year sovereign bonds. The sample covers the period from 2002:01 to 2019:07. The analysis aims to provide answers to two questions: Has the global financial crisis accentuated the interdependencies in the Eurozone debt markets? If yes, how did it influence the movements in sovereign bond yields? The results suggest that the global financial crisis did not accentuate the levels of interdependence between the main Euro zone debt markets. In addition, the results suggest the existence of high movements in periods of crisis and not crisis. We also found that yields on PIIGS sovereign bonds decreased their interdependencies with their peers in the years 2002 to 2019, with the exception of the Greek debt market.*

Keywords: *Interdependencies, Eurozone Debt Markets, Global Financial Crisis.*

JEL Classification G18

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1. INTRODUCTION

The Eurozone was created to strengthen financial integration among its members. Part of this integration was the harmonization of sovereign debt markets, which resulted in high levels of integration and sharp movements between sovereign bond yields (Gilmore, Lucey and McManus, 2008), (Dajcman, Festic and Kavkler, 2012).

After the fall of Lehman Brothers Bank, the financial and banking crisis spread globally, calling into question existing theories of risk management. Greece, a member state of the Euro Zone, admitted that the budget deficit was 12.5% of GDP. In addition, it was revealed that the Greek public accounts had been falsified, and that the real volume of public debt was systematically hidden in order to guarantee accession to the euro. These events caused the European peripheral countries to have called for foreign aid, namely Spain, Portugal, Italy, Ireland and, finally, Cyprus. The financial crisis has shaken the confidence of creditors, and the disclosure that Greece's public accounts had been distorted, has had a suspicious effect on European Union (EU) countries. Suddenly, the yields on loans made through sovereign bonds became higher because, from the investors' perspective, the assumption that the sovereign bonds of EU countries were less risky led to uncertainty (Smolik and Vacha, 2015).

This research adds two relevant contributions to the literature.

The first contribution refers to the study of the interdependencies between the Eurozone debt markets, using as benchmarks the US and Japanese markets, through the analysis of sovereign bond yields. As far as we know, the authors, Kim, Lucey and Wu (2005), Abad, Chuliá and Gómez-Puig (2010), Volosovych (2011), Pozzi and Wolswijk (2012), Claeys, Moreno and Suriñach (2012), Dragomirescu-Gaina and Philippas (2013), Sibbertsen, Wegener and Basse (2014), Răileanu-Szeles and Albu (2015), Ehrmann and Fratzscher (2017), Kim, Lucey and Wu (2018) analysed the interdependencies in the EU sovereign bond markets, but the approach was essentially different from the one followed in this study.

The second contribution is related to the methodology used, sovereign yields, as regime change processes, can accommodate a unitary root regime during normal periods and a second regime as a reversion to the average, in turbulent periods. These findings should also be taken into account when examining sovereign bond yields. Specifically, as spreads constitute parity relations between yields and their underlying securities, the level and possible changes in the autoregressive parameters of the series have information related to their deterministic processes (Ang and Bekaert (2002); Ang and Bekaert (2002a)). Lanne (2001) shows that short-term and long-term interest rates have characteristics of unitary roots and that conventional cointegration tests tend to overrule the null value of integration, i.e. non-cointegration.

Thus, when we compare the results of work on sovereign bond yields according to the sample range, the data provide evidence of non-linearity. In addition, panel data techniques widely used in sovereign yield studies may not be the most efficient, as they incorporate effects on the average in their results and do not allow the disclosure of country-specific properties. This may restrict the differences in the results of studies that have examined the determinants of spreads since the Eurozone debt crisis. Specifically, on the one hand, part of the literature argues that spreads are related to fiscal conditions in Eurozone economies (see, for example, Manganelli and Wolswijk (2009); Schuknecht, von Hagen and Wolswijk (2009); Bernoth and Erdogan (2012)). On the other hand, in other studies, market sentiment and the process of expectation formation are more impor-

tant than fiscal effects (e.g. Favero and Missale (2012); Favero (2013); Georgoutsos and Migiakis (2013); Favero and Missale, 2016).

In terms of structure, this research is organized in 5 sections. Section 2 presents an analysis of the state of the art in relation to articles on integration and interdependencies in the Eurozone sovereign bond markets. Section 3 describes the methodology. Section 4 contains the data and results. Section 5 concludes.

2. LITERATURE REVIEW

The topic of financial integration in European securities markets has attracted a very relevant interest in empirical research. The authors Baele, Ferrando, Hördahl, Krylova and Monnet (2004) show a rule to evaluate the degree of integration in European financial markets that is based on the concept of parity, i.e., the exogenous factors must cause equal and unidirectional movements on prices in the markets so that the markets are fully integrated. His analysis showed that yields on Eurozone sovereign bonds show high levels of financial integration.

The authors Babecký, Komarek and Komárková (2017) consider that the analysis related to financial integration, nowadays, is relevant from the point of view of cost versus benefits analysis. The literature commonly agrees that financial integration brings benefits in less turbulent periods. However, in times of crisis, high financial integration increases the probability of contagion, due to the close interrelationship between financial markets through their proximity. Globally, and in the long run, the benefits of financial integration are expected to outweigh the costs.

Sosvilla-Rivero and Morales-Zumaquero (2012), Santis (2012), Antonakakis and Scharler (2012), Bhanot, Burns, Hunter and Williams (2014), Claeys and Vašíček, (2014), Christiansen (2014) analysed the independence between the Eurozone debt markets in the context of the global financial crisis and showed mixed results. Sosvilla-Rivero and Morales-Zumaquero (2012) find evidence of interdependencies in the yields of the sovereign bonds of 11 EMU countries in the period from 2001 to 2010. Santis (2012) considers that, between 2008 and 2011, the risk on sovereign bonds in the PIIGS countries is higher and statistically significant. The author shows that the shocks from Greece to the peripheral countries of the Eurozone, as well as to Belgium and France, point to contagion and not interdependence. Antonakakis and Scharler (2012) argue that shocks in sovereign yields between Eurozone countries are highly synchronized, however, shocks in sovereign bond yields of peripheral countries cause very strong shocks in non-peripheral Eurozone markets. Bhanot, Burns, Hunter and Williams (2014) show significant interdependencies between Greek sovereign spreads and Eurozone debt markets, however, reject the contagion hypothesis. Claeys and Vašíček, (2014) suggest that shocks between sovereign bond yields have increased considerably since 2007, but their importance is heterogeneous across countries. In addition, the results show that the effects of volatility influence the domestic fundamentals of EMU countries. Christiansen (2014) shows that the integration of sovereign debt markets is stronger in EMU than for non-EMU members and stronger for old members than for new EU members. During recent periods of crisis, integration is weaker, especially for EMU countries.

A common evidence in the post-crisis empirical literature is the reversal observed in financial market integration in European Union countries as a consequence of the crises of 2008 and 2010 (Pungulescu 2013). This phenomenon is also known as weak integration (Islami and Welfens, 2013) or even estrangement (Răileanu-Szeles and Albu, 2015). However, the most recent studies show signs of recovery in financial integration, for example, based on evidence from Eurozone

markets (ECB, 2016). However, there is also evidence of financial fragmentation in the euro area (Lucotte (2015); Mayordomo, Abascal, Alonso and Rodriguez-Moreno, (2015)).

Yang and Hamori (2013), Orlowski and Tsibulina (2014), Deltuvait (2015) and Babecký et al. (2017) studied the interdependencies between the debt markets of Central and Eastern Europe and some Eurozone countries. The authors argue for differentiated evidence. Yang and Hamori (2013) analysed the interdependencies between the bond markets of the CEEC-3 countries (Poland, Czech Republic and Hungary) and Germany in the period from 2000 to 2013. The authors argue that financial integration was already significant before the adoption of the euro in 2004 in the Czech Republic, while the process of financial integration continues in Poland, but not in Hungary. The bond markets in Poland and Hungary decreased their interdependence with Germany during the period of the global financial crisis. Orlowski and Tsibulina (2014) examined the interdependencies between the sovereign bond markets and the stock markets of Germany and those of Poland, the Czech Republic, Hungary, as well as Slovenia and Slovakia. Sovereign bond yields in the Czech Republic and Poland show high interdependence with the German market. Slovenian and Slovak stock yields do not show interdependencies with German yields, while the markets of Poland, the Czech Republic and Hungary show very significant interdependencies. Deltuvait (2015) studied the interdependencies in the sovereign bond markets of Central and Eastern European countries (CEEC-3). The author shows that the interdependencies of the CEEC – 3 bond markets are higher than when compared to the other markets analysed. Babecký et al. (2017) analyzed whether financial integration was resumed, focusing on the period from 2002 to 2015. The analysis covers the economies of Central Europe (Czech Republic, Hungary and Poland), the new countries of the euro area (Slovenia and Slovakia) and Western Europe (Austria, Germany, Portugal). The results show that the global financial crisis mainly caused a temporary disintegration in the financial markets analysed in relation to the Eurozone markets. In 2015, the situation in financial markets gradually returned to the degree of pre-crisis integration, however, there are signs of segmentation in sovereign securities markets.

3. METHODOLOGY

Economic time series are often affected by events that destabilise the permanence of their parameters. In this sense, Inclán and Tiao (1994) proposed the CUSUM test to test a change in the variation of the normal distribution. The CUSUM and CUSUMQ tests are examples of suitable tests to determine a possible temporal location of structure breakdowns, so they will be used as an indicator of a possible breakage. Based on the results found, we will use the Bai and Perron test (2003) to detect the multiple structural breakdowns in the data series in each sub-period.

In order to analyze the long-term interdependencies between the yields of Eurozone sovereign bonds, we will use the methodology of Gregory and Hansen (1996). To study the short-term relationships between the Eurozone sovereign debt markets, we will use the impulse-response functions (IRF) methodology, with Monte Carlo simulations. These models provide a dynamic analysis (variable over time), based on the estimates of the VAR model, making it possible to study the causality relationships found, even when Granger's causality relationships between the variables are not previously detected (Lütkepohl and Saikkonen 1997).

In this article, we chose to use generalised impulse-response functions, introduced by Koop, Pesaran and Potter (1996) and Pesaran and Shin (1998), and to choose the Monte Carlo simulation procedure, with 1000 repetitions. This analysis differs from the traditional impulse-response-orthogonalised analysis, because it does not depend on the ordering of the variables in the VAR

model. The traditional approach, such as that based on Cholesky's factoring, for the orthogonalisation of VAR innovations, leads to different results, depending on the ordering of variables.

4. DATA AND RESULTS

4.1. Data

Sovereign bond yields are daily and comprise the period from January 1, 2002 to July 2, 2019 (4566 observations). It was decided to divide the sample into three subperiods, one Pre-CFG which corresponds to the subperiod from 1 January 2002 to 31 July 2007, one crisis subperiod, which we refer to as Global Financial Crisis (GFC) which covers the subperiod from 1 August 2007 to 14 December 2014 and a third subperiod which contains the period from 1 January 2015 to 2 July 2019, which we refer to as the Post-GFCG subperiod.

Table 1. Sovereign Debt Markets
Source: Own elaboration

Countries	Index
France	France Govt – 10YR
Germany	Germany Govt – 10YR
Greece	Greece Govt – 10YR
Ireland	Ireland Govt – 10YR
Italy	Italy Govt – 10YR
Japan	Japan Govt – 10YR
Portugal	Portugal Govt – 10YR
Spain	Spain Govt – 10YR
US	US Govt – 10YR

4.2. Results

The interdependence tests, referring to the yields of 10-year sovereign bonds in the pre-crisis global financial sub-period, show 52 pairs of integrated markets, with breakdown of structure (out of 64 possible). It is easy to see that the debt markets of Ireland and Portugal are the most cointegrated in this period of non-crisis. These results are corroborated by authors Yang and Hamori (2013), Orlowski and Tsibulina (2014) and Deltuvait (2015), which show interdependencies in sovereign debt markets.

In the period of the global financial crisis, the results suggest 53 integrated markets, with a breakdown in structure (out of 64 possible). Japanese and Spanish sovereign bond yields are the most interdependent debt markets. France, Germany, Ireland and Portugal have 6 integrations, while Italy, Greece and the USA have 5 and 4 integrations, respectively. When compared with the previous period, we can see that the yields of sovereign bonds of Greece, Ireland, Italy and Portugal fell significantly, while Japan, Spain and the USA increased considerably the level of integration with their peers, namely Japan, which doubled the level of integration. The results obtained suggest that, in the sub-period of the global financial crisis, the long-term interdependencies between sovereign bond yields, under analysis, did not rise when compared to the previous period, in global terms. These results are corroborated by the authors, Sosvilla-Rivero and Morales-Zumaquero (2012), Antonakakis and Vergos (2013), Bhanot, Burns, Hunter and Williams (2014), Claeys and Vašíček (2014) and Christiansen (2014), which show the existence of interdependencies, during the global financial crisis, in these Eurozone debt markets.

Yields on 10-year Treasury Bonds cointegrated 35 times (out of a possible 64) in the post-global financial crisis period. The debt market with the most integration is that of Greece. The remaining markets decreased significantly their levels of integration with their peers, namely those of France, Germany, Italy, Japan and Spain. Yields on US sovereign bonds are not integrated with their peers. The results obtained suggest that in this period of non-crisis there has been a significant reduction in the interdependence between the yields of Eurozone, US and Japanese sovereign bonds. These results are corroborated by the studies of the authors Lucotte (2015) and Mayordomo et al. (2015) which show a financial fragmentation in the Eurozone debt markets.

The impulse response functions for the first pre-crisis sub-period, calculated on the basis of the autoregressive vector model, made it possible to identify 64 cases of statistically significant reactions to shocks from the markets under analysis. In this non-crisis period, it was possible to assess the existence of 406 shocks (out of 800 possible). Spain is the market that causes the most shocks (49), causing the largest number of reactions in the markets of France and Japan (8 out of 10 possible). Ireland and the USA cause 48 reactions, while Germany, Italy, France, Portugal, Japan and Greece cause 46, 45, 43 and 42 shocks in their peers, respectively.

During the sub-period of the global financial crisis, relations between the markets studied were, in general, significant. Of particular note were the 378 shocks between the yields of Eurozone sovereign bonds. Japan caused 46 shocks in its peers, having had a greater relevance in the German market (9 out of 10 possible). The USA and Spain caused 44 reactions, while Germany, Ireland, Italy, Greece, Portugal and France caused 42, 40 and 38 shocks to their peers, respectively. Eight shocks had statistically significant effects during only one period (10 days), in particular those resulting from the impulses caused by the Irish, Spanish and US securities markets, in the sovereign bonds of the countries of Greece, the US and Ireland, respectively. In this period of crisis, France, Germany, Greece, Ireland, Italy, Portugal, Spain and the USA decreased their movements, while Japan increased its movements with its peers. In addition, the shocks were, in general, less persistent in this period of crisis.

As in the previous two sub-periods, there were 392 reactions between markets in this non-crisis period. Spain shows 49 reactions with its peers, with a greater emphasis on the markets of Ireland, Japan and Portugal (7 out of 10 possible). Italy, USA, Portugal, Ireland, France, Greece, Germany and Japan caused 48, 47, 45, 44, 43, 42 and 37 shocks in their peers, respectively. The Portuguese market caused 9 reactions in Ireland, while the USA caused 8 shocks in Japan. The number of statistically significant shocks in the three sub-periods was 406, 378 and 392, respectively, reason to conclude that the global financial crisis did not increase the movement between the yields of Eurozone sovereign bonds.

5. CONCLUSION

The conclusion to be drawn, based on econometric models, is that the global financial crisis has not accentuated the levels of interdependence between the main debt markets of the Eurozone. In turn, the impulse/response functions showed the existence of positive movements, with statistical significance, with persistence of more than one week. We can therefore infer that the assumption of the hypothesis of market efficiency is questionable, since the forecast of the movement of a given market can be improved if we consider the lagged movements of other markets, enabling the occurrence of arbitrage operations. In conclusion, the yields of PIIGS countries' sovereign bonds decreased their interdependencies with their peers in the years 2002 to 2019, with the exception of the Greek debt market.

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