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ANALYSING OF DIFFERENCES IN TERMS OF EXPOSURE LEVEL TO OVER-CONFIDENCE BIAS CONSIDERING SOCIO-ECONOMIC FACTORS

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Abstract

Over-confidence is a bias of that many entrepreneurs is under influence. There are several studies showing that entrepreneurs, who are under the influence of over-confidence bias, tend to trade inordinately, make more investments in risky financial instruments and less product diversification. This study aims to test over-confidence bias level of 100 entrepreneurs in terms of their trading volume and risky investments in their portfolio for the last three consecutive years. While previous studies mostly analyze the issue from theoretical perspectives, this study focuses on more verifiable facts such as transactions in BIST (Borsa Istanbul). This study shows that in terms of both trading volume and portfolio diversification, entrepreneurs' professions, education levels, income levels, marital status and genders differ according to exposure level to over-confidence. The study reveals a difference in age profile of entrepreneurs in terms of exposure to over-confidence bias considering trading volume, but not in portfolio diversifications.

Keywords: behavioral finance, overconfidence bias, individual investor

JEL Classification: D81, G17, G32

1. Introduction

Psychology is the basis for human desires, goals and motivations, and it is also the basis for a wide variety of human errors that stem from perceptual illusion, overconfidence, over-reliance on rules of thumb, and emotions (Shefrin 2002, 9). Economists started implementing psychological findings into economic models starting in the '1970s, but the most rapid development of that trend began in the 1990s (Skala 2008, 41). Behavioural finance studies the application of psychology to finance, with a focus on individual-level cognitive biases (Hirshleifer 2014, 1). One of the most important biases is overconfidence bias. In today's markets where speed, information and internet use are increasingly important, overconfidence bias is a psychological one which influences individual investors intensely. Many academic studies that have been performed on behavioural finance suggest that investors may act under the influence of overconfidence bias in the financial decision-making process and have a tendency of trusting too much on their own knowledge and judgments in a systematic way. In according to Fama (1998), stock prices are determined by the informed investors, and they are subject to two biases: One of them is overconfidence and other is self-attribution. Fama identifies to overconfidence as bias leads to investors to exaggerate the precision of their private signals about a stock's value. Overconfidence has been defined in many ways. Characteristic of human information processing (Ayton *et al.* 1999, 279); to be too sure of assumptions and opinions (Russo and Schoemaker, 1989); tendency to overestimate the likely occurrence of a set of events (Zacharackis and Stepherd 2001, 311); difference score between confidence and accuracy (Dawes and Mulford 1996, 204); positive difference between confidence and accuracy (Schaefer at al. 2003, 473). Overconfident people have some characteristics. They are overconfident about their own relative abilities, and unreasonably optimistic about their futures (Camerer and Lovallo 1999, 306). They put too much weight on recent experience (Ritter 2003, 429). They have too much credit their successes (Gervais and Odean 2001, 1) and overconfident investors trade more than rational investors (Glaser and Weber 2003, 4). Well, why do people trust themselves excessively? Narcissistic personality (Schaefer at al 2004), authoritarian personality (Olivares, 1993), optimism self-efficacy and self-monitoring (Wolfe and Grosch, 1990), depressed mood (Dunning and Story, 1990), availability, anchoring, confirmation bias and hindsight (Russo and Schoemaker, 1992) are the other views about reasons of overconfidence. Overconfidence manifests itself in different forms: miscalibration, better-

than-average effect, and excessive optimism (Abreu 2014, 35) The illusion of control refers to the situation where individuals tend to overvalue their skills, miscalibration is the situation where an individual subjectively overvalue his own opinions despite the existence of an objective fact, and better-than-average effect means the tendency of people to consider themselves better-than-average in whatever subject. Excessive optimism, on the other hand, refers to looking at the events on the bright side at an unreasonable level.

Although the investors think that the outcome of overconfidence is earning more, this is not always true. Overconfidence often causes investors to purchase and sell more and decreases the welfare of investors (Odean 1998, Barber and Odean 2001). Moreover, overconfidence leads preference for volatile stocks (Baker *et al.* 2009, 7).Overconfidence seems to disappear, or underconfidence is observed (Klayman *et al.* 1999, 217). In fact, overconfidence of people can be identified more clearly based on their observable behaviors rather than their words. This study derives and analyses overconfidence bias of investors based on their observable financial behaviors. As part of the study, actual data is used in relation to security trading transactions that had been performed by 100 individual investors from January 2, 2009, to December 3, 2011, at the İstanbul Stock Exchange. Based on the information obtained from security trading transactions of 100 investors, daily variables of transaction volume and portfolio diversification level were calculated and determined. The portfolio diversification level gives us the number of shares available in the portfolio on relevant date and it is assumed that investors who perform portfolio diversification have a low perceived risk. Transaction volume refers to total number of trading transactions on relevant date. Similarly, it is suggested that investors with a low perceived risk have a higher transaction volume. Therefore, having a high transaction volume and high number of shares in the portfolio is considered as an indicator of overconfidence. Overconfidence bias is evaluated based on demographics.

2. Literature review on overconfidence bias

Overconfidence may lead to low return or loss relatively in investment judgment. Barber and Odean (1999) examined the trading history of 60.000 investors over the six year periods and they find that investors who traded most were underperforming the index by 500 basis point. The reason of this phenomenon was judgments of these investors about they can beat the market in accordance to writers. In their study conducted at various stock exchanges in the United States of America, Statman *et al.* (2006) established that the trading volume, compared to other weeks, is higher after the weeks when high return is acquired and related it with increasing confidence in the investors. In their study on Chinese investors, Chen *et al.* (2007) reported that securities which Chinese investors buy underperform compared to those they sell, they adopt a disposition effect by selling appreciated securities rather than depreciated securities, and they exhibit overconfident traits by holding less securities and trading more frequently. Barber and Odean (2001) analyzed over 35.000 accounts between February 1991 and January 1997 which they acquired from an intermediary firm, in relation to excessive transactions that investors made. In their study, they focused on what percentage of shares in an account changed, in other words has been sold and replaced by other shares, in a year. At the end of the study, it has been demonstrated that men made 45% more transactions than women. They explored that the ratio of change of the shares are 85% in the accounts of single men, 73% in that of married men, 53% in that of single women, 51% in that of married women. It has been indicated that the reason men making more transactions than women is their-overconfidence or their consideration of themselves as having more and accurate knowledge than women. These two situations result in men making more transactions than women.

Also, overconfidence bias is common at company managements. In their study conducted in 18 countries, Koellinger *et al.* (2005) determined that perceptions play a very important role in establishing a new workplace and CEOs are overconfident about their own perceptions rather than objective probabilities. The authors highlighted that CEOs overestimate the possibility of their own success. In their study conducted on corporate financial decisions, Malmendier *et al.* (2011) found that overconfident CEOs prefer less external financing, CEOs with depression history takes a negative stand on debts and CEOs with military history have a more aggressive attitude including the leverage ratio. Malmendier and Tate (2008) reported that overconfident CEOs over-estimate their ability to generate returns and the odds of making an acquisition are 65% higher if the CEO is classified as overconfident. This effect is largest if the merger is diversifying and does not require external

financing was found by writers. Ben-David *et al.* (2007) found that when valuing their cash flows overconfident chief financial officers (CFO) use lower discount rate, make more investment, use more loans, tend to offer lower dividend and prefer taking long-term loans rather than short-term ones. Huang and Kisgen (2013) found that male executives (CFO) undertake more acquisitions and issue debt more often than female executives, and acquisitions made by firms with male executives have announcement returns approximately 2% lower than those made by female executive firms. As a result of that study, it is revealed that men exhibit relative overconfidence in significant corporate decision making compared with women. Accordingly, Lewellen *et al.* (1977) found that men spend more time and money on investment portfolio management and trade more often than women. Thus, the authors suggested that managing investment portfolios is a masculine task. In their study of company executives, Forbes (2005) revealed that individual age, firm decision comprehensiveness and external equity funding affect the degree to which entrepreneurs are overconfident. In addition, they reported that founder-managers are more overconfident than are new venture managers who did not found their firms. Daniel *et al.* (1998) and Friesen and Weller (2005) found that there is a relationship between overconfidence levels of company executives and the book-to-market ratio. Accordingly, uncertainty dominates the firms with a low book-to-market ratio and this should be a sign of overconfidence in these firms according to the psychology-finance literature (Friesen and Weller 2006, 352).

In their study on 1,000 investors, Graham *et al.* (2009) found that investors who feel competent trade more often and have more international assets in their portfolios. They also find that male investors, and investors with larger portfolios or more education, are more likely to perceive they as competent than are female investors, and investors with smaller portfolios or less education. In their study on 245 participants, Biais *et al.* (2005) found that miscalibration reduces and self-monitoring enhances trading performance. Additionally, they remarked that psychological factors have more influence over men than women. In their study of London-based traders, Fenton-O'Creevy *et al.* (2003) found a relationship between the illusion of control and poor performance and mention about the negative impact of overconfidence based on an empirical study. Kumar and Lim (2008) show that investors who exhibit more clustered trades show weaker disposition effects and better-diversified portfolios. They also show that investors who execute less-clustered trades exhibit a preference for small-cap and value stocks, and they earn higher raw returns but lower risk adjusted returns. Odean (2000) examines trading activity in 10,000 accounts and finds that securities that the investors buy underperform compared with the securities they sell. And they show the disposition effect, one of the elements of overconfidence, as the reason of that underperformance. In their study conducted in Finland, Grinblatt and Keloharju (2009) found that overconfident investors and those investors must prone to sensation seeking trade more frequently. In their empirical study, Lee *et al.* (2013) asked students from accounting and finance departments to manage a portfolio of 500,000 US Dollars in actual market conditions. They found that male investors spent more time on their portfolio and created more risky portfolios compared with female investors. In her study, Vissing-Jørgensen (2003) found that although investors have some biases, those biases reduce to a certain degree in investors with higher level of income. Karlson and Norden (2007) examined that demographics and investment choices of 15,000 individuals in the Swedish pension system which contains 4.4 million people. The authors found in their study that the impact of overconfidence is observed more in men compared with women when making investments in local assets.

In their empirical study, Allan and Evans (2010) found that experience did not reduce overconfidence and there is a negative relationship between expected value and overconfidence bias, meaning that expected value cannot be reached as a result of overconfident offers. Another empirical study on overconfidence was conducted by Maciejovsky and Kirchler (2002). As a result of their multi-stage experimental study, they found that levels of overconfidence increase towards the end of an experiment, when participants start to depend on their knowledge. Deaves *et al.* (2008) employed their study in many countries and found consequently that calibration-based overconfidence engender additional trade. In addition, the authors determined that age influences trading activity.

3. The object of the research and hypothesis used

The object of this study is to investigate the possible differences that may occur with regard to the level of the overconfidence prejudice that investors are exposed according to the socio-economic

and demographic groups they belong to. Hypothesis that are tested in the study within this scope are given below:

H_1 = There is a significant difference between male and female investors with regard to their trading volume.

H_2 = There is a significant difference between male and female investors with regard to their portfolio diversification.

H_3 = There is a significant difference between married and single investors with regard to their trading volume.

H_4 = There is a significant difference between married and single investors with regard to their portfolio diversification.

H_5 = There is a significant difference amongst investors from different monthly income groups with regard to their trading volume.

H_6 = There is a significant difference amongst investors from different monthly income groups with regard to their portfolio diversification.

H_7 = There is a significant difference amongst investors with different educational backgrounds with regard to their trading volume.

H_8 = There is a significant difference amongst investors with different educational backgrounds with regard to their portfolio diversification.

H_9 = There is a significant difference amongst investors from different age groups with regard to their trading volume.

H_{10} = There is a significant difference amongst investors from different age groups with regard to their portfolio diversification.

H_{11} = There is a significant difference amongst investors from different occupational groups with regard to their trading volume.

H_{12} = There is a significant difference amongst investors from different occupational groups with regard to their portfolio diversification.

4. Method of the study and data

Within the scope of the study, actual data in relation to the transactions of exchange of shares made by 100 individual investors in İMKB between 2 January 2009 and 3 December 2011 was used. Data that is acquired from the intermediary firm of a bank includes the gender, age, profession, marital status, level of education and monthly income of the investor as well as date and time, price, interest, day, amount and session contents related to the transactions of exchange of shares. While establishing the investors whose data would be included in the scope of the study, random sampling method has been used. The investors whose data was included in the scope of the study reside in different regions of Turkey. Information about the assets and financial knowledge levels of the investors couldn't be included in the study since the intermediary firm from which the data was acquired, and hence, it constituted a limitation for the study didn't demand them. Frequency and percentage distributions in relation to the sampling of the study are given in the table below. The tables below that haven't reached the total of 100 are related to the lack of information about the investors.

Table 1 - Sampling frequency and percentage distributions

Age	Frequency	Percentage Distribution	Gender	Frequency	Percentage Distribution
18-25	1	0,01	Female	16	0,16
26-39	27	0,27	Male	84	0,84
40-55	55	0,55	Total	100	100

Age	**Frequency**	**Percentage Distribution**	**Gender**	**Frequency**	**Percentage Distribution**
55-	17	0,17	**Marital Status**	**Frequency**	**Percentage Distribution**
Total	100	100	Married	73	0,73
Education	**Frequency**	**Percentage Distribution**	Single	15	0,15
Primary School	9	0,09	Not Specified	12	0,12
High School	21	0,21	Total	100	100
Undergraduate	43	0,43	**Profession**	**Frequency**	**Percentage Distribution**
Graduate	3	0,03	Unemployed	2	0,02
Not Specified	24	0,24	Worker	5	0,05
Total	100	100	Public Officer	7	0,07
Monthly Income Level	**Frequency**	**Percentage Distribution**	Self-employed	16	0,16
0-999 TL	28	0,28	Specialist	47	0,47
1.000 TL-2.499 TL	30	0,3	Housewife	3	0,03
2.500 TL-3999 TL	26	0,26	Retired	19	0,19

Within the scope of the study, with reference to the information acquired from the intermediary firm in relation to the transactions of exchange of shares, variables of trading volume and portfolio diversification levels are calculated and derived on a daily basis. The level of portfolio diversification refers to the number of shares present in the portfolio on the mentioned day. It is assumed that investors who make low portfolio diversification have a low risk perception. The trading volume, beside, refers to the total number of transactions of exchange made on the mentioned day. In a similar manner, it is assumed that investors whose risk perception decreases have increased trading volumes.

5. Findings and discussion

Determining whether there is difference in trading volume between male and female investors was analyzed by T-Test. According to the results of the analysis, a significant difference in trading volume between male and female investors was identified (Sig. 0,025; Sig. 2-tailed. 0,000). Hereunder, H_1 hypothesis that claims there is a significant difference in trading volume between male and female investors was verified. Statistics and test results in relation to the male and female investors are given in Table 2 and 3. According to these, female investors have higher trading volume than male investors.

Table 2 - The Difference in trading volume with regard to male and female investors

	Gender	**N**	**Average**	**Standard Deviation**	**Average of Standard Error**
Trading Volume	**Male**	2403	3,02	3,29	0,067
	Female	282	3,75	3,20	0,190

Table 3 - Test results of the difference in trading volume with regard to male and female investors

		LEVENE Test (for Equal Variances)		**T- test (for Equal Averages)**						
		F	Sig.	t	df	Sig. 2-Tailed	Average Differ.	Standard Error of the Differ.	Confidence Interval of the Differences %95	
									Low	High
Trading Volume	Equal Variance	5,023	0,025	-3,512	2683	0,000	-0,7258	0,20667	-1,1310	-,3205
	Unequal Variance			-3,588	354,339	0,000	-0,7258	0,20226	-1,1235	-,3280

Determining whether there is difference in portfolio diversification between male and female investors was analyzed by T-Test. According to the results of the analysis, a significant difference in portfolio diversification between male and female investors was identified (Sig. 0,000; Sig. 2-tailed. 0,000). Hereunder, H_2 hypothesis that claims there is a significant difference in portfolio diversification between male and female investors was verified. Statistics and test results in relation to the male and female investors are given in Table 4 and 5. According to these, female investors have higher portfolio diversification than male investors.

Table 4 - The difference in portfolio diversification with regard to male and female investors

	Gender	**N**	**Average**	**Standard Deviation**	**Average of Standard Error**
Portfolio Diversification	**Male**	2403	9,655	6,8685	0,1401
	Female	282	11,553	7,7592	0,4620

Table 5 - Test results of the difference in portfolio diversification with regard to male and female investors

		LEVENE Test (for Equal Variances)		**T-test (for Equal Averages)**						
		F	Sig.	t	df	Sig. 2-tailed	Average Differ	Standard Error of the Differ.	Confidence Interval of the Differences %95	
									Low	High
Portfolio Diversification	Equal Variance	44,047	0,000	-4,326	2683	0,00	-1,897	0,43856	-2,7573	-1,0373
	Unequal Variance			-3,930	334,726	0,00	-1,897	0,48283	-2,8471	-,9475

Determining whether there is difference in trading volume between married and single investors was analyzed by T-Test. According to the results of the analysis, a significant difference in trading volume between married and single investors was identified (Sig. 0,000; Sig. 2-tailed. 0,000). Hereunder, H_3 hypothesis that claims there are a significant difference in trading volume between married and single investors was verified. Statistics and test results in relation to the married and single investors are given in Table 6 and 7. According to these, single investors have higher trading volume than married investors.

Table 6 - The difference in trading volume with regard to single and married investors

	Marital Status	**N**	**Average**	**Standard Deviation**	**Average of Standard Error**
Trading Volume	**Married**	2348	3,013	3,1172	0,0643
	Single	337	3,750	4,2570	0,2318

Table 7 - Test results of the difference in trading volume with regard to single and married investors

		LEVENE Test (for Equal Variances)		T-test (for Equal Averages)						
		F	Sig.	t	df	Sig. 2-tailed	Average Differ.	Standard Error of the Differ.	Confidence Interval of the Differences % 95	
									Low	High
Trading Volume	Equal Variance	53,111	0,000	-3,858	2683	0,000	-0,7375	0,19117	-1,1123	-0,3626
	Unequal Variance			-3,065	389,377	0,000	-0,7375	0,24065	-1,2106	-0,2644

Determining whether there is difference in portfolio diversification between married and single investors was analyzed by T-Test. According to the results of the analysis, a significant difference in portfolio diversification between married and single investors was identified (Sig. 0,000; Sig. 2-tailed. 0,000). Hereunder, H_4 hypothesis that claims there are a significant difference in portfolio diversification between married and single investors was verified. Statistics and test results in relation to the married and single investors are given in Table 8 and 9. According to these, single investors have higher portfolio diversification than married investors.

Table 8 - The Difference In Levels of Portfolio Diversification With Regard To Single and Married Investors

	Marital Status	**N**	**Average**	**Standard Deviation**	**Average of Standard Error**
Portfolio Diversification	**Married**	2348	9,6303	6,8754	0,1418
	Single	337	11,4214	7,5699	0,4123

Table 9 - Test results of the difference in levels of portfolio diversification with regard to single and married investors

		LEVENE Test (For Equal Variances)		T-test (For Equal Averages)						
		F	Sig.	t	df	Sig. 2-tailed	Average Differ.	Standard Error of the Differ.	Confidence Interval of the Differences % 95	
									Low	High
Portfolio Diversification	Equal Variance	30,671	0,000	-4,414	2683	0,000	-1,7910	0,40579	-2,5867	-0,9953
	Unequal Variance			-4,107	419,433	0,000	-1,7910	0,43609	-2,6482	-0,9338

Determining whether there is difference in trading volume amongst investors from different monthly income groups was analyzed by One-way ANOVA test. According to the results of the analysis, H_5 hypothesis that claims there is a significant difference in trading volume amongst individual investors from different monthly income groups was verified (F=3,530; Sig. 0,014). Scheffe test results are shown in Table 10. According to this, investors with monthly income between 1.000- 2.500 TL have lower trading volume than the investors with a monthly income of 4.001 TL and above.

Table 10 - The differences in trading volume with regard to monthly income groups

(I) Monthly Income (TL)	(J) Monthly Income (TL)	Average Differ. (I-J)	Standard Error	Significance	%95 Confidence Interval	
					Low	**High**
1.000-2.500	4.001 and above	-0,4818	0,15587	0,023	-0,9178	-0,0458

Determining whether there is difference in levels of portfolio diversification amongst investors from different monthly income groups was analyzed by One-way ANOVA test. According to the results of the analysis, H_6 hypothesis that claims there is a significant difference in the levels of portfolio diversification amongst individual investors from different monthly income groups was verified (F=35,384; Sig. 0,000). Scheffe test results are shown in Table 11. According to this, the level of portfolio diversification of individual investors with a monthly income below 1.000 TL is lower than the ones with a monthly income between 1.000-2.499 TL and the ones with a monthly income above 4.000 TL. The fact that the investors from the lowest income group (0-999 TL) have significantly lower marginal propensity to save may be claimed to lead to this result. Assuming that the amount which investors having a monthly income between 0-999 TL reserve a small amount for investment, it is not expected for them to diversify their portfolio on a high level. On the other hand, the level of portfolio diversification of individual investors with a monthly income between 2.500-4.000 TL is lower than the ones with a monthly income between 1.000-2.499 TL and the ones with a monthly income above 4.000 TL.

Table 11 - The Differences in the levels of portfolio diversification with regard to monthly income groups

(I) Monthly Income (TL)	(J) Monthly Income(TL)	Average Differ. (I-J)	Standard Error	Significance	%95 Confidence Interval	
					Low	**High**
0-999	1.000-2.499	-6,7450	1,50997	0,000	-10,9688	-2,5212
0-999	4.001 and above	-6,4955	1,51895	0,000	-10,7444	-2,2466
1.000-2.499	2.500-4.000	2,8899	0,31808	0,000	2,0001	3,7796
2.500-4.000	4.001 and above	-2,6404	0,35831	0,000	-3,6427	-1,6381

Determining whether there is difference in trading volume amongst investors with different educational backgrounds was analyzed by One-way ANOVA test. According to the results of the analysis, H_7 hypothesis that claims there is a significant difference in trading volume amongst individual investors with different educational backgrounds was verified (F=18,854; Sig. 0,000). Scheffe test results are shown in Table 12. According to this, investors with a graduate degree has lower trading volume than the investors who are primary-school, high-school and college graduates. The trading volume of high school graduate investors is higher than the ones with an undergraduate degree. This situation can be explained with the assumption that the level of financial knowledge and understanding & evaluating the markets of the investors with a graduate degree are higher than any other group. The investors with a graduate degree may have intended not to make a lot of transactions in the research period in which volatility was high.

Table 12 - The differences in trading volume with regard to educational backgrounds

(I) Education	(J) Education	Average Differ (I-J)	Standard Error	Significance	%95 Confidence Interval	
					Low	**High**
Primary Sch.	Graduate	1,8201	0,46710	0,002	0,5134	3,1267
High School	Undergraduate	0,914	0,14614	0,000	0,5054	1,3230
High School	Graduate	1,9773	0,36000	0,000	0,9702	2,9843
Undergraduate	Graduate	1,0631	0,34643	0,024	0,0940	2,0321

Determining whether there is difference in the level of portfolio diversification amongst investors with different educational backgrounds was analyzed by One-way ANOVA test. According to the results of the analysis, H_8 hypothesis that claims there is a significant difference in the level of portfolio diversification amongst individual investors with different educational backgrounds was verified (F=41,720; Sig. 0,000). Scheffe test results are shown in Table 13. According to this, primary-school graduate investors have lower levels of portfolio diversification than that of high-school and college graduates and higher than that of investors with a graduate degree. On the other hand, high school graduate investors trading volume than the investors who are primary-school, high-school and college graduates. The level of portfolio diversification of high school graduate investors is higher than that of the investors with undergraduate and graduate degree. Finally, investors with an undergraduate degree have higher levels of portfolio diversification than that of the ones with a

graduate degree. Speaking in general, we can see that while the educational level increases the level of portfolio diversification decreases.

Table 13 - The differences in the levels of portfolio diversification with regard to educational backgrounds

(I) Education	(J) Education	Average Differ. (I-J)	Standard Error	Significance	%95 Confidence Interval	
					Low	**High**
Primary School	High School	-3,9711	0,72548	0,000	-6,0001	-1,9417
Primary School	Undergraduate	-2,3961	0,69577	0,008	-4,3424	-0,4499
Primary School	Graduate	3,8144	0,98016	0,002	1,0726	6,5561
High School	Undergraduate	1,5750	0,30665	0,000	0,7172	2,4327
High School	Graduate	7,7854	0,75542	0,000	5,6723	9,8985
Undergraduate	Graduate	6,2105	0,72694	0,000	4,1771	8,2439

Determining whether there is difference in trading volume amongst investors from different age groups was analyzed by One-way ANOVA test. According to the results of the analysis, H_9 hypothesis that claims there is a significant difference in trading volume amongst individual investors with different educational backgrounds was not verified (F=3,320; Sig. 0,054). Determining whether there is difference in the level of portfolio diversification amongst investors from different age groups was analyzed by One-way ANOVA test. According to the results of the analysis, H_{10} hypothesis that claims there is a significant difference in the level of portfolio diversification amongst individual investors from different age groups was verified (F=140,397; Sig. 0,000). Scheffe test results are shown in Table 14. According to this, investors from the age group that is between 26-39 has higher levels of portfolio diversification than the ones from the age group between 40-55 and lower than the ones from the age group of 56 and above. On the other hand, the level of portfolio diversification of the investors from the age group that is between 40-55 is higher lower than the ones from the age group of 56 and above. Generally speaking, as expected, as age increases, an increase in the level of portfolio diversification is observed.

Table 14 - The differences in the levels of portfolio diversification with regard to age groups

(I) Age	(J) Age	Average Differences (I-J)	Standard Error	Significance	**%95 Confidence Interval**	
					Low	**High**
26-39	40-55	2,9480	0,29842	0,000	2,217	3,678
26-39	56-	-2,6453	0,39286	0,000	-3,607	-1,683
40-55	56-	-5,5934	0,35427	0,000	-6,461	-4,725

Determining whether there is a difference in trading volume amongst investors from different occupational groups was analyzed by One-way ANOVA test. According to the results of the analysis, H_{11} hypothesis that claims there is a significant difference in trading volume amongst individual investors from different occupational groups was verified (F=37,587; Sig. 0,000). Scheffe test results are shown in Table 15. According to this, the trading volume of public officers is higher than that of specialists, self-employed people, workers and retired people. On the other hand, housewives' trading volume is higher than specialists, self-employed people, workers and retired people.

Table 15 - The differences in trading volume with regard to occupational groups

(I) Profession	(J) Profession	Average Differ. (I-J)	Standard Error	Significance	%95 Confidence Interval	
					Low	High
Specialist	Public Officer	-1,8972	0,19796	0,000	-2,556	-1,238
Specialist	Housewife	-2,2560	0,30920	0,000	-3,285	-1,226
Self-employed	Public Officer	-2,2827	0,26158	0,000	-3,153	-1,411
Self-employed	Housewife	-2,6415	0,35333	0,000	-3,818	-1,465

(I) Profession	(J) Profession	Average Differ. (I-J)	Standard Error	Significance	%95 Confidence Interval	
					Low	High
Worker	Public Officer	-2,9784	0,37156	0,000	-4,215	-1,741
Worker	Housewife	-3,3372	0,44099	0,000	-4,805	-1,868
Public Officer	Retired	2,4581	0,24485	0,000	1,642	3,273
Retired	Housewife	-2,8169	0,34113	0,000	-3,952	-1,681

Finally, determining whether there is difference in the level of portfolio diversification amongst investors from different occupational groups was analyzed by One-way ANOVA test. According to the results of the analysis, H_{12} hypothesis that claims there is a significant difference in the level of portfolio diversification amongst individual investors from different occupational groups was verified (F=127,676; Sig. 0,000). Scheffe test results are shown in Table 16.

Table 16 - The differences in the levels of portfolio diversification with regard to occupational groups

(I) Profession	(J) Profession	Average Differ. (I-J)	Standard Error	Significance	%95 Confidence Interval	
					Low	**High**
Specialist	Self-employed	3,4582	0,40784	0,000	2,100	4,816
Specialist	Worker	5,3077	0,66178	0,000	3,104	7,511
Specialist	Public Officer	-5,9543	0,39097	0,000	-7,256	-4,652
Specialist	Retired	-2,1080	0,36508	0,000	-3,323	-0,8924
Specialist	Housewife	-8,4407	0,61068	0,000	-10,474	-6,407
Self-employed	Public Officer	-9,4125	0,51662	0,000	-11,132	-7,692
Self-employed	Retired	-5,5662	0,49732	0,000	-7,222	-3,910
Self-employed	Housewife	-11,8988	0,69783	0,000	-14,222	-9,575
Worker	Public Officer	-11,2620	0,73383	0,000	-13,705	-8,818
Worker	Retired	-7,4157	0,72038	0,000	-9,814	-5,017
Worker	Housewife	-13,7484	0,87097	0,000	-16,648	-10,848
Public Officer	Retired	3,8463	0,48358	0,000	2,236	5,456
Public Officer	Housewife	-2,4863	0,68811	0,023	-4,777	-0,195
Retired	Housewife	-6,3326	0,67373	0,000	-8,576	-4,089

According to this, the levels of portfolio diversification of the investors from an occupational group which requires specialty such as doctor, engineer, and academician are higher than self-employed people or workers, and lower than public officers, retired people and housewives. On the other hand, self-employed people and workers diversify their portfolio on a level lower than public officers, retired people and housewives. When looked at the level of portfolio diversification of public officers, we observe that it is higher than retired people and lower than housewives. Finally, retired people are demonstrated to have lower levels of portfolio diversification than housewives.

Conclusion

In their study, Akerlof and Shiller (2009) investigate how confidence affects economies, in what ways the low level of confidence in individuals and corporations during financial depression periods should be increased and the relationship between financial crisis and confidence. The scarcity of confidence in economic individuals and corporations affect economy in a negative way, while overconfidence is capable of disappointing both individuals and corporations in obtaining the results expected from them. Overconfidence leads to individuals overrating their competence and knowledge. This situation may result in the individuals as making wrong evaluations, having extreme expectations, making decisions that may have risky results and encountering the opposite of the expectation. For instance; a lot of researches such as Odean (1998), Barber and Odean (2001)

confirmed that the investors who act with the bias of overconfidence encounter the opposite of their intention to obtain more income. Bias of overconfidence will probably not make the investors rich. This fact is stated very effectively by Gervais and Odean (2001) as follows: "Overconfidence does not make traders wealthy, but process of becoming wealthy can make traders overconfident." Varşous researches such as Neale and Bazerman (1985), Camerer and Lovallo (1999), Scheinkman and Xiong (2003) blame overconfidence as a cause for labor strikes, litigation, price bubbles and financial crisis. Peterson (2004), Green and Watcher (2005) and Crough *et al.* (2008) mention the negative effects of the overconfidence in corporations to economy. What should be done at this point is to preclude the actions of low or overconfidence and instead, to establish a balanced confidence required for both individuals and corporations.

In this study, whether there is a difference in individuals' financial investments as per their demographic characteristics with regard to being under the influence of the bias of overconfidence was tried to be identified. According to the results, it was observed that in terms of both trading volume and portfolio diversification; the occupation, level of education and income, marital status and gender of the investors differed in the exposure of overconfidence bias. On the other hand, no differentiation in the ages of the investors was observed as per trading volume in being exposed to overconfidence bias, however, it was observed in portfolio diversification.

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THE CAUSAL RELATIONSHIPS AMONG CORRUPTION, POLITICAL INSTABILITY, ECONOMIC DEVELOPMENT AND FOREIGN AID: EVIDENCE FROM THE ECONOMIC COMMUNITY OF WEST AFRICAN STATES

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Abstract:

Although the determinants and impacts of economic development, corruption, political instability and aid have been investigated, little has been done to examine the causal relationships among them. This paper investigates the causal relationships among economic development, corruption, political instability and aid in the Economic Community of West African States (ECOWAS) from 1999 to 2012, using several techniques that include the granger causality test within a multivariate cointegration and error-correction framework, and forecast error variance decomposition and impulse response function analyses.

The results of the analyses indicate there is a short-run positive unidirectional causality from political instability to aid and a negative unidirectional causality from political instability to economic development; a long-run positive unidirectional causality from political instability to corruption and a negative unidirectional causality from political instability to economic development; a long-run positive unidirectional causality from aid to corruption and a negative unidirectional causality from aid to economic development; including a long-run positive bidirectional causality between economic development and corruption in ECOWAS countries. Thus, policies that promote political stability would foster economic development, lower corruption and reduce the reliance on aid; policies that lessen the reliance on aid would reduce corruption and promote economic development; and policies that reduce corruption would enhance economic development which in turn leads to lower corruption in the long-run in the region.

Keywords: corruption, political instability, economic development, foreign aid, ECOWAS.

JEL Classification: E21

1. Introduction

Although most countries that are less developed, very corrupt and politically unstable rely on foreign assistance (or aid), the foreign aid system tends to have some impacts on the levels of economic development and corruption, including the political conditions in countries receiving aid. Moreover, it is usually not easy to separate the effects of economic problems, political instability, and civil wars from the effects of foreign aid (Brautigam & Knack 2004).

The savings gap model predicts that aid compliments domestic savings, increases the rate of capital formation and the fraction of income saved, and enhances a country's capacity to grow (Griffin 1970). This view was echoed earlier by Chenery and Strout (1966) that aid reduces the savings and trade gap and as a result promotes economic growth. Other ways by which aid can contribute to the receiving country's economy include strengthening of domestic institutions, payment of high salaries to civil servants, giving training and technical assistance to the judiciary and accounting offices, and the management of strategic government programs (Brautigam & Knack 2004).

But many have questioned the importance of aid or external finance in developing countries (see Bauer 1971; Griffin & Enos 1970; Gulati 1978; Stoneman 1975; Weisskopf 1972). Toeing the path of Bauer (1971), Wright and Winters (2010) argued that aid slows down political development by contributing to the development of bad institutions in the aid recipient-countries. Griffin and Enos (1970) suggested that donor-countries give aid to poor countries base on the political support/alignment of recipients to donors. Thus, in giving aid, donors consider their national interest rather than the needs, potentials, economic performance, or the virtue of poor countries. For instance,

it has been argued that the United States leading role in aid donation in East Asia is not unconnected with her fight against communism (Fritz & Menocal 2007). Another argument against foreign capital is that it hurts the host country's economy by suppressing domestic savings and encouraging consumption, rather than promoting investment in productive assets (Adelegan 2000; Griffin & Enos 1970; Stoneman 1975; Weisskopf 1972).

Additionally, aid can lead to the growth of public sector and increase spending on defence and police (Griffin, 1970; Gulati, 1978), and as a result lead to political instability. For instance, if the leadership uses the arms acquired and the police to suppress the press and those who seek for accountability and transparency in government, it will encourage political crisis. The inconsistencies of donors have also been blamed for fuelling political crisis in developing countries. Even though donors claim to promote democracy and good governance in aid-dependent countries, they have also been inconsistent in promoting ideal democratic practices. A case at hand is, while donors increased aid to Paul Biya for stealing presidential elections in Cameroon in 1992 including autocratic regimes headed by Gnassingbé Eyadéma in Togo and Mobutu in Zaire, Benin which was democratizing had its aid reduced (Englebert & Tull 2008). It is not surprising therefore, that these crop of leaders held on to power for years through unconstitutional means, and in the process bred political crises in their respective countries. Where people's votes do not count, leaders rarely see themselves as been accountable and responsible to the electorate. Also, aid can encourage coup and political instability, particularly if people place a high value on the control of the government and aid receipts (Grossman, 1992; Knack 2004).

The tendency of incumbents (Presidents or Head of States) to hold to power via unlawful means explains why many leaders in aid-dependent countries are very corrupt. Also, Fritz and Menocal (2007) opined that aid can promote rent-seeking or corruption among government officials if it is seen as a windfall. However, Tavares (2003) pointed out that aid can reduce corruption if it is associated with rules and conditions that limit the discretion of public officials of the recipient (conditionality effect). In addition, aid can reduce corruption if it cushions the shortfalls in government revenue and lead to increases in the salaries of government employees (liquidity effect).

Interestingly, aid allocation can be affected by the receiving country's levels of economic development (or income level), corruption and political conditions. For instance, Chauvet (2002) opined that political factors play important role in the allocation of aid by donors. Given that most donors-countries are democratic states, they encourage their former colonies and countries with weak political structures to embrace democracy by strengthening their political and democratic institutions. Therefore, countries that are democratizing are likely to be given more aid.

A country's level of economic development also influences aid allocation. All things being equal, most donors allocate more aid to poorer or least developed countries (Alesina & Dollar 2000), in order to raise their welfare. This view has been supported by Chauvet (2002) and Neumayer (2003b). Furthermore, aid allocation is also dependent on a country's level of corruption. Donors usually advice the leadership in poor countries to reduce public sector corruption, that has been found to be a major obstacle to economic development, to be eligible for assistance. Therefore, countries with improved and quality governance (or less corruption) are likely to receive more aid. On the other hand, donors may give more aid to countries where the level of corruption is high, to enable them invest in the fight against corruption (Alesina & Weder 2002). For example, donors can help establish anti-corruption agencies/bodies including training officials saddled with the responsibility of investigating, arresting and prosecuting offenders.

Besides, economic development, political factors and the level of corruption tend to re-enforce one another. For instance, Abu *et al.* (2015) argued that the levels of corruption and economic development, and political instability are interrelated in developing countries. Interestingly, researchers have established a connection between political factors and corruption (Claderon & Chong 2007; Mbaku & Paul 1989; Montinola & Jackman 2002), political instability and economic growth/development (Aisen & Veiga 2013; Alesina *et al.* 1996; Asteriou & Price 2001; Fosu 2002a, 2002b), as well as corruption and economic growth/development (Anoruo & Braha 2005; Bentzen 2012; Mauro 1995).

Available information indicates that most Economic Community of West African States (ECOWAS) countries are less developed, very corrupt and politically unstable (Abu *et al.* 2015). For instance, the Transparency International (TI) report for various years illustrate that the corruption

perception index (CPI) of ECOWAS countries (except Cape Verde) has consistently been less than 5 (out of a maximum of 10). Moreover, many ECOWAS countries ranked below 100 on the TI rankings for several years. These suggest that almost all the countries are very corrupt. Similarly, the Political Risk Service International Country Risk Guide (ICRG) report over the years show that the political risk rating (PRR) of most ECOWAS countries is less than 60%, indicating that the countries are facing serious political crisis. In the same manner, this group of countries has relied heavily on aid, as the share of aid (overseas development assistance) in government expenditure ranged from 27% in Togo to 54% in Senegal, 58% in Niger, up to 67% in Cape Verde and Guinea Bissau (Brautigam & Knack 2004).

Despite the abundant research on corruption, political instability, economic development and aid, researchers have not paid adequate attention to the issue of causality among the variables particularly in the ECOWAS region. Although the recent study by Abu *et al.* (2015) emphasized the importance of examining causality among corruption, political instability and economic development in the ECOWAS, the authors did not consider foreign aid in their analysis. This paper extends their work by assessing the casual relationships among corruption, political instability, economic development and aid in the region.

An examination of causal relationship is very important because it provides an insight on the variable policy makers need to control to achieve the desired levels of the target variable. For instance, if the causality test results demonstrate that it is aid that causes corruption/political instability, then policy makers can design policies to lessen the corruption/political instability effects of aid. In the same vein, if the results suggest that corruption/political instability precedes economic development, policy makers can employ policies to curb corruption or reduce political crisis in order to attain higher levels of economic development, and so on. To our knowledge, this is the first attempt to study the causal relationships among the four variables particularly in the ECOWAS. Following the introduction, section two is the literature review. The theoretical framework comes up in section three, while section four is for data analysis and discussion. Section five concludes the paper.

2. Literature review

Researchers have examined the connection between two or three of corruption, political instability, economic growth/development and aid. For instance, there are ample studies on the relationship between corruption and economic growth/development. For instance, Mauro (1995) employed ordinary least squares (OLS) and two stage least squares (TSLS) methods to examine the relationship between corruption and economic growth across countries. The authors' findings suggest that corruption lowers economic growth. Bentzen (2012) assessed the impact of corruption on economic development (gross domestic product per capita) in a sample of countries, using the instrumental variable (IV) estimation technique. The author discovered that corruption has a strong negative effect on economic development. Gyimah-Brempong (2002) used a dynamic panel estimator to examine the impact of corruption on economic growth and income distribution in African countries. The results demonstrate that corruption lowers economic growth directly and indirectly through lowering investment in physical capital. Anoruo and Braha (2005) employed the fully modified OLS (FMOLS) to examine the impact of corruption on economic growth in a group consisting of 18 African countries. The results show that corruption reduces economic growth directly by reducing productivity, and indirectly by hindering investment. Brautigam and Knack (2004) found that high GDP per capita is associated with improvement in quality of governance in Sub-Saharan Africa (SSA).

Also, scholars have investigated the association between political instability and economic growth/development. Asteriou and Price (2001) used GARCH-M models to test the effect of political instability on growth in the United Kingdom from 1961 to 1997. The results indicate that political instability has a significant negative impact on economic growth. Aisen and Veiga (2013) employed the system-GMM technique to examine the impact of political instability on economic growth in 169 countries from 1960 to 2004. The results demonstrate that higher political instability leads to declines in growth rates of GDP per capita. Alesina and Perotti (1996) investigated the relationship between income distribution, political instability and investment in 71 countries from 1960 to 1985. The authors' findings suggest that political instability decreases economic growth by lowering investment. Alesina *et al.* (1996) evaluated the relationship between political instability and GDP per capita

growth in 113 countries from 1950 to 1982, using a simultaneous equation approach. The results illustrate that higher degree of political instability (measured by a high propensity of government collapse) lowers economic growth. Gyimah-Brempong and Dapaah (1996) used a simultaneous equation model to examine the effects of non-elite political instability on economic growth in SSA. The results demonstrate that political instability has a significant negative influence on economic growth. Adelman and Morris (1968) estimated an econometric model of socio-economic and political change in underdeveloped countries. The authors confirmed that higher growth contributes the political stability via reducing political discontent and unrest in developing societies. They also discovered that higher political stability fosters economic performance. Other studies that found a significant impact of political instability on growth particularly in Africa include Fosu (2002a, 2002b) and Mbaku (1988).

Moreover, the empirical relationship between political factors and corruption has been investigated. For instance, Schumacher (2013) found that higher degree of democracy (measured by an improvement in electoral accountability) leads to a decline in bribery. Mbaku and Paul (1989) tested the rent-seeking theory of political instability for Africa, using a simple model. The results of their analysis support the claim that government-created rents act as an engine of political destabilization in Africa. Claderon and Chong (2007) analyzed the causality between rent-seeking behaviour and democracy in Uruguay, using the VAR approach and granger causality tests. The results suggest that higher democratic quality reduces rent-seeking. Montinola and Jackman (2002) confirmed that corruption is lower in dictatorships regime compare to partially democratized countries, and higher degree of democracy lowers corruption. Brautigam and Knack (2004) found that political violence is associated with poor governance in SSA.

Furthermore, scholars have examined the relationship between aid and corruption. Tavares (2003) employed OLS and IV techniques to assess the effect of aid on corruption in 11 OECD countries, including a sample of countries selected from SSA, East Asia and Latin America. The results demonstrate that aid lowers corruption. Brautigam and Knack (2004) examined if aid affect the quality of governance in SSA, using both OLS and TSLS methods. The results reveal that higher aid levels are associated with deterioration in governance. Svensson (2000) investigated if aid is associated with rent-seeking in a sample of countries, using the IV approach. The results indicate that aid is associated with higher levels of corruption in countries where there is a high likelihood of competing social groups. In addition, the author failed to find any evidence that donor-countries systematically allocate aid to countries with lower level of corruption. Neumayer (2003a) failed to find evidence that countries with less corruption are rewarded with higher aid. Knack (2001) analyzed the impact of aid dependency on quality of governance using cross-country data. The author found that higher aid leads to lesser quality of governance (captured by indices of bureaucratic quality, corruption, and the rule of law). Alesina and Weder (2002) examined if corrupt governments receive lesser aid across countries. The authors discovered that more corrupt governments receive higher aid. In addition, Scandinavian donors seem to give more aid to less corrupt countries, while the United States gives preference to democratic governments and pays little attention to the quality of governance in receiving countries.

Authors have also examined aid and political system relationship. For instance, Knack (2004) did a multivariate analysis of the effect of aid on democratization across countries from 1975 to 2000. The results illustrate that aid does not foster democratization. Neumayer (2003a) found that higher democracy (measured by political freedom) leads to higher aid receipts. Chauvet (2002) investigated the effects of socio-political instability (measured by elite instability, violent and social instability) on aid allocation by donors, using the TSLS approach with fixed effects. The results reveal that both violent and elite instability have a positive effect on aid allocation. Svensson (1999) evaluated the impact of aid on democracy and economic growth across countries using several estimation methods. The author did not find any evidence that aid is channeled to more democratic countries. Dollar and Levin (2006) found that aid has a positive relationship with democracy. Wall (1995) discovered an insignificant relationship between aid and political variables. Wright (2009) empirically tested if aid foster or hinder democratization in 101 countries from 1960 to 2002. The authors found that aid to a single-party regime increases the likelihood of democratization, while aid to military regimes reduces the probability of democratization. Frey and Schneider (1986) discovered that politically stable countries receive more aid from the 1970s through 1980s. Nielsen *et al.* (2011) examined the

connection between aid shocks (severe decreases in aid revenues) and violent armed conflicts, using a comprehensive dataset of bilateral and multilateral aid from1981 to 2005. The results indicate that negative aid shocks increase armed conflicts. Alesina and Dollar (2000) found that countries that democratize receive more aid. Gang and Lehman (1990) discovered that political instability has no effect on aid allocation.

Besides, researchers have evaluated the relationship between aid and economic growth/development. Dowling and Hiemenz (1985) employed cross-section and pooled regressions to investigate the pattern of both bilateral and multilateral aid allocations during the 1970s for a sample of 90 countries. Their findings suggest that low-income countries receive more aid per capita compared to middle-income countries. Gang and Lehman (1990) confirmed that GDP per capita has a negative impact on aid allocation in Latin American countries. Wall (1995) found a negative correlation between income per capita and aid. Alesina and Dollar (2000) studied the pattern of aid allocation by donors to aid recipients. They found that aid allocation is significantly affected by economic needs of the recipients. Burnside and Dollar (2000) investigated the relationships between aid, economic policies, and growth of GDP per capita. They discovered that aid has a positive impact on growth in developing countries with good policies (such as fiscal, monetary, and trade policies), while the influence is marginal in the presence of poor policies. Neumayer (2003b) confirmed that poorer countries (with low income level) receive more aid. Chauvet (2002) found that low-income countries receive more multilateral aid. Guillaumont and Chauvet (2001) discovered that countries that face a difficult environment or more vulnerable countries are likely to receive more aid. Gulati (1973) failed to find a significant correlation between aid and growth, while Gulati (1978) found a positive correlation between aid and income growth in less developed countries. Griffin and Enos (1970) observed an inverse relationship between the average rate of growth of GNP and aid-GNP ratio in Latin American countries.

Looking at the literature, it is evident that researchers have not paid attention to the issue of causality among corruption, political instability, economic development and aid particularly in the ECOWAS. Thus, this study extends the literature by examining the causal relationships among the variables in the region.

3. Theoretical framework

In building our model, we borrow the ideas of Shleifer and Vishny (1993), Mauro (1995, 2004) and Park (2003). For instance, Mauro (1995) presented a scenario where an individual politician sets a high bribe rate. The resultant widespread corruption leads to poor economic performance and collapse of the government through revolutions and coups (Mauro 2004). On his part, Le Billon (2003) suggested that increasing violent kinds of competitive corruption among different groups that engage in corruption can lead to armed conflicts. Assuming that government officials saddled with the responsibility of disbursing funds meant for the provision of basic amenities divert such funds for personal use, it will further raise the inequality and poverty level of the people. As corruption persists, it leads to discontent, prompting protests and strikes, and eventually the collapse of (change in) government. Whereas change in government is done through electioneering process (Gyimah-Brempong & Dapaah 1996) and in line with constitutional provisions in developed countries, it often takes unconstitutional means (such as military takeovers) in ECOWAS countries (Abu *et al.* 2013). In fact, successive military regimes in the ECOWAS alluded to corruption as one of the reasons for seizing power (Edi 2006).

On the other hand, Shleifer and Vishny (1993) suggested that if public office holders are uncertain they will complete their term in office (as a results of instability in the polity), they would resort to irresponsible act such as rent-seeking. In the same vein, Park (2003) argued that higher uncertainty resulting from political instability would induce government officials to acquire wealth via corrupt practices so as to maintain their social status even after they are out of job. In explaining the role of corruption in fuelling war, Le Billon (2003) mentioned that if elections are rigged, both the ruling class and opposition may resort to violence to emphasize or defend their position.

Moreover, Mauro (1995) pointed out that low-income (poor) countries tend to be more corrupt and politically unstable. This suggests that low-incomes can force individuals to indulge in corrupt activities to raise their socio-economic welfare, in addition to promoting political instability (Abu *et al.* 2015). Fortunately, it has been argued that high incomes tend to reduce corruption (Montinola &

Jackman 2002; Schumacher 2013; Van Rijckeghem & Weder 2001), as well as promoting political stability (Adelman & Morris 1968; Helliwell 1994). Furthermore, corruption and political instability undermine an economy's development through among other things, their effects on savings, investment and production (Abu *et al.* 2015).

As stated earlier, aid seems to be theoretically linked to the levels of corruption, political instability, and economic development. For instance, aid or external finance can hurt an economy by reducing domestic savings and encouraging consumption, rather than promoting investment in the recipient country (Adelegan 2000; Griffin & Enos 1970). While some studies demonstrate that foreign capital impedes economic growth (Weisskopf 1972; Stoneman 1975), others indicate aid leads to higher growth (Burnside & Dollar, 2000).

Also, aid can promote democracy through technical assistance in electoral processes, strengthening of legislatures and judiciaries, encouraging civil society organizations and a free press, promoting education and raising incomes levels (Knack, 2004). On the other hand, aid can fuel political crisis in the recipient country by promoting the growth of public sector, including increasing defence and police expenditures (Griffin, 1970; Gulati, 1978). Consequently, the leadership can use the ammunitions and state police to suppress the press and those who seek for accountability and transparency in government. In the same vein, aid can promote coup and political instability, if people place a high value on the control of the government and aid receipts (Grossman, 1992; Knack, 2004).

More so, aid can reduce corruption through conditionality and liquidity effects (Tavares, 2003). The conditionality effect entails that aid is associated with rules and conditions which limit the discretion of government officials in the receiving country, while the liquidity effect implies that aid reduces corruption through cushioning the shortfalls in government revenue as well as increasing the salaries of government employees. But Fritz and Menocal (2007) argued that aid can encourage corruption among government officials if it is seen as a windfall.

By the same token, aid allocation can be affected by the levels of economic development and corruption, and political conditions in the receiving country. For instance, political factors have been found to have a significant impact on aid allocation by donors (Chauvet 2002). Also, studies have shown that more corrupt governments receive more aid (Alesina & Weder 2002), while less corrupt countries receive lower aid (Neumayer 2003a). Furthermore, aid-recipient's level of economic development has some influence on aid allocation (Chauvet 2002, Neumayer 2003b). Thus, it seems that corruption, political instability, economic development and aid cause one another.

4. Data analysis and discussion

The data used in this study were collected from three main sources as follows. The Corruption index (CPI) was obtained from the TI, political instability index (PRR) from the ICRG, and foreign aid and economic development from the World Development Indicators. The variables are defined and/or measured as follows. Political instability has been measured by the number of successful coups, number of people killed in domestic mass violence as a fraction of total population, number of attempted but unsuccessful coups, or the number of politically motivated assassinations (Alesina & Perotti 1996). But such (rich) data is not readily available for ECOWAS countries for a considerable number of years. Therefore, political instability is proxied by the PRR. The PRR ranges from 0% (very high political risk) to 100% (very low political risk), and its components include military in politics, political terrorism, political leadership, civil war, organized religion in politics, racial and national tension, law and order, political party development and external conflicts. The PRR has been employed in recent empirical studies (see Abu *et al.* 2013, 2015; Hayakawa *et al.* 2013), and has been found to be highly correlated with macroeconomic variables.

Also, it is usually not easy to measure corruption, and people's perception about corruption varies from one society to another. Moreover, since most corrupt activities are done in secrecy because they are considered unlawful, it is difficult to measure them. Furthermore, the objective measure of corruption (such as the number of individuals convicted for engaging in corrupt act) has been criticised on several grounds. For instance, Lambsdorff (1999, 2006) mentioned that the high level of conviction in Singapore and Hong Kong does not imply that corruption is high in those countries, but instead suggest that the judiciary and anti-corruption bodies are very efficient in detecting and prosecuting corrupt individuals. Given the shortcomings of the objective measure, corruption perception indices (subjective data) are frequently used. Similarly, Gyimah-Brempong (2002)

contended that, due to inadequate measurements of corruption, one can use the corruption perception indices. To this end, we employed the CPI. The index ranges from 0 (very corrupt) to 10 (very clean), and has been used in recent studies (Abu *et al.* 2015; Blackburn *et al.* 2010; Gyimah-Brempong 2002; Swaleheen 2007). The reliability of the CPI cannot be questioned as it has been found to be highly correlated with economic variables (Blackburn *et al.* 2010).

Economic development is proxied by GDP per capita which has been employed in recent studies (see Abu *et al.* 2015; Bentzen 2012). Aid is measured as the share of net official development assistance received in GNI. It is important to mention that 13 ECOWAS countries were considered is this study due to unavailability of data on PRR for two countries (Benin and Cape Verde). The study covers the period 1999-2012. Also, due to missing data on certain variables such as the CPI for some years in some countries, we are left with an unbalanced data.

4.1 Unit root tests

Prior to estimating our relationships, we performed unit root tests to ascertain the stationarity properties of the variables. The tests are important because they guard against the generation of meaningless results. Granger and Newbold (1974) and Phillips (1986) suggested that regression results generated using non-stationary series would be spurious. The Fisher-Augmented Dickey Fuller (Fisher-ADF) and Fisher-Phillips Perron (Fisher-PP) statistics were employed to conduct the unit root test. The unit root test results reported in Table 1 indicate that the series have a unit root at level, while they turned out stationary after first differencing. This lends support to the view that many macroeconomic variables are non-stationary at their level, but become stationary after their first differencing (Nelson & Plosser 1982).

Table 1 - Results of panel unit root tests (with intercept)

Variables	Fisher-ADF		Fisher-PP	
	Level	1st diff.	Level	1st diff.
LnCOR	-0.0718 (0.4714)	-3.0180*** (0.0013)	1.9802 (0.9762)	-3.6313*** (0.0000)
LnPOL	0.5436 (0.7067)	-4.3285*** (0.0000)	-0.2329 (0.4079)	-7.4548*** (0.0000)
LnGDP	1.6408 (0.9496)	-3.9291*** (0.0000)	4.6867 (0.9999)	-7.6076*** (0.0000)
LnAID	-1.0941 (0.1369)	-5.5767*** (0.0000)	-1.5471 (0.0609)	-9.7276*** (0.0000)

Note: Numbers in parenthesis are probability values. *** indicates a rejection of the null hypothesis of unit root at 1% significance level.

4.2 Cointegration tests

Given that the series are stationary at first difference, we proceeded to examine if they are cointegrated or have a long-run relationship. If the results reveal that the series are cointegrated, it implies that the estimated relationships would be free from spuriousness. Furthermore, the presence of cointegration suggests that causality would exist in at least one direction (Granger 1986). To achieve this objective, we employed the Pedroni residual cointegration test (Pedroni 1997, 1999). The results reported in Table 2 demonstrate that the variables have a cointegrating relationship.

Table 2 - Results of Pedroni residual cointegration tests

Statistics (Within-dimension)	Value
Panel v-statistic	-0.3934
Panel rho-statistic	1.1289
Panel PP-statistic	-2.9360***
Panel ADF-statistic	-2.2981**
Statistics (Between-dimension)	**Value**
Group rho-statistic	2.7512
Group PP-statistic	-8.8574***
Group ADF-statistic	-4.8261***

Note: ** and *** indicate a rejection of the null hypothesis of no cointegration at 5% and 1% significance level, respectively.

4.3 Granger causality tests

Having established that the variables are cointegrated, we moved on to examine the direction of causality among them. According to Granger (1969), variable 'X' is said to granger cause another variable 'Y', if Y is better predicted by the lagged values of X than by not doing so with the lagged values of Y in the reverse case. Our task here is to investigate if the current values of each dependent variable can be predicted by lagged values of the explanatory variables. To this end, the multivariate vector error-correction model (VECM) was employed to conduct the Granger causality tests. In the VECM, each of corruption (COR), political instability (POL), economic development (GDP) and foreign aid (AID) is specified as a function of the other variables as follows.

$$\Delta LnCOR_{it} = \alpha_0 + \sum_{j=1}^{J} \alpha_1 \Delta LnPOL_{it-j} + \sum_{i=1}^{J} \alpha_2 \Delta LnGDP_{it-j} + \sum_{i=1}^{J} \alpha_3 \Delta LnAID_{it-j} + \sum_{i=1}^{J} \alpha_4 \Delta LnCOR_{it-j} + \phi_1 ECT_{t-1} + U_{1it} \quad (4.1)$$

$$\Delta LnPOL_{it} = \beta_0 + \sum_{i=1}^{J} \beta_1 \Delta LnCOR_{it-j} + \sum_{i=1}^{J} \beta_2 \Delta LnGDP_{it-j} + \sum_{i=1}^{J} \beta_3 \Delta LnAID_{it-j} + \sum_{i=1}^{J} \beta_4 \Delta LnPOL_{it-j} + \phi_2 ECT_{t-1} + U_{2it} \quad (4.2)$$

$$\Delta LnGDP_{it} = \delta_0 + \sum_{i=1}^{J} \delta_1 \Delta LnCOR_{it-j} + \sum_{i=1}^{J} \delta_2 \Delta LnPOL_{it-j} + \sum_{i=1}^{J} \delta_3 \Delta LnAID_{it-j} + \sum_{i=1}^{J} \delta_4 \Delta LnGDP_{it-j} + \phi_3 ECT_{t-1} + U_{3it} \quad (4.3)$$

$$\Delta LnAID_{it} = \lambda_0 + \sum_{i=1}^{J} \lambda_1 \Delta LnCOR_{it-j} + \sum_{i=1}^{J} \lambda_2 \Delta LnPOL_{it-j} + \sum_{i=1}^{J} \lambda_3 \Delta LnGDP_{it-j} + \sum_{i=1}^{J} \lambda_4 \Delta LnAID_{it-j} + \phi_4 ECT_{t-1} + U_{4it} \quad (4.4)$$

where: Ln is the log of the variables; Δ is the first difference operator; U the residuals; ECT_{t-1} is the one period lagged of the error-correction term; and the t-statistic of the ECT_{t-1} is used to determine the long-run causality.

The statistical significance of each explanatory variable's coefficients is measured using the Wald test. The coefficients are restricted to a common value. Thus, if the common value of the coefficients of a particular explanatory variable (in the equation of interest) is found to be statistically significant, then it can be concluded that the variable causes the dependent variable and vice versa.

Prior to conducting the causality test, we used the lag order selection criteria to choose the appropriate lag length. The various criteria including Akaike information criterion (-4.0889), Schwarz criterion (-3.4801) and Hannan-Quinn information criterion (-3.8454) indicate that the optimum lag length is 1. The results of Granger causality tests reported in Table 3 illustrate that there is a short-run unidirectional causality from political instability to economic development and aid; there is a long-run unidirectional causality from political instability, economic development and aid to corruption; and there is a long-run unidirectional causality from corruption, political instability and aid to economic development in the ECOWAS.

Table 3 - Results of Granger causality tests

	Independent variables				
Dependent variab.	**$\Delta LnCOR_{it}$**	**$\Delta LnPOL_{it}$**	**$\Delta LnGDP_{it}$**	**$\Delta LnAID_{it}$**	**ECT_{t-1}**
$\Delta LnCOR_{it}$	-	3.2274	1.5470	2.5634	-0.1296*** [-3.2254]
$\Delta LnPOL_{it}$	1.5056	-	0.8174	1.8984	-0.0160 [-0.8723]
$\Delta LnGDP_{it}$	2.7389	8.3783**	-	1.8458	-0.1438*** [-3.2574]
$\Delta LnAID_{it}$	0.6656	8.3106**	0.9103	-	-0.3261 [-1.7534]

Note: ** and *** indicate a rejection of the null hypothesis of no causality at 5% and 1% significance level, respectively; and t-statistics are in parenthesis.

4.4 Forecast error variance decomposition and impulse response analyses

The Granger causality analysis conducted above is limited to 1999-2012, but it does not consider the dynamic interaction of the variables beyond the sample period. Also, causality tests reveal the direction of causality among the variables only, and do not indicate if the sign of the relationship is positive or negative. Moreover, the tests are not able to illustrate how long the impacts require to take place in a system. In order to understand the dynamic relationships among corruption, political instability, economic development and aid beyond the sample period (that is, 1999-2012), we conducted the forecast error variance decomposition and impulse response function analyses (Sims 1980). The forecast error variance decomposition (FEVD) is useful in ascertaining the relative strength of random shock in the system. Sims (1980) argued that if a variable is actually exogenous, its variance can only be explained by its own shock only. The FEVD tells us the amount of variations in a variable that is caused by its own shock including shocks to other variables in the system. In the short-term, a higher percentage of the variation in a variable is caused to its own shock, but in the long-term the impact of shocks to other variables increases. In computing the variance decomposition, each variable in the system is disturbed with a one standard deviation. On the other hand, the impulse response function analysis (IRF) is used to trace out each variable's response to a shock to the other variables in the system.

The results of the FEVD of corruption, political instability, economic development and aid to a one standard deviation shock in corruption, political instability, economic development and aid over the 10 years period are reported in Table 4. The results of the FEVD illustrate that economic development is the most exogenous variable, followed by corruption, political instability and aid. For instance, 96.0%, 95.7%, 92.5% and 63.8% of the variations in the error variance for economic development, corruption, political instability and aid, is explained by its own shock, respectively, in the second year. In explaining the shocks to corruption, economic development is more important than aid and political instability in the short-run, while aid and political instability are more important than economic development in the long-run. For instance, economic development, political instability and aid account for 3.02%, 1.02% and 0.30% variations in corruption, respectively, in the second year. But aid, political instability and economic development explain 9.71%, 8.39% and 3.50% variations in corruption, respectively in the tenth year.

Moreover, corruption is more important followed by aid and economic development in explaining the shocks to political instability in the short-run and long-run. For instance, corruption, aid and economic development explain 6.48%, 0.97% and 0.10% variations in political instability, respectively, in the second year. In the same manner, corruption, aid and economic development account for 12.2%, 2.31% and 0.46% variations in political instability, respectively, in the tenth year.

Furthermore, aid is more important than political instability and corruption in explaining the shocks to economic development in the short-run and long-run. Whereas, aid accounts for 2.11% variations in economic development in the second year, corruption and political instability explain 1.10% and 0.80% variations in economic development in the same period. Similarly, aid's contribution to the variations in economic development is 21.9% in the tenth year, while corruption and political instability account for 4.11% and 1.52% variations in economic development, respectively, during the same period.

In explaining shocks to aid, political instability is more important followed by economic development and corruption in the short-run and long-run. For instance, political instability accounts for 21.4% and 18.4% variations in aid in the second and tenth year, while economic development and corruption explain 8.86% and 15.7%, and 6.00% and 14.3%, respectively, during the same period.

Table 4- Results of forecast error variance decomposition analysis

Variance decomposition of LnCOR:				
Yr	LnCOR	LnPOL	LnGDP	LnAID
1	100	0.00	0.00	0.00
2	95.7	1.02	3.02	0.30
10	78.4	8.39	3.50	9.71

Variance decomposition of LnPOL:

Yr	LnCOR	LnPOL	LnGDP	LnAID
1	7.86	92.1	0.00	0.00
2	6.48	92.5	0.10	0.97
10	12.2	85.1	0.46	2.31

Variance decomposition of LnGDP:

Yr	LnCOR	LnPOL	LnGDP	LnAID
1	1.43	0.04	98.5	0.00
2	1.10	0.80	96.0	2.11
10	4.11	1.52	72.4	21.9

Variance decomposition of LnAID:

Yr	LnCOR	LnPOL	LnGDP	LnAID
1	4.32	8.75	10.6	76.3
2	6.00	21.4	8.86	63.8
10	14.3	18.4	15.7	51.7

Cholesky Ordering: LnCOR LnPOL LnGDP LnAID

The results of the IRF presented in Table 5 demonstrate that over the ten years period, a one standard deviation shock to political instability, economic development and aid has a positive impact on corruption. Furthermore, a shock to corruption has a positive impact on political instability over the ten years period, while a shock to aid has a negative impact political instability over the same period.

Additionally, a shock to corruption has a positive impact on economic development, while a shock to aid has a negative effect on economic development over the ten years period. Whereas, a shock to political instability has a positive impact on economic development in the second year, its impact is negative in the tenth year. Moreover, a shock to corruption and political instability has a positive impact on aid, but a shock to economic development has a negative impact on aid over the ten years period.

Table 5- Results of impulse response function analysis

Response of LnCOR:

Yr	LnCOR	LnPOL	LnGDP	LnAID
1	0.12	0.00	0.00	0.01
2	0.10	0.02	0.03	0.02
10	0.09	0.04	0.02	0.04

Response of LnPOL:

Yr	LnCOR	LnPOL	LnGDP	LnAID
1	0.01	0.05	0.00	-0.01
2	0.01	0.05	0.00	-0.00
10	0.02	0.04	0.00	-0.01

Response of LnGDP:

Yr	LnCOR	LnPOL	LnGDP	LnAID
1	0.02	-0.00	0.13	-0.03
2	0.01	0.02	0.12	-0.03
10	0.03	-0.01	0.12	-0.09

Response of LnAID:

Yr	LnCOR	LnPOL	LnGDP	LnAID
1	0.11	0.16	-0.17	0.47
2	0.13	0.28	-0.12	0.31
10	0.15	0.12	-0.15	0.23

Cholesky Ordering: LnCOR LnPOL LnGDP LnAID

The findings of this study indicate that there is a short-run unidirectional causality from political instability to economic development and aid, while there is a long-run unidirectional causality from economic development, political instability and aid to corruption, and also from corruption, political instability and aid to economic development in the ECOWAS. Furthermore, economic development, political instability and aid all have a positive impact on corruption both in the short-run and long-run. Besides, corruption has a positive impact on political instability, while aid has a negative

impact on political instability both in the short-run and long-run. Also, corruption has a positive impact on economic development both in the short-run and long-run, while political instability and aid have a negative impact on economic development in the long-run. Moreover, political instability and corruption have a positive impact on aid, while economic development has a negative impact on aid both in the short-run and long-run.

Based on these analyses, there is a short-run positive unidirectional causality from political instability to aid and a negative unidirectional causality from political instability to economic development; a long-run positive unidirectional causality from political instability to corruption and a negative unidirectional causality from political instability to economic development; a long-run positive unidirectional causality from aid to corruption and a negative unidirectional causality from aid to economic development; as well as a long-run positive bidirectional causality between economic development and corruption in ECOWAS countries.

Conclusion

There is no doubt that most ECOWAS countries are less developed, very corrupt, and politically unstable, in addition to relying heavily on foreign aid. Although, many studies have been conducted to examine the impacts and determinants of corruption, political instability, economic development and aid, little attention has been paid to the issue of causality among them particularly in the ECOWAS region. This study investigates the causal relationships among the variables in the ECOWAS using several techniques that include Granger causality test within a multivariate cointegration and error-correction framework, and forecast error variance decomposition and impulse response function analyses.

The findings suggest that the unstable political environment is the cause of low level of economic development, high corruption and reliance on aid in the ECOWAS region. Also, foreign aid seems to encourage corruption and contribute to the region's underdevelopment, while corruption and underdevelopment reinforce each other. Thus, policies that promote political stability would foster economic development, lower corruption and reduce the reliance on aid; policies that lessen the reliance on aid would reduce corruption and promote economic development; and policies that reduce corruption would enhance economic development which in turn leads to lower corruption in the ECOWAS.

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*** Political Risk Service.

*** Transparency International.

*** World Development Indicators.

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FLEXICURITY MODEL AND ITS APPLICATION IN THE SLOVAK REPUBLIC

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Abstract:

A good example for the EU countries which want to improve their labor market policy could be the Danish model. This complex model can modernize and improve the labor market within the country, it can improve the relationships among employers and employees and it can also minimize the poverty and discrimination within the labor force. This paper focuses on the main aspects of the Flexicurity system and on the situation on the Slovak employment and unemployment market. It also summarizes up the conditions and assumptions of Slovak Republic and its labor market. The main goal of the paper is presenting the significant aspects of the Flexicurity system implementation under Slovak conditions.

Keywords: flexicurity, labor market, unemployment, employment, long term unemployment

JEL Classification: J40

1. Introduction

The labor market is a very flexible system that provides demand and supply of the labor force. The growth on this market is very flexible and it has a need to set an appropriate social system. This fact is an actual issue all over the world for several years now. An innovative approach to the labor market policy was set in the early years of the 21st century and it is called the *flexicurity* model. It represents a good example of achieving an economic growth, high employment rates, sound and stable public finances and an overall balanced social environment. Its main aspect and attitude is a flexible labor market. It has to be supported by an active labor market and educational policy. These two components mutually interact and contribute to the social security as a significant national competitiveness factor (Marx 2014). The main goal of this paper is to provide an updated review on the issue of unemployment in Slovakia, mostly focused on the sphere of the flexicurity model.

2. Fundamental attributes of the Flexicurity model

The first implementer of the Flexicurity model was Denmark. It has managed to create a safe and sound and also a flexible labor market thanks to the high rates of employment and high unemployment benefits. These enable employees and also employers to accept the negative aspects of this system. The innovative ideas of the Flexicurity approach have significantly improved the Danish competitiveness and the advantages are strongly evident.

Flexicurity is a welfare state model with a pro-active labor market policy. The term was first coined by the social democratic Prime Minister of Denmark Poul Nyrup Rasmussen in the 1990s. Today, flexicurity is a key tenet of the so called Nordic Model. For the first time, the term Flexicurity was used by a Dutch professor Jurjen Adriaansens. The term refers to the combination of labor market flexibility in a dynamic economy and security for workers (Bredgaard, Larsen, Madsen 2006), The Government of Denmark views flexicurity as entailing a *"Golden Triangle"* (Madsen 2002) with a "three-sided" mix of flexibility in the labor market combined with social security, an active labor market policy with rights and obligations for the unemployed".

The term has been used for the labor market model incorporating the elements of labor market flexibility and of security of employees or people who lost their jobs. A whole concept is based on the high flexibility degree of an individual employment relationship between an employer and an

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employee and on a high degree of protection of personal income received from an employer or within the social system in case of being unemployed. The system is intensely supported by the third component – an active employment policy focusing on a requalification of an individual working ability (Caspar *et al.* 2012).

The European Commission considers flexicurity as an integrated strategy to simultaneously enhance flexibility and security in the labor market. Flexicurity is designed and implemented across four policy components:

- flexible and reliable contractual arrangements,
- comprehensive lifelong learning strategies,
- effective active labor market policies,
- modern social security systems providing adequate income support during employment transitions.

All this is done in a context of high minimum wage and high average wage, besides clear progressive taxation.

In the European Commission's approach, flexicurity is about striking the right balance between flexible job arrangements and secure transitions between jobs, so that more and better jobs can be created. The idea is that flexibility and security should not be seen as opposites but as complementary. Flexibility is about:

- developing flexible work organizations where people can combine their work and private responsibilities,
- where they can keep their training up-to-date,
- where they can potentially have flexible working hours, about giving both employers and employees a more flexible environment for changing jobs. (Wilthagen T. 1998; Michalski 2014a, b). Flexibility of financial aspects was described by Raisova *et al.* 2014; Mura *et al.* 2012; and Mura and Buleca 2012.

Security means "*employment security"*– to provide people with the training they need to keep their skills up-to-date and to develop their talent as well as providing them with adequate unemployment benefits if they were to lose their job for a period of time (Kalleberg, 2013).

Flexicurity is also seen as a way to preserve the European social model while maintaining and improving the competitiveness of the European Union. It is argued that, in the context of globalization and technological change which place greater demands on business to adapt continuously, high levels of employment security will not depend only on protection of workers' specific job, but mainly on the means for workers to stay on the job market, manage smooth transitions between jobs, and make progress in their careers (Lykketoft, 2006; Michalski *et al.* 2014; Szabo *et al.* 2013).

Upon the adoption of the common principles of flexicurity, the Council called on the Member States to take them into account in drawing up and implementing *"national flexicurity pathways"* (European Council 2011). Progress in the implementation of flexicurity strategies is reported by Member States in their National Reform Programs and is monitored by the European Commission in the framework of the European Employment Strategy. The 2011 Euro Plus Pact calls for its promotion in the Eurozone (Bernhardt and Krause 2014).

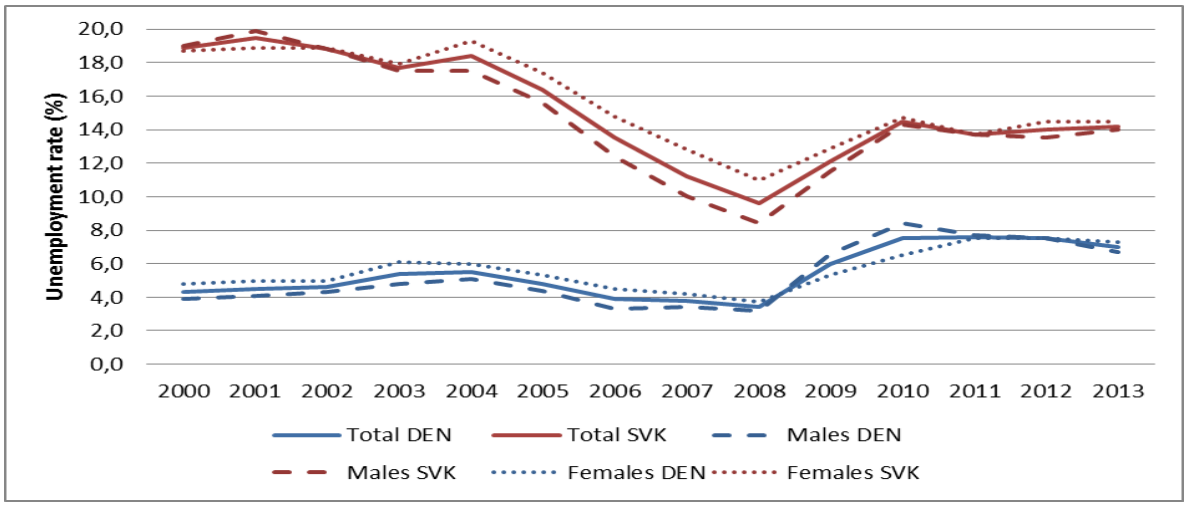
Although the Flexicurity issues have been an object of an economic interest for several years, a definition has not been created yet. The term "Golden Triangle" (Madsen 2002), which has been already mentioned, representing the labor market measures between the flexible employment rules, the generous social benefits and the strong activation and educational measures is preferred (Heyes 2013).

3. Characteristics of the Slovak Republic in terms of usage of the flexicurity model

Flexicurity is a modern model for the construction of employee´s working position with emphasis on the social background of this position. It has to be stated that the model cannot be implemented as a standard systemic tool because of the specificities of each country. Every country, even every country region has different cultural, economic and structural background and conditions. The following chapter analyzes the Slovak labor market and it provides the picture of the environment and the current situation in Slovak Republic.

3.1 Analysis of labor market in Slovak Republic with emphasis on the value of the main indicators in recent years

At the era of former Czechoslovak Federal Republic (before the year 1993) was created the high unemployment rate which has always been a characteristic sign of the Slovak economy. This rate is primarily a consequence of the transformational recession of the Slovak economy between years 1991 and 1993 and also of a collapse of the Czechoslovak Federal Republic afterwards characterized by a significant decline of the employment and increase of the unemployment. This was affected by several factors. As the most important one is known a fall in domestic and foreign demand – the decline in the domestic demand was affected by the significant growth of an inflation rate; a reduction in external demand was created and conditioned by the dissolution of the former The Council for Mutual Economic Assistance – CMEA markets (the essential part of Slovak export was located to this markets).



Source: Author´s own graph based on the Eurostat Database

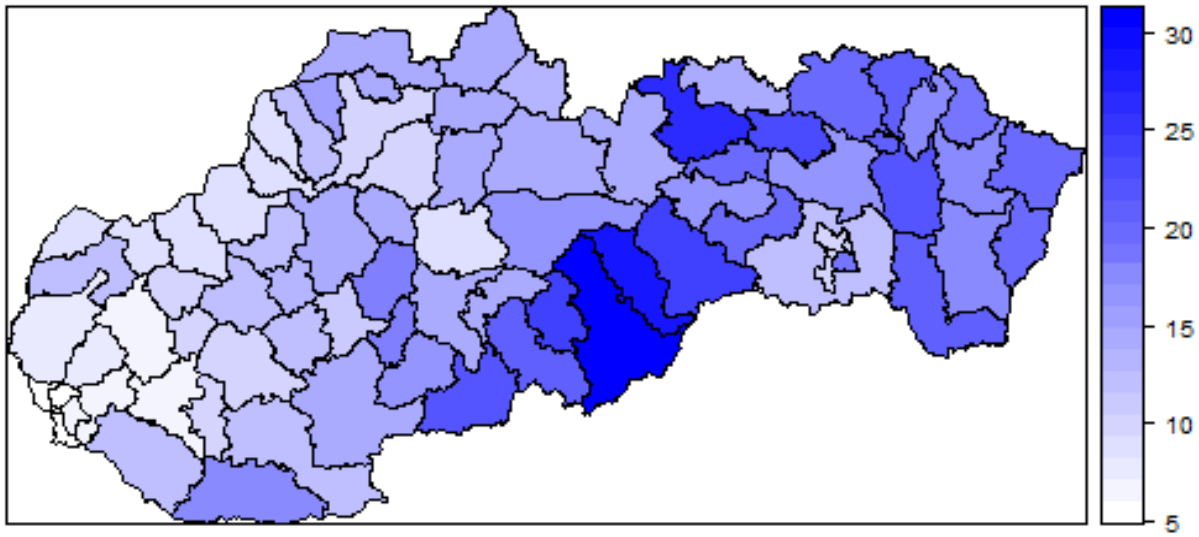
Figure 1 - Total unemployment rates in Slovakia and in Denmark for the period of 2000 – 2013

The intensifying of the economic restructuring process since 1999 contributed to the further increase of the unemployment rate. As we can see from the Figure 1, its growth reached the peak in the year 2001 (19.7% – more than 520,000 unemployed people). This unemployment rate could be analyzed differently among men and women. At the time of that peak male unemployment rate was higher than female unemployment rate. Since then the unemployment rate has been gradually decreasing, as the substantial economic reforms implemented since 2002 contributed to its sustained decline. At that time, foreign investors started to note Slovakia as an area for their potential investments.

This inflow of foreign investments intensified the creation of new jobs and working positions. Thanks to that, the unemployment rate decreased in 2007 to 11.00% (on average, but at this time the female unemployment was higher than male unemployment). In 2008 this decline of the unemployment rate continued, but as we can see, in an obviously slower pace. In 2008 it fell to 9.0% (about 244 000 unemployed people and the female unemployment was still higher the male unemployment). It was the lowest rate since 1999. Unemployment usually affects people basic or lower education – they form about 70% of the total unemployed). On the hand, the share of unemployed with university education is about 3.5%. Slower decline in unemployment dynamics between years 2007 and 2008 is related to a long-term unemployment, which is a specific problem of the Slovak labor market. This situation will be analyzed in Figure 4.

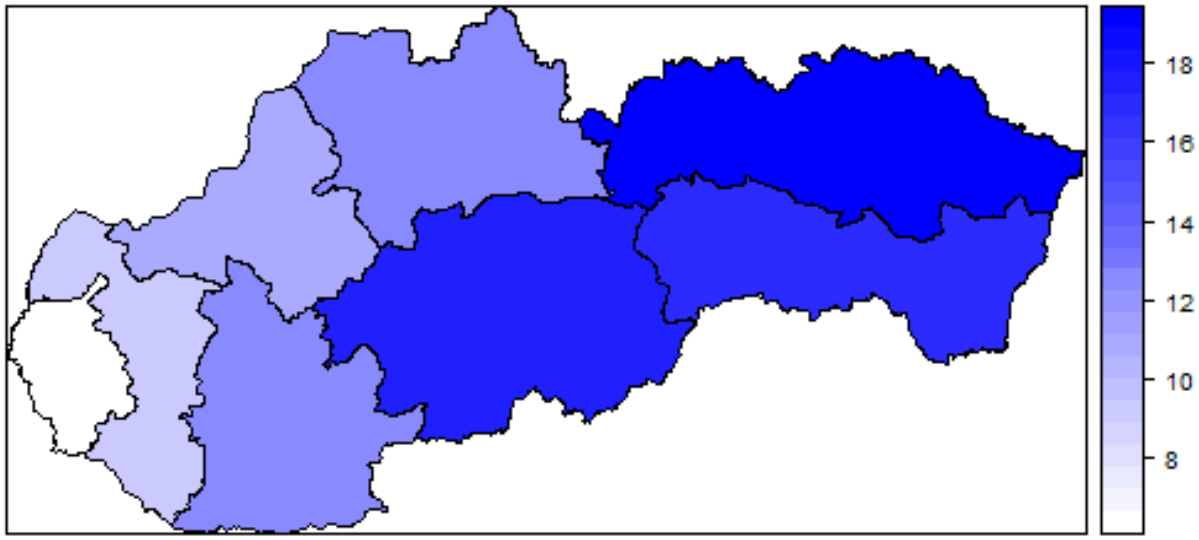
Since 2008 the unemployment rate has risen again because of the economic crisis that has paralyzed not just the United States and the rest of the developed world, but many of Slovak production companies, too. On Figure 1 we can also see that from the year 2011 the unemployment rate has stabilized on a balanced level – about 14% on average, but female unemployment remained

higher then male unemployment. This can be caused by the fact that in Slovakia the gender equality is not fully completed and preserved.



Source: Author´s own graph based on the Slovstat Database

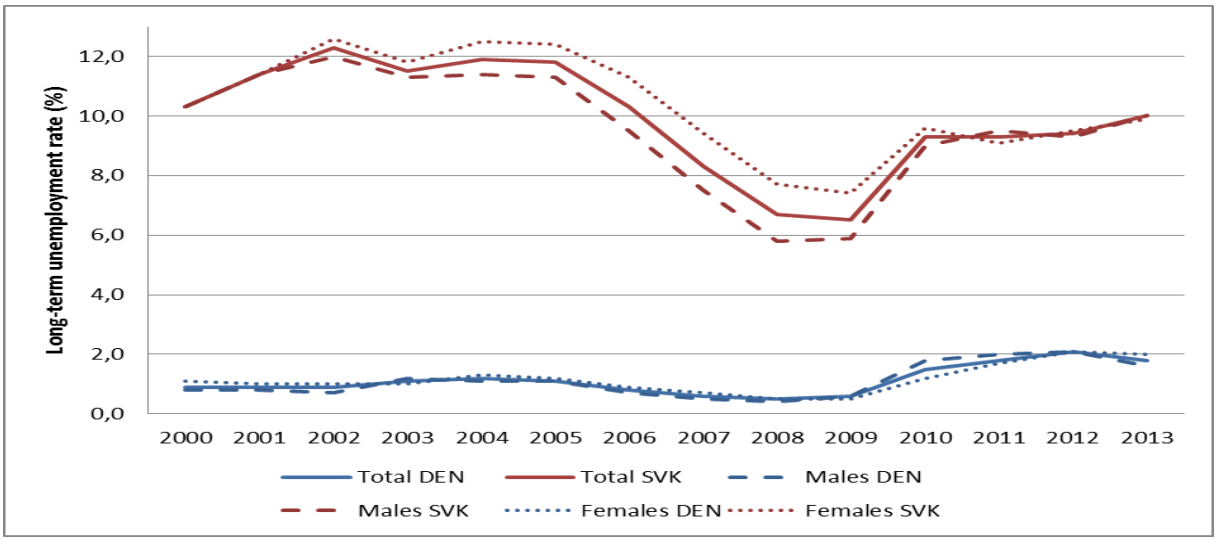
Figure 2 - Unemployment rates in Slovakia in 2013 specified by counties



Source: Author´s own graph based on the Slovstat Database

Figure 3 - Unemployment rates in Slovakia in 2013 specified by regions

As we have previously mentioned, the decrease in total unemployment depends particular on the long-term unemployment reduction. In this process past experiences shown a role of active market policies (ALMP) which could temporally interrupted long-term unemployment with seasonal or temporary work. As we can see in the Figure 2 long-term unemployment is highest in less developed regions. More than 25% of long-term unemployment rate are shown in dark red - Rimavská Sobota, Revúca, Poltár as a part of Banská Bystrica region, Rožňava as a part of Košice region and finally Kežmarok and Sabinov, part of Prešov region. From the regional perspective the highest rate of registered unemployment recorded Prešov (20.81%). Above average rate of Slovak registered unemployment (14.68%) are also Banská Bystrica with 20.36% and Košice region with 19.08%. On the other hand in economic developed regions as Bratislava or Trenčín is unemployment level low.



Source: Author´s own graph based on the Eurostat Database

Figure 4 - Long-term unemployment rates in Slovakia and in Denmark for the period of 2000 – 2013

Figure 4 shows us total long-term unemployment rates in Slovakia and in Denmark since 2000. This Figure shows us also both male and female long-unemployment rates.

Slovak republic is typical for existing significant regional differences due to low labor mobility. Over the observation period long-term unemployment rate reached its peak in 2002. From this point long-term unemployment rate began to decline till the worldwide crises in 2009. Development of the Slovak labor market is influenced by implementation of institutional reforms in 2004. These reforms were implemented with so-called "National Projects" and they were focused on integration of people with disabilities to work, increase numbers of student internships and motivate unemployed people to job search process. Global crisis brings in 2010 rapid increase in the long-unemployment rate. Since then long-term unemployment rate balanced at constant level without significant fluctuations. We can also say that, long-term unemployment rate of women is in most of the observation period higher than long-term unemployment rate of men.

3.2 Differences in the implementation of flexicurity model in Denmark and Slovakia

To understand the principles of Flexicurity better we should present the basic characteristics of Danish model within the comparability analysis with Slovakia. This is presented in the following chapter. The success of the Flexicurity model in Denmark is based on favorable macroeconomic conditions. For Denmark a stable economic growth and sound public finances are typical. Table 1 compares these basic macroeconomic indicators in these two countries. It is necessary to say that we use employment rate from 15-64 years old people in all ISCED 2011 levels.

Table 1 - Selected macroeconomic indicators of Denmark and Slovakia for year 2013

Year 2013	Slovak Republic		Denmark
Real GDP growth		1.4%	-0.5%
Inflation rate		1.5%	0.5%
Public deficit		2.6% GDP	0.7% GDP
Public debt		55.4% GDP	44.5% GDP
Employment rate	Total	59.9%	72.5%
	Males	66.4%	75.0%
	Females	53.4%	70.0%
Unemployment rate	Total	14.2%	7.0%
	Males	14.0%	6.7%
	Females	14.5%	7.3%

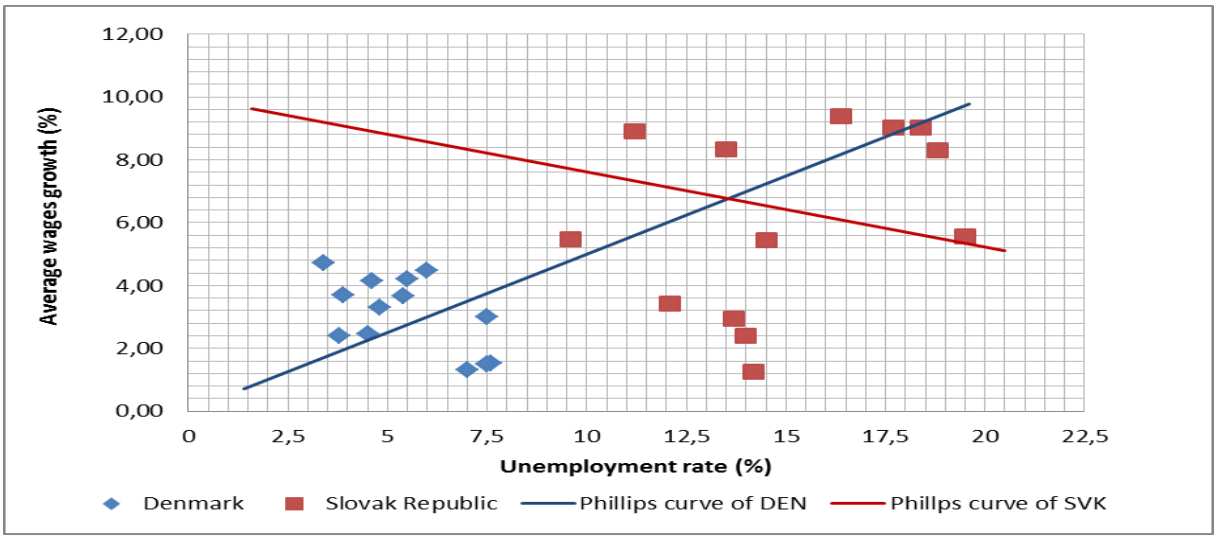
Year 2013	Slovak Republic		Denmark
Long-term unemployment	Total	10.0%	1.8%
	Males	10.0%	1.6%
	Females	9.9%	2.0%

Source: Eurostat (2015)

Except for the macroeconomic conditions, the Danish labor market also has its specificities when comparing to the situation in the Slovak Republic. In further text we will compare labor markets via *"Golden Triangle"* measures. Firstly, in Denmark are implemented flexible rules for hiring and dismissal of employees but in Slovakia is flexible hiring of employees still problematic. Mobility in Slovakia is relatively very low. Secondly, we can say that the Danish social system is much more generous than Slovakian modest, almost restrictive support system. Wage replacement in Denmark is much higher than in Slovakia and is paid for a period of 4 years. And finally, Slovakia has very poor support of an active labor market policy and an educational policy (Páleník, Noška and Páleník 2011).

The principle of the *"Golden Triangle"* in Denmark is the acceptability of the high numeric flexibility if a citizen gets high unemployment benefits and if a chance of a convenient return to work is relatively high. In case of some specific problems occur, such as insufficient qualification for the offered working positions, the active labor market policy with the opportunity of requalification and other activities fostering the return to work are applied.

In order to look closer at the effects of structural reforms and macroeconomic changes that were done in the Danish labor market and in the sphere of the unemployment and wage development we have created the Phillips curve which represents the relationship between the real wages growth and the unemployment rate (Figure 5).

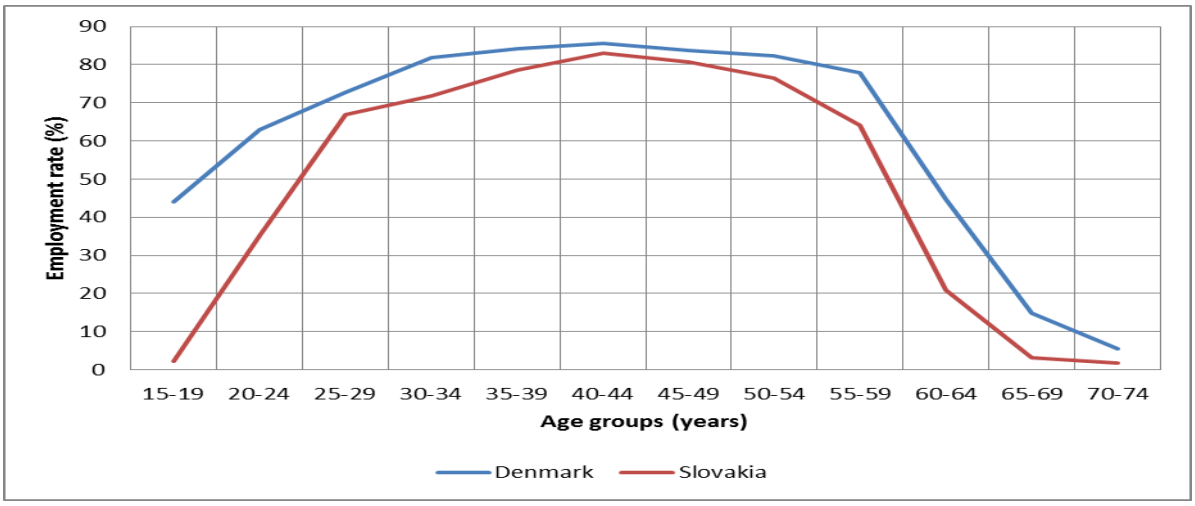


Source: Author´s own graph based on the OECD Database

Figure 5 - Phillips curve in Denmark and in Slovakia for the period of 2001 – 2013

The Phillips curve gives the view on the Danish and Slovak labor market from 2001 to 2013 using the unemployment rate and the wage inflation to show the precise evaluation of the situation on the labor market. We have used yearly data to observe the long-term development dynamics of the labor market. That was based on the Flexicurity model.

In conclusion we can say that in each year of the whole analyzed period the unemployment rate in Slovakia was higher than in Denmark. In addition, the lower levels of unemployment in Slovakia were connected to the higher wage inflation. On the other side, a minor decrease in wages associated with a decrease in unemployment in Denmark can be attributed to the successful application of the Flexicurity model. From the graph on Figure 5 we can say that the unemployment rate never fell under 1.5% a never exceeded 20.5% in both countries.



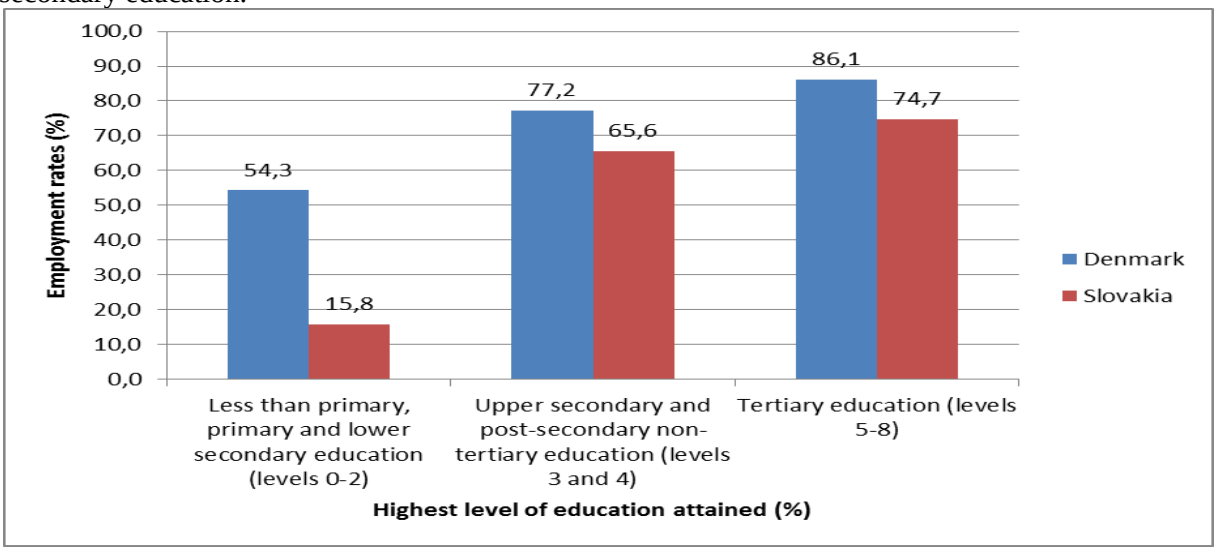
Source: Author´s own graph based on the Eurostat Database

Figure 6 - Employment rates by age groups (%) in year 2013

Figure 6 shows us employment rates in both Denmark and Slovakia. We can see that Danish employment rate curve is for the each age group higher than Slovak curve. The biggest difference in employment rate is visible for the age group 15-19, where Slovakia achieves values 17 times less than Denmark. The employment of the young Danes (15-19 years) is something over 40% while the Slovaks employment rate is only 2.3%. Starting with the age of 25 employment rates of Slovakia and Denmark started to balance. Both Denmark as well as Slovakia reaches the peak in the age group 40-44. There are 5.4% of Danes and 1.7% of Slovaks in the age 70-74 still working.

In theSource: **Author**´s own graph based on the Eurostat Database

Figure 7 we can see employment rates by the highest level of education attained. Employment rate increases with increase in level of education as well as in Denmark and Slovakia. In Denmark differences in employment after reaching higher level of education are not so pronounced. On the other hand in Slovakia there is the significant difference between (almost 50%) employment of people with upper secondary and post-secondary non-tertiary education and less than primary and lower secondary education.



Source: Author´s own graph based on the Eurostat Database

Figure 7 - Employment rates by highest level of education attained (%) in year 2013

3.3 Restrictive aspects of flexicurity model implementation

There exist some conditions that have to be considered for the successful implementation of the Flexicurity model in Slovakia. These conditions, also regarded as barriers have things to do with specificities of Slovak Republic (Gavurova *et al.* 2014). These particularities could have an impact on

the success of the implementation and, as history shows us, they will have a very significant impact on this process. In this part we would like to describe some of these Slovak specificities that could be very significant in this process.

The big Slovakian problem is a large regional disparity between regions (Soltes and Gavurova, 2013, 2014). As we can see in a **Error! Reference source not found.** and Source: **Author´s own graph based on the Slovstat Database**

Figure 2 - Unemployment rates in Slovakia in 2013 specified by counties

differences in unemployment in regions vary greatly. In general we can say that the eastern part of Slovakia is less attractive destination for investors and vacancies creators. Over recent years due to foreign investors Košice became something like "Slovakian IT Valley" which creates most of the new job places. The problem of economic cutting off Prešov and Košice from the rest of Slovakia is still unfinished infrastructure. The completion of Bratislava – Košice D1 highway is a priority in improving interest of foreign investors. Quality infrastructure will also increase the actual labor mobility.

Slovakia is a country with the highest share of the Roma population with comparison to the size of total population. *The Roma issue* and the inclusion of Roma into work still represent an unsolved problem. The problem is the lack of working habits of Roma. Solving this problem cannot be completed overnight. It is important to begin systematic education, improving the level of qualification and to teach mostly young Roma aged 18-30 working habits to make them beneficial to the employer not a burden (Vaňo 2001). Social system which does not encourage enough to seek job is described below.

Social environment and system is also a very important and very complex condition that could affect the process of implementation of the Flexicurity model. Slovak social environment is negatively marked with unemployment, taxation and also with overall dissatisfaction of people. These entire defects come from the setting of the social system. These settings can also lead to higher unemployment and to more dissatisfaction. The main factors causing the high rates of unemployment in Europe include:

- regular supply and a high level of social benefits,
- low professional and spatial mobility, which causes rigidity of the market,
- high tax rates generally.

Especially the level of social benefits causes the unwillingness to improve our working position. The next condition is connected with the previous paragraph. During our study we noticed that Slovak people are not willing to move or transfer for better conditions and it refers to low *mobility level*. It is a generally known fact that lo of people, especially women, travel to Austria, Germany and other Western European countries because of work but it is still a very low percentage of people and it do not lower the unemployment rate in Slovakia. We assume that the unwillingness to move to other country or, often, a city to get a job stems from the temperament of people who are very traditional and family based. They rather stay home and close to their family and are unemployed and dependent on the social system then move hundreds of miles from their family. This barrier is in our opinion very closely connected with the functioning of the Slovak social system and its weaknesses and defects.

Based on the analysis in the previous part of the paper we can see a high rate of *long-term unemployment*. The solution of this problem is also complex and closely linked to the problem of lifelong education, about which we discuss in the further parts of the paper. The long-term unemployed lose their willingness to reemployment considerably and lose their working habits. For employers become unattractive and unable to successfully integrate them into the working environment. Lifelong education system with emphasis on the retraining and skills development is crucial. We can see the solution of skills development and in interconnectedness of the government and private sector. The problem may be high costs and fluctuation of staff, who were been trained but leave the work (social reasons etc.) In Slovakia less than 10% of unemployed attend some of the educational courses provide by the employment offices (IHP 2011)

As we can see in the Figure 6 *unemployment of young people* in very high. Early integration of young people into the working process is the key. Not doing this can have disastrous consequences. Juvenile delinquency increases with the growth of unemployment. The solution is a strong emphasis

on the development of education system. Public authorities' access is required. Therefore is necessary to establish a system of primary, secondary and higher education, which will be aligned with labor market needs. However, this requires the cooperation of the government and employers. It is necessary to solve the problem felt by many employers and a lack of qualified craftsmen. On the other hand, we have a group of young people who do not have jobs because employers require several years of experience.

Another very significant aspect could be *lifelong education* or we could also call it *lifelong retraining*. Lifelong education is the "ongoing, voluntary, and self-motivated" pursuit of knowledge for either personal or professional reasons. Therefore, it not only enhances social inclusion, active citizenship, and personal development, but also self-sustainability, rather than competitiveness and employability. One of Slovakia´s biggest problem is, as it was already said, unemployment. Unemployment rises with age and if a person loses his job in the age of 40, without a proper education or skills it becomes very difficult (sometimes impossible) to find another job. We can say that this process of lifelong education could affect and also increase the chances of finding a job, a well-paid job, especially in higher ages.

Supporting the business environment could very significantly improve the general situation in Slovakia and that is the reason why is highly recommended to pay attention to this specificity. Slovakia has a very unique business environment with very strict business policy, taxation and payments to the Social Insurance Agency. Current level of the payments is 194.25 €. Minimum assessment base is on the level of 50 % from the minimal wage which represents 412 € and it leads to higher level of tax, higher level of monthly assessment base and higher level of the monthly advance payment and advance payment on the health insurance. These payments lower the net income and due to this it lowers the living standards (Gavurova *et al.* 2014).

The Danish flexicurity system is financed mainly from government spending – *income taxes*. Denmark applies progressive taxation system, in which taxes cannot exceed 59% of the income. Slovak Republic has flat tax rate of 20%. Total government income and therefore potentially expenditures for the development and implementation of the flexicurity system are much lower in Slovakia than in Denmark (Labor Code of the Slovak Republic 2011).

Conclusion

Each EU member state has got the obligation to elaborate its own national Flexicurity program. Every country has different background, social and political situation, so, it can´t be possible to take one model from a successful implementation in other country and simply apply it to another country. Every state has different conditions and specificities, so the model has to be adjusted to the particular labor market. Slovakia and Denmark as examples and cases of this study are the countries of the similar area and population size. However, the labor market situation is very different. Significant disparities are in a sphere of taxation. While Slovakia is known for one of the lowest income tax rate in the OECD area being under the OECD average, Denmark has one of the highest rates among OECD countries. Another problem which is a very significant problem is the long-term unemployment and also the unemployment of young people.

Additional problem that leads to big disparities between the countries is the high unemployment rate. In Slovakia is this rate notable. We have to mention the high unemployment rate among young people till the age of 30 and also the long-term unemployment. Danish unemployment does not represent such a big defect in the system. Slovakia has a need to create an educational system (primary, secondary, tertiary) which needs to include the model of lifelong education and retraining. The whole educational system needs to be more harmonized with the needs of the labor market, so, the lifelong education could be helpful in this process. The coaction of these two components cannot be functioning without the cooperation and participation of the governmental sector and the sector of employers and employees.

The last but not the least conclusion is the observation that Slovakia needs to improve its business environment and support more small businesses and businessmen.

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INTERNATIONAL AFFAIRS STIMULATION BY MACROECONOMIC INDICATORS OF RESULTS AND ECONOMIC EFFICIENCY

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Abstract

Macroeconomic statistics has as primary role the macroeconomic variables measurement. A wide range of users resort to statistical information provided through its macroeconomic indicators: bodies of state institutions, non-governmental organizations, research institutions, international organizations, private organizations, companies, etc. Macroeconomic statistics is founded on a uniform system of statistical methodologies and classifications and nomenclatures system, among which of high importance are: the institutions classification, property classification and classification of economic activities. Each country's economic activity manifests as a set of flows that occur between its elements or between them and the rest of the world in relation to production, distribution and consumption of goods and services. The socioeconomic practice uses standardized classification systems which are basic components of economic information system and, also, indispensable tools for organizing the gathering, storage, processing and data analysis.

Keywords: *actual flows, statistical data macroeconomic statistics, set of flows, statistical registers, economic classifications.*

JEL Classification: E21

1. Introduction

The methodological premises of national economic circuit characterization are: defining and classification of units operating on domestic and / or foreign partners; defining and classification of relations between these units; establishing data sources and methodologies for collecting and aggregating their information in the form of statistical indicators; coordination and integration of various subsystems of indicators in a small panel, in the system of national accounts; ensuring the international comparability of macroeconomic indicators.

The information on economic activity entities and their flows can be found in documents produced by them for internal business management (financial and accounting records) or to regulate relations with the state tax system.

The National Accounts System is a statistical tool that allows overview of fundamental equilibrium resources - uses of a national economy and is used in statistics UN and other international bodies. The European System of Integrated Economic Accounts (ESA) is a coherent and detailed set of accounts and tables whose purpose is to provide a systematic picture, comparable and complete of the economic activity of each member country of the European Union. The indicator system is based on data from customs statistics held by a company or by a national body which processes data obtained from customs registration of goods.

2. Flows between economic statistical entities and international affairs

The units among which flows occur are natural or legal persons called economic entities classified according to the function performed in the national economy into 5 categories: *private households or housewifery*, acting on the production factors markets as units of labor supply and on the material goods and services market as exponents of demand. Alongside private households, private administrations (private non-profit organizations, churches, political parties, trade unions, etc.) are also important; *enterprises (companies, autonomous administration)* attract factors of production (capital, labour, land) and provide goods and/or services either to private households or to other businesses or public administration; *the state* is an economic particular entity that, on one hand, acts as a households consuming goods and services, and, on the other hand, creates some material goods of public use. The generic name of "state" refers to both the central government institutions and those established at local, county or regional level; *banks* (commercial ones) represent a category of economic issues,

which can be assimilated to a certain extent to companies because appear on the market as a provider of banking and financial services and insurance.

Their main mission is to gather and mobilize savings existing with other categories of economic entities and to submit them for recovery or investment; the rest of the world is another complex economic entity, bringing together under this name all transactions with external partners, natural or legal persons established in another country.

Among the five categories of economic entities there occur several operations, flows, economic transactions which take the following forms: sale/purchase of goods, provision / employment of services, granting / loan commitment, receipts/payments diverse.

The 12 flows can be defined as follows: in return for work done, private households receive income from businesses (Yg); to survive and to ensure reproductive process, part of household income is consumed (Cg) for the purchase of goods and services; Another part of household income is saved (Eg) by depositing in the bank; household income also include direct taxes payable to the State (Td) as well as consumer subsidies (Sg) granted to households in the form of state allowance, compensation, benefits, etc .; State also charges indirect taxes (Tind) which are imposed on businesses and assigns temporarily production subsidies; part of state revenues are intended to cover their own consumption (C), goods needed being purchased by enterprises; differences between state revenues and consumption expenses constitute state saving (E) and capitalize in banks; some companies are exporting goods and services (X); some of the goods and services needed by the population and the factors of production are imported (M); exports (X) and imports (M) of goods and services generate collections and payments in relationships with foreign countries, which is achieved by means of authorized banks; as the fixed capital of the company shall be recovered by the production of goods and services, they store the wear equivalent in bank (A), that part of the net profit of the company that, by the decision of shareholders, does not take the form of payments or paid dividends falls under this flow, too; attracting additional capital provided by banks to enterprises to invest (In). The calculations of output macroeconomic indicators take into account the flows divisions into two classes: actual cash flows or real economic transactions, which have as their object goods and services. These flows are characteristic to production, exchange and use of material goods and services and financial flows (transactions) which are the operations.

3. Statistical data collection and aggregation

For data collection three types of statistical records can be used: monthly, quarterly and annual surveys conducted among businesses and households. Most of such records is based on a sample representative at national economy level, which allows to estimate the macro-economic indicators, in case a certain level of error is accepted; t*he exploitation of departmental statistics*, which are exhaustive continuous records; *the use of tax system records* that statistically are statement based observations .

Access to these data sources are authorized by competent authorities that collects them in terms of protecting personal information. Data are grouped and aggregated by means of some lists of products or services, catalogues of economic entities, activities classifications and territorial nomenclatures. Flows of goods and services are grouped according to economy manufacturing branches (NACE - National Classification of Economic Activities) to be included in the inputs and outputs fields. Financial flows are grouped by institutional sector in order to observe the formation of income and economic entities and their redistribution amongst sectors.

4. Statistical systems, nomenclatures, classifications and statistical registers

The statistical systems employed are:

- System of National Accounts (SNA);
- Balance of Payments of the International Monetary Fund;
- Central Product Classification;
- The International Standard Classification of All Economic Activities, Revision 3.

Nomenclatures, classifications and statistical registers play a role in:

- Systematization of individual data by restricting the number of characteristic values of group;
- Structuring community in homogeneous parts;

- Presentation and description of the corporate structure;
- Characterization of the links between statistical characteristics.

Economic nomenclatures meet at least three requirements: common language research; research of a significant level of aggregation; research of some opportunities that would allow processing various types of data.

Example: The prices for industrial production can be based on the following lists: classification of economic representatives in the NACE Class; Nomenclature of industrial products PRODIND representative inside the economic agent; Classification of representative varieties in the products PRODIND.

Statistical classification of economic activities in the European Union is based on Regulation no. 3037/90 of 9 October 1990. The main international classifications are established by the United Nations Organisation, the European Community and the Customs Cooperation Council.

The Classifier of UNO activities is the International Standard Industry Classification -ISIC used both for the presentation of traditional statistics and national accounts works.

The Classification consists of four different levels of detail. The highest approved level of includes large activities, codified from 1 to 9. These are subdivided into 33 categories (codified with two digits). Categories are also divided into 71 classes (codified with three digits), classes are divided into 160 elementary positions (codified with four digits). The European Union uses the Nomenclature of Activities of the European Community NAEC for industry and trade. The main product nomenclature of UNO International Trade Classification Type-ITCT. It consists of 5 detailing levels from 10 to 1924. The International Trade Classification Type is replaced by the Products Central Classification. At first, in UE they used P.R.O.D.C.O.M subsequently P.R.O.D.I.N.D. The new industrial products nomenclature P.R.O.D.I.N.D. comprises about 2700 products compared to 1030 in the preceding classification. Unlike PRODCOM, PRODIND includes products belonging to: mining, energy products processing industry, of waste recycling, production and distribution of electricity, gas and hot water, water collection, treatment and supply. PRODIND includes 1117 positions nominated in PRODCOM, for which information must be sent to EUROSTAT.

5. System of National Accounts (SNA)

The National Accounts System is a way of evidence of the national economic activities, a macroeconomic evidence system which aims the quantitative, aggregate, simplified, comprehensive and coherent representation of the economic activities carried out in a period.

At the level of U.E. the National Accounts System peculiarities are:

- it is based on the theory of production factors and reflects its content for markets and uses concepts of capitalist economic theory;
- it reflects all human activity including that related to ensuring public order and social security;
- is a quantitative, simplified and aggregate representation of economic reality;
- it is a statistical record using accounting techniques, namely the principle of double-entry accounts for compiling analytical accounts reflecting economic activity.

Economic activity is performed by a lot of economic entities.

The set of economic entities can be divided into: *private households* - the economic entities dealt with in the national accounting as consuming units, meaning revenues are used to meet consumer needs; *companies* are economic entities producing goods and services for profit; *state* includes economic subjects that produce goods and services for collective purpose; *banks* are a special category of economic entities that are not intended to produce goods and services but monetary capital that it mobilizes, collected from households, companies and the state in order to exploit other economic entities at home and abroad; *foreign countries* group the non-national units activities to the extent that they carry out transactions with resident units or flows.

All transactions carried out by an economic subject fall into four activities, there is an account for each activity. Intermediate consumption consists of goods and services purchased by the company processed and entered fully into the goods and services produced by the company. Indirect taxes are state transfers to firms that are removed before income tax (VAT, taxes on production, import taxes).

Grants are state income transfer awarded to companies to influence prices or support production. Data contained in the production account one can calculate the following indicators:

- *Gross value added* at market price, as difference between the value of output and intermediate consumption. Based on this indicator it is determined, at the macroeconomic level the gross domestic product (GDP);
- *Net value added* expresses the newly created value; it is determined by subtracting depreciation, indirect taxes from gross value added plus exploitation subsidies;
- Gross surplus is determined from gross value added eliminating indirect taxes minus subsidies and remuneration of labor;
- Net surplus is calculated as the difference between gross surplus and depreciation of fixed capital.

Four national accounts or synthetic accounts are used in the National Accounts System: production account; consumption account; accumulation account; the rest of the world account. So the System of National Accounts is a coherent set of accounts and charts, which arranges the necessary elements of the macroeconomic indicators calculation and carried out activity analysis in the national economy during the reference period.

National accounts are obtained by consolidation and aggregation of the sectors activity accounts. Aggregation involves summing economic transactions carried out by subjects belonging to a sector, in their relations with economic entities in other areas. Consolidation involves offsetting transactions of the same kind, between economic subjects belonging to the same sector. So reciprocal intra flows are compensated are removed from the calculation and only the intersectoral flows are compensated. If intersectoral flows are compensated, then they proceed to clearance, meaning that only the net flows and balances of the relations between sectors are recorded to achieve results at the scale of the national economy. The national accounts system is divided into two groups of seven national accounts and accounts that are developed both at the level of sectors and the entire economy. The sequence of workflows reflects actual and financial processes, related to: production activity; distribution activity; Redistribution activity; end use activity. The two main national accounts are: synthetic account - 0 and foreign countries account - 8 account.

6. European System of Integrated Economic Accounts (ESI)

It is characterized by two different ways of perceiving the economy, as follows:

- To balance the processes of production and resources sectors. They regroup the considered units with homogeneous production producing exclusively a product or group of products.
- To describe the flows of income and expenditure and financial flows, the system is based on classification by sectors of the economy. They bring together, in all activities the considered institutional units.

ESI includes - according to their nature - a large number of operations. They shall be restricted to three main categories:

- Operations with goods and services. They deal with the production, exchange and use of goods and services by industries and sectors, produced in the period considered, as well as operations with existing goods.
- Distribution operations - by which the distribution of added value between residents and non-producers and redistribution of income and wealth is performed.
- Financial operations. These correspond within the system changes in receivables and liabilities of the various sectors.

7. Estimation of macroeconomic aggregates

A number of macroeconomic indicators, whose role is to illustrate quantitatively the performance of the national economy, can be determined based on time series data provided,

Usually distinction is made between actual results indicators, such as PID / GNP NDP/ NNP, UN and macroeconomic aggregates of income: personal income (PI), disposable income (DI), which depends not only on national economy performance but also the proportion between consumption and savings in households and state fiscal policy.

Starting from the principle that, what is revenue for an economic entity, constitutes, for another, costs, a double identity can be accepted. From this identity can be derived methods for estimating initial macroeconomic indicators and the type of initial information to be used in the process of aggregation and consolidation of accounts:

- based on actual flows of goods and services: according to their production - production method; depending on their consumption - consumption method.
- on the basis of financial flows between economic topics: depending on the formation of income - income method; based on the use of revenue - expenditure method..

Using input data from various statistical sources and applying different methods of processing, the four methods lead to different estimated values, which involves making a statistical adjustment. The production method involves aggregating transactions, covering material goods and services produced by businesses in the reference period.

If gross global product (GGP) includes all goods and services produced and intended for consumption, gross domestic product (GDP), estimated at market prices, does not consider intermediate consumption (IC) but production for final consumption (FC).

8. Main macro-economic indicators

The macroeconomic results indicators are determined based on the National Accounts System: government consumption; private consumption; international openness; net exports; gross capital formation; cost of living index; general price index; consumer price index; indices of trade.

The gross domestic product measures the market value of the gross production of final goods and services produced during the calculation of economic subjects pursuing their economic activity within the country. GDP is the broadest measure of an economy, and represents the total economic value of all goods and services produced in a country during a given year.

In statistical terms, GDP is determined by three methods:

- Added value method;
- End-use method (expenditure approach);
- Income method.

Since the GDP figure itself is often considered a not very accurate indicator, most traders take seriously into account the two reports that are issued months before finalizing the final GDP figures: the advance report and the preliminary report.

- The value added method has the advantage of capturing the contribution of each economic agent in the production of goods and services. Basically, the method consists in adding by branches and at macroeconomic level of gross value added of each economic agent inside the country. Gross value added is determined as the difference between gross global product and intermediate consumption.
- End-use method involves summing the components expressing the final use of goods and services valued at market prices, less the value of imported goods and services. Private consumption (Pc) is the value of consumer goods and services designed to meet people's needs. Government consumption (Gc) expresses the total expenditure incurred by government agencies when purchasing goods and services. Gross capital formation (GCF) includes gross fixed capital and inventories. Gross fixed capital formation represents the value of durable goods intended for purposes other than those of utility, with a certain value, acquired by resident producer units in order to be used during more than one year in their production processes and the value of services incorporated into fixed capital goods. Stock variations is the difference between inputs and outputs in stocks of inventories during the period considered. Net export (X-M) is the difference between the value of goods and services exported and imported.
- Income method involves summing elements expressing the factors of production compensation embodied in income received by the owners (wages, interest, rents, profits) in fixed capital consumption allowances and in indirect taxes.

After this method GDP includes: compensation of labour (wages, payroll taxes, etc.); interest and annuities; depreciation of fixed capital; net indirect taxes (indirect taxes - operating grants); profit owners for units that are not corporations; profit corporation consisting of: corporate tax, dividend and retained earnings. Net domestic product (NDP) is the size of net value added goods and services produced by domestic economic agents in a given period. Usually NDP is calculated as the difference between GDP and amortization:

$$NDP = GDP – A \quad (1.1.)$$

Gross National Product (GNP) is defined as the current market value of all final goods and services produced by domestic economic agents in a period of one year. Usually, one starts from GDP calculated at market prices and from the gross value balance added to national agents abroad and foreign agents inside the country (GVBA).

$$GNP\ pp = GDP\ pp + GVBA\ pp \quad (1.2.)$$

Net national product (NNP) expresses the net value of final goods and services produced by domestic economic agents in a period of time. Net national product can be expressed:

a) either from GNP and GDP thus:

$$NNP\ pp = GNP\ pp - A\ pp\ pp \quad (1.3.)$$

or:

$$GNP\ pp = GDP\ pp + GVBA\ pp - A \quad (1.4.)$$

b) either from NDP which is adjusted by the balance between income from economic activity and heritage of national economic agents operating abroad and those of foreign agents in the country (BIEAF).

$$NNPpf = GNP\ pf + BIEAF \quad (1.5.)$$

When net national product is determined at the factors price it is called national income, too.

$$NNPpf = NI \quad (1.6.)$$

9. Price indicators used in macroeconomic statistics

The theory and practice of international statistics using three types of indexes that illustrates more or less correct the movement of prices in the respective economy:

- The producer price index (PPI);
- Consumer price index (CPI);
- General price index (GDP deflator. or the GNP; PGI).

The legal basis for calculating the Producers Price Index (PPI) is the European Council Regulation of 19 may1998 no.1165-98, which recommends its introduction in all EU economy.

The index takes into account: variations in quantity per type of goods; changes in the stock of finished and semi-finished products; quantities of technological changes; services such as assembly, mounting, installation, repairs, etc. The index calculation does not include: extraction and ores preparation; weapons and ammunition; industrial production with a long manufacturing cycle; ships and aircraft; unique products from branches of engineering; production manufactured and delivered within the same enterprise (domestic consumption).

The main nomenclatures used in the calculation of this index are:

- CNEA (Classification of National Economy Activities)
- PRODIND - Product Nomenclature comprising 2696 product.

PPI is calculated as a Laspeyres price index and has the following advantages:

- is easily determined in that the database should be updated only for new prices;
- Is a relatively inexpensive index implying low costs because of the first advantage.

IPP has disadvantages that depend on the calculation formula and the level at which it considers prices taken into account:

- it is criticized for overestimating the price increases fixed structure;
- it takes into account only deliveries between businesses, ignoring total final consumption;
- it is under the influence of repeated entry of a single price movement.

Consumer Price Index (CPI) is based on price supervision when sold to a final consumer. This is based on a basket of consumption, usually set every 5 years based on a thorough investigation on

household consumption.

Consumer Price Index (CPI) is probably the most important indicator of inflation. This includes changes in retail prices for basic consumption basket. Inflation is directly related to the purchasing power of a currency in its own frontiers and affects its position in international markets. If the economy develops under normal conditions, CPI growth may lead to an increase in the base interest rate. Consumer price index is calculated only for the elements entering the population direct consumption, excluding: consumption from own resources; expenditures for investments and accumulation; interest paid on loans; insurance rates, fines; taxes and expenditures paid for the agricultural production of individual households.

Consumer price index has the following advantages: relatively easy calculation; low cost, but is more expensive than the producer price index.

IPC has some disadvantages: overestimates price increase; it underpins wage indexation, which makes it often invoked when monthly inflation rates are very high; he ignores intermediate consumption, where the price increase is not so great; index gives a false picture of the real growth of prices, because as we depart on time, consumption cost structure undergoes changes, consumer adapting his demand differentiated according to the movement of prices. General price index (GDP deflator - PGI) takes into account the movement of all categories of prices in the economy, starting from the economic results destination.

$$GDP = Pc + Gc + Gcf + (X - M) \quad (1.7.)$$

For each of the four destinations: private consumption, government consumption, gross capital formation and net exports is calculated one index of prices (index variable structure), later used to determine deflator. It follows the general index of prices (the deflator). Cost of living index (CLI) is used in international comparisons.

This is a price index of variable structure, *i.e.*, weighted by the current structure of consumption. In countries with unstable economies, in general, in countries where the consumption structure knows significant changes in very short periods it is appropriate that, in calculating real income, cost of living index be used. For countries with stable economies, where consumption patterns know no changes from one period to another, it is recommended that the consumer price index be used in calculating real income. Depending on the publication of these indicators we can be observed the market volatility. The degree of volatility is determined by the importance of a given indicator. Announcement of interest rates shows that they play important role in currency price changes on the foreign exchange market. As institutions that establish their interest rates, central banks are therefore the most influential actors in the process. Interest rates influence and dictate their investment flows. Since currencies are representations of a country's economy, differences in interest rates affect the relative value of currencies in relation to one another. When central banks change their interest rates, this causes the currency market to experience fluctuations and volatility. Employment indicators reflect the overall health of an economy or business cycle.

Conclusions

To have a consistent picture of flow of economic entities, the national accounts system develops activity accounts for each sector and national accounts for the whole economy.

Macroeconomic aggregates GDP and NDP are spatially delimited by the country border. In fact, some of the businesses in the country are representatives of other national economies, as abroad national economic agents activate. If aggregation of activities is based on the national affiliation of businesses, then there follow GNP and NNP as expressions of all economic macroeconomic outcomes belonging to a nation, regardless of where they operate: in the country or abroad.

Macroeconomic indicators are statistics that indicate the current state of the economy of a state, according to a particular economic sector (industry, employment, trade, etc.) These data are published regularly at some point by government agencies and by the private sector. To understand how an economy works, it is important to know how many jobs are created or destroyed, what percentage of the workforce actively works, and how many people declare themselves unemployed. For measuring inflation it is important to monitor the rate at which wages rise.

Retail sales indicator is published monthly and it is important for traders on the foreign

exchange market because it indicates overall consumer purchasing power and success of retail stores. The report is particularly useful because it is a real-time indicator of overall consumer spending patterns that is adjusted for seasonal variations. It can be used to predict the evolution of internal indicators of greatest importance, and to assess the immediate direction of an economy.

The balance of payments is the ratio between the amount of payments received from abroad and amount of payments going abroad. The balance of payments indicates the total amount of foreign trade, transactional balance, and balance between export and import, transfer payments. If payments coming from abroad exceed the payments to other countries and international organizations, the balance of payments is positive. The surplus is a favorable factor for the economic growth of the national currency.

Stabilizing economy is one of the objectives that governments seek to obtain by manipulating fiscal and monetary policies. Fiscal policy refers to the fees and expenses and monetary policy to financial markets and the supply of credit, money, and other financial assets.

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BANK-SPECIFIC DETERMINANTS OF PROFITABILITY: SOME EVIDENCE FROM EUROPE

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Abstract:

This paper aims to investigate how company-level factors affect European banks profitability over the period 2006-2012. Our specification follows a panel data model selected according to the Hausman test and our regression estimates are derived using the Generalized Least Squares method. The profitability indicators are ROAA and ROAE; the profitability determinants are referred to size, revenue diversification, efficiency, credit portfolio, level and structure of capital, and funding. Overall our regression results indicate that the high bank profitability is associated with a good efficiency, a low percentage of net loans over total assets, a high growth of gross loans, and a high loan impairment charge over loans. Furthermore, our results generally show a negative impact of bank size and of the common equity over total equity. We also find an ambiguous relationship between funding indicators and profitability. We seek to analyze the impact of the recent financial crisis on profitability by splitting up the years observed into two sub-periods (the pre-crisis period and the crisis years), so that we generate new information about the impact of the crisis on European banks. Furthermore, our profitability determinants include some variables not considered in previous studies.

Keywords: financial crisis, European banking system, profitability determinants, performance, panel data.

JEL Classification: G21, C23, L25

1. General remarks

Literature on bank profitability suggests different approaches to research on this subject. Studies are focalized on one or more measures of performance (ROA – Return on Assets; ROE – Return on Equity; Net Interest Margin; Share Price; Stock Return). They distinguish between bank-specific aspects, and external and industry-related factors as determinants of the performance of the banking industry, focusing on one kind of variables (e.g. Aburime, 2008a) or both of them (e.g. Ben Naceur and Goaied 2008). Other parameters selected to assess the profitability of banks are the country where intermediaries are based (a single country, Davydenko 2011, versus a panel of countries, Molyneux and Thornton 1992) and the period considered (periods of greater or lesser duration, covering or not different economic cycles, e.g. Dietrich and Wanzenried 2011; periods analyzed as a whole, divided or not into sub-periods; some years studied individually, Rozga and Kundid 2013).

In our paper the focus is on bank-specific determinants of profitability and the analysis refers to banks of different European countries over the years 2006-2012. In particular, we investigate a panel dataset regarding the 400 biggest banks of 26 European countries during the period 2006-2012, split up into two sub-periods: the first one, 2006-2008, when the financial crisis in Europe was not yet so widespread, and the second one, 2009-2012, when European economy plunged into the downturn. The decision to consider a sample of large European banks is due to the fact that they can, more than the others, affect the systemic stability. The choice to examine both the whole period and the two sub-periods, as well as being a specific contribution of our paper, is for better understanding the way and the intensity the financial crisis has influenced the European banks performance. To this end we decide to assume 2008 as the dividing year between the two sub-periods: in September, after the failure of Lehman Brothers, the financial crisis first broke out.

Indeed, the issue of banks profitability, and therefore the study of its determinants, has become all the more crucial as a result of the on-going crisis. That is the reason we decide to analyze how the specific determinants have affected European banks profitability over the last years, assuming 2008 as

a watershed for the study of the main effects of the crisis. In this respect we select some indicators, among the many suggested by literature and others new (and that is another contribution of our study), that in our opinion are the best ones in explaining the relationship between banks characteristics and performance. The indicators selected are referred to six macro-areas, signaling important aspects of the banking activity: size; revenue diversification; efficiency; credit portfolio; level and structure of capital; funding. For some areas we use only one indicator (e.g. for the efficiency, the Cost-Income Ratio), while for others we use more indicators (e.g. for the credit portfolio, the Growth of Gross Loans, the Net Loans over Total Assets, and the Loan Impairment Charge over Loans). This is due to the different complexity of the areas considered: the more complex they are, the greater the need to point out more than one indicator, in order to ensure an adequate representation. As a further contribution of our study, for some areas we select new variables: that is the case of both the Common Equity over Total Equity for the structure of capital, and the Interbank Assets over Interbank Liabilities for the funding; in other cases, the variables examined are widely shared (among all, the logarithm of Total Assets for the size).

The paper is structured as follows. Section 2 surveys the theoretical background on banks profitability and points out our research hypotheses. Section 3 outlines the sample, the independent and dependent variables, and the methodology used in the analysis. Section 4 shows the empirical findings and Section 5 concludes.

2. Theoretical background and hypotheses

Banks profitability is commonly expressed by ROA, as an indicator of the ability of banks management to generate income from their assets; in other words, it indicates the managerial efficiency. Benefits of using this ratio are almost universally accepted and that is why most of the literature considers it as the key indicator for the assessment of profitability for banks (Golin 2001). On the other hand, it must be underlined that ROA may create a positive bias in assessing performance, as it excludes off-balance sheet items. This remark is particularly significant for European banks, for which the off-balance sheet business plays an important role in the determination of the total profit, as pointed out by Goddard *et al.* (2004), who therefore decide to adopt ROE as profitability measure. ROE reveals how much profit a bank generates with the money shareholders have invested. The major limitation of the analyses based on this ratio is that they disregard the risks of leverage: the higher a bank's leverage, the higher the ROE (and the lower the ROA). Moreover, it should be stressed the effect produced by regulation on the degree of capitalization (Athanassoglou *et al.* 2008).

Despite the limitations mentioned above, most studies consider both the ROA and the ROE as indicators of bank performance. Other measures are used less frequently, and mostly in combination and together with ROA and ROE. They include the Net Interest Margin, the Economic Value Added (both of them analysed, together with ROA and ROE, by Heffernan and Fu 2008), the Cost Income Ratio (examined with the Net Interest Margin and ROE by De Vincenzo and Quagliarello 2005); Landi and Venturelli 2001 consider, in addition to the ROA, the negative of cost income, in order, they state, to obtain a direct measurement of performance) and the Stock Returns (Beltratti and Stulz 2009).

Factors that have been identified as having an influence on bank performance include external and industry-related variables – linked to the characteristics of the market in which banks perform their activities and to the features of the banking sector – and internal ones, that are banks characteristics, controlled – directly or indirectly – by the management.

The former consist mainly of Gross Domestic Product Growth, interest rates, inflation, tax policy, exchange rate regime, market concentration and development. Since these factors are not the specific subject of our research, it is worth mentioning some of the most recent papers dealing with them, indicated according to the geographical area to which the analysis is referred. As regards Europe, see Athanasoglou *et al.* (2006) for the South Eastern European Region; Davydenko (2011) for Ukraina; Dietrich and Wanzenried (2011) for Switzerland; Trujillo-Ponce (2013) for Spain. With regard to Asia, see Heffernan and Fu (2008) for China; Raza *et al.* (2013) for Pakistan. As regards Africa, see Aburime (2008b) for Nigeria, and Ben Naceur and Goaied (2008) for Tunisia.

In order to review the existing literature on the bank-level determinants of profitability, we suggest a distinction into macro-areas, as follows:

Size

The published literature suggests that the relationship between bank profitability and size is ambiguous. Some studies state that a growing bank size is positively related to bank profitability (Smirlock 1985; Athanasoglou *et al.* 2006; Pasiouras and Kosmidou 2007), because larger banks can benefit from a higher degree of loan and product diversification than smaller ones – economies of scope – (Elsas *et al.* 2010) and from economies of scale (Baumol 1959; Alexiou and Sofoklis 2009; Iannotta *et al.* 2007; Mercieca *et al.* 2007). A positive impact of a large size can also come from the possibility to cut the cost for raising capital, as underlined by Short (1979).

However, other papers point out a weak relationship between size and profitability (e.g. Goddard *et al.* 2004). Also Berger *et al.* (1987), Boyd and Runkle (1993), Miller and Noulas (1997), Athanasoglou *et al.* (2008) highlight that large size can save slightly the costs.

As a result, the effect of the size is non-linear: firstly profitability increases with size, but then it declines. Eichengreen and Gibson (2001) underline that the positive effect size produces on profitability may be up to a certain limit; beyond a threshold the impact could be negative for various difficulties in operating with large structures, such as agency costs and bureaucratic ones (Davydenko 2011). Then negative effects can be linked to hard diversification strategies for minimizing risks, which lead to lower returns and so to reduced profits (Ben Naceur and Goaied 2008; Tan and Floros 2012). Barros *et al.* (2007) argue that larger banks with a higher degree of diversification perform poorly, indicating that smaller and more specialized intermediaries are able to better mitigate the asymmetric information related to the lending activity.

Based on the findings of the literature, we expect either a positive or a negative relationship between size (expressed by the logarithm of Total Assets – Log A) and profitability.

Revenue diversification

As in the case above, the influence produced by the revenue diversification on bank profitability is not definite. There is no doubt that in the background of growing competition and decreasing of the net interest margin, banks have searched for new sources of revenues by diversifying their offer, moving to fee-based services. Positive relationship between revenue diversification and profitability is shown by Chiorazzo *et al.* (2008); Elsas *et al.* (2010); Sufian and Chong (2008); Alper and Anbar (2011). De Vincenzo and Quagliarello (2005) indicate a positive link only for larger banks. Landi and Venturelli (2001) state that the enlargement of the financial services determines higher performances in terms of cost and profit efficiency. Rozga and Kundid (2013) underline that banks with higher product diversification have greater cross-selling opportunities. On the other hand, there are several studies that underline that more diversified banks do not achieve higher performance (Acharya *et al.* 2002; DeLong 2001; DeYoung and Rice 2004; Morgan and Katherine 2003; Stiroh 2004; Stiroh and Rumble 2006; Trujillo-Ponce 2013). Demirgüç-Kunt and Huizinga (1999) state a negative effect on profitability when the diversification regards in particular some activities, such as trade in currencies, derivatives and credit cards provisions, due to the aggressive competition at international level.

In general, the revenues of the non-traditional activities could be not sufficient to compensate the reduction of the net-interest margin, as argued by Lepetit *et al.* (2008). Based on the findings of the literature, we expect either a positive or a negative relationship between revenue diversification (expressed by Net Fees and Commissions over Total Assets – FEE/A) and bank profitability.

Efficiency

The sign of the impact of the operational efficiency (typically expressed by the cost-income ratio, defined as the operating costs – administrative costs, staff salaries and property costs, excluding provisions – over total revenues) on bank profitability is generally shared: the higher the indicator, the lower the efficiency of a bank and the lower its profits (Bourke 1989; Athanasoglou *et al.* 2008; Davydenko 2011; Dietrich and Wanzenried 2011; Heffernan and Fu 2008; Athanasoglou *et al.* 2006; Trujillo-Ponce 2013; Alexiou and Sofoklis 2009; Pasiouras and Kosmidou 2007).

Consistently with the literature, we expect a negative relationship between cost-income ratio (expressed by Non-Interest Expense over Gross Revenues – EXP/REV) and bank profitability.

Credit portfolio

The asset structure influences the profitability through both the volume and the quality of loans granted. There is wide consensus on the fact that a higher incidence of loans in the portfolio of a bank implies better performance (Rhoades and Rutz 1982), by increasing interest revenues due to the higher risk (risk-return trade-off). The reasons of a positive impact on profits are, among others, the liberalization of interest rates and the consequent opportunity for banks to apply markup pricing (Garcia-Herrero *et al.* 2009). Positive effects come also from the opportunities of the cross-selling of services capable to generate fees and commissions (Rozga and Kundid 2013). The way the volume of loans affects banks profitability must be analyzed also in terms of liquidity risk, arising from the possible inability of a bank to accommodate decreases in liabilities or to fund increases on the assets side of the balance sheet: the less liquidity assets, the higher the liquidity risk, the higher profits (Eichengreen and Gibson 2001). The direct link between the relative volume of loans and profitability is shown by several studies: Abreu and Mendes (2002); Angbazo (1997); Barros *et al.* (2007); Chiorazzo *et al.* (2008); DeYoung and Rice (2004); Pasiouras and Kosmidou (2007); Trujillo-Ponce (2013). On the other side, we have also to bear in mind that loans might be more costly both to be produced and monitored than other assets (Iannotta *et al.* 2007), with a consequent negative impact on profits.

Furthermore, on looking at the issue of the credit portfolio and its ability to affect the performance, consideration should also be given to the quality of the loans granted, as a crucial variable for assessing banks profitability: poor quality determines low profit and vice versa. So, even if the higher risk of loans is one of the reasons of their higher returns (Kasman *et al.* 2010; Iannotta *et al.* 2007), it implies also larger accumulation of unpaid loans, affecting negatively the performance through loan losses (Miller and Noulas 1997; Tan and Floros 2012). The same negative impact must be considered if we look at provisions, as a portion of the gross income of a bank to cover expected loans losses (Alexiou and Sofoklis 2009; Athanasoglou *et al.* 2008; Hernando and Nieto 2007).

On the other hand, it should be underlined, as pointed out by Heffernan and Fu (2008), that higher provisioning might indicate a timely recognition of weak loans by prudent banks.

Overall we can conclude that good loan quality is typically associated to good performance, but, as mentioned by Trujillo-Ponce (2013), it could also produce an opposite effect, as it implies more resources tied up to credit underwriting and loan monitoring, leading to increased costs (see also Iannotta *et al.* 2007).

Based on the findings of the literature, we expect either a positive or a negative relationship between credit indicators (expressed by Growth of Gross Loans – GROWL, Net Loans over Total Assets – LOAN/A, and Loan Impairment Charge over Loans – CHA/L) and bank profitability.

Level and structure of capital

Well-capitalized banks tend to perform better: this is the result of several studies (among others, Bourke 1989; Molyneux 1993; Berger 1995; Demirgüç-Kunt and Huizinga 1999; Abreu and Mendes 2002; Staikouras and Wood 2004; Goddard *et al.* 2004; Ben Naceur and Goaied 2001 and 2008; Pasiouras and Kosmidou 2007; Beltratti and Stulz 2009).

More capitalized banks are safer and their ability to perform persists also during a poor economic climate; in other words, the positive impact can be linked, as argued by Athansaglou *et al.* (2008), to the fact that capital works as a safety net in the case of adverse scenario. Further advantages of a higher level of capitalization are connected to the greater creditworthiness of a bank and the lower expected financial distress (including bankruptcy) costs (both for banks and customers) and to the consequent opportunity to lower fundraising as well as funding costs. Lastly, we have to bear in mind the obligations the capital adequacy framework imposes to banks, requiring a minimum level of capital as a percentage of risk-weighted assets; this implies that higher levels of capital tend to characterize banks with riskier assets (Iannotta *et al.* 2007) and therefore with higher profits.

Consistently with the literature, we expect a positive relationship between capital level (expressed by Book Value of Equity over Total Assets – E/A) and bank profitability.

Looking at the structure of banks capital, it is worth considering the portion of common equity over total equity as an important determinant of profitability. This is a key issue also in the light of the recent developments of the capital adequacy framework (Basel 3). Apart from regulation, it is easy to

understand that the higher incidence of the common equity, the greater capacity of absorbing losses. This may imply the opportunity for banks to hold riskier assets, to lower funding costs, and at the same time to enhance their soundness: all these occasions are able to influence positively the performance. Based on above observations, we expect a positive relationship between capital structure (expressed by Common Equity over Total Equity – CE/E) and bank profitability.

Funding

Banks relying more on financing through deposits have a more stable and less expensive funding than banks that rely more on the money market (Beltratti and Stulz 2009; Claeys and Vander Vennet 2008; Garcia-Herrero *et al.* 2009). Based on above observations, banks profitability should improve by increasing deposits and lowering interbank liabilities.

Consistently with the literature, we expect a negative relationship between the indicator of business self-financing (expressed by Loans over Customer Deposits – LOAN/DEP) and profitability. In addition, we expect a positive relationship between the interbank funding indicator (expressed by Interbank Assets over Interbank Liabilities – IA/IL) and bank profitability.

3. Sample, variables, and methodology

Sample

Our sample comprises the 400 biggest European banks at year-end 2012; they are sorted by total assets and based in 26 European countries (Andorra, Austria, Belgium, Bulgaria, Cyprus, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Spain, Sweden, Switzerland, and United Kingdom). We analyze the large European banks, considering they can, more than the others, affect the systemic stability.

The banks are observed over the years 2006-2012, split up into two sub-periods in order to analyze the impact of the recent financial crisis on profitability: the period 2006-2008, when the crisis was not so yet widespread in Europe, and the period 2009-2012, during which European economy plunged into recession. We consider 2008 as the dividing year between the two sub-periods, because – as is well known – it was in September, after the failure of Lehman Brothers, that the financial crisis broke out.

Not all the banks are observed for the whole period since some institutions enter the sample in one of the years after 2006. So our sample is an unbalanced panel dataset: it includes 400 banks in 2012, 394 in 2011, 385 in 2010, 377 in 2009, 374 in 2008, 364 in 2007, and 341 in 2006. Furthermore it consists of 2,635 observations over the entire period, and the observations drop to 1,079 and 1,556 in the years 2006-2008 and 2009-2012 respectively.

Variables

The annual bank-specific data used in our empirical analysis (balance sheet and income statement items) are extracted from the Bureau van Dijk Electronic Publishing and Ficth's Bankscope database, and some ratios are calculated by our own. As in other similar studies (Iannotta *et al.* 2007; Dietrich and Wanzenried 2011), we use consolidated statements, and unconsolidated statements for the banks not belonging to banking groups, thereby avoiding any problems of double-counting and duplicate information in the construction of our database. The dataset is reviewed for reporting errors, outlier values, abnormal ratios, and other inconsistencies.

Hereafter we describe both the dependent and independent variables used in our analysis (see Table 1 for a summary). The dependent variables (ROAA and ROAE) are drawn from the banking literature (see Section 2). We do not use the net interest income divided by total assets, because it considers the profit generated only by interest-bearing activities and therefore it is a crude indicator of profitability (Trujillo-Ponce 2013).

ROAA (Return on Average Assets) is the ratio of Net Income to Average Total Assets. This profitability indicator is our main dependent variable: in fact, as the literature points out (see Section 2), it has become the most common measure of bank profitability, although it produces a positive bias in assessing bank performance since it overlooks off-balance sheet items.

ROAE (Return on Average Equity) is the ratio of Net Income to Average Total Equity. We use the ROAE as an alternative profitability indicator. It lends itself to distorted interpretations: for

example, banks with lower financial leverage, and so with higher capital, usually show a higher ROAA but a lower ROAE (Dietrich and Wanzenried 2011). We report the results for both the profitability indicators (for an analysis of the differences between them, see Athanasoglou *et al.* 2008).

The bank-specific explanatory variables used in the econometric analysis are selected on the basis of the main empirical results shown by previous studies concerning bank-specific determinants of profitability, as illustrated in Section 2. Furthermore, our profitability determinants include some variables not considered in previous research. The variables, which are ten, are described below:

- Log A: The logarithm of Total Assets. Total assets are a proxy for bank size, and so they account for economies/diseconomies of scale, product diversification, and operational efficiency.
- FEE/A: Net Fees and Commissions over Total Assets. This is a business mix indicator, pointing out income diversification and non-interest income sources.
- EXP/REV: Non-Interest Expense over Gross Revenues. This variable, known as Cost- Income Ratio, expresses operational efficiency; in fact, it measures the overheads as a percentage of net income before impairment charges. Non-Interest Expenses include personnel expenses and other operating expenses, such as depreciation, amortisation, administrative expenses, occupancy costs, software costs, operating lease rentals, audit and professional fees.
- LOAN/A: Net Loans over Total Assets. This ratio indicates the way in which the assets side of a balance sheet is structured. Net loans equal gross loans minus reserves for impaired loans/non-performing loans. It serves as a proxy for liquidity and credit risk.
- GROWL: Growth of Gross Loans. This indicator compares the current year's gross loans as a percentage of the gross loans of the previous year. It is a growth indicator associated with credit and liquidity risk.
- CE/E: Common Equity over Total Equity. Common Equity includes common shares and premium, retained earnings, reserves for general banking risks, and statutory reserves. This is a capital structure indicator: the greater the weight of Common Equity, the better the quality of equity.
- E/A: Book value of Equity over Total Assets. This financial leverage indicator measures the amount of protection afforded to the banks by the equity and the banks' ability to withstand losses.
- LOAN/DEP: Loans over Customer Deposits. This liquidity and funding ratio indicates to what extent the bank's relatively illiquid loans are funded by relatively stable customer deposits rather than wholesale or market funding.
- IA/IL: Interbank Assets over Interbank Liabilities. It indicates the dependency of a bank on the other intermediaries in the interbank market and therefore it measures the degree of liquidity in the interbank market.
- CHA/L: Loan Impairment Charge over Loans. This variable expresses the rate of the loan portfolio which has become impaired during the year and has been deducted from the annual profits. It is a proxy for asset quality, so it models credit risk.

Table 1 lists both the dependent and independent variables, showing also the type of indicator and the expected effect on profitability according to literature (see Section 2).

Table 1 - Variables

DEPENDENT VARIABLES: PROFITABILITY INDICATORS			
ROAA	Net Income/Average Total Assets (%)		
ROAE	Net Income/Average Total Equity (%)		
Independent variables	**Description**	**Type of indicator**	**Expected Effect 2006-2012**
Log A	Log of Total Assets	Size indicator	+/-
FEE/A	Net Fees and Commissions/ Total Assets (%)	Business mix indicator	+/-
EXP/REV	Non-Interest Expense/ Gross	Indicator of cost management efficiency	-

DEPENDENT VARIABLES: PROFITABILITY INDICATORS			
	Revenues (%)		
LOAN/A	Net Loans/Total Assets (%)	Credit risk indicator and Liquidity indicator	+/-
GROWL	Growth of Gross Loans (%)	Credit risk indicator, Liquidity risk indicator, and Growth indicator	+/-
CE/E	Common Equity/Total Equity (%)	Capital structure indicator	+
E/A	Total Equity/Total Assets (%)	Financial leverage indicator	+
LOAN/DEP	Loans/Customer Deposits (%)	Loan funding structure indicator and Liquidity indicator	-
IA/IL	Interbank Assets/ Interbank Liabilities (%)	Funding indicator and Liquidity indicator	+
CHA/L	Loan Impairment Charge/Loans (%)	Credit risk indicator	+/-

***Source*:** own elaboration.

Tables 2, 3, and 4 report the descriptive statistics of the variables used in the regression analyses. They include pooled data over the entire period from 2006 to 2012, the period 2006-2008, and finally the period 2009-2012. Overall, the tables show some remarkable differences between mean and median, displaying heterogeneity among the banks in our sample. The correlation matrix is reported in Table 5.

We can deduce that on average the banks of our sample have a ROAA of 0.38% and a ROAE of 5.49% over the entire period and, as expected, both the profitability indicators are lower in the post-crisis years (0.29% and 4.03% on average respectively). The average size of banks increases throughout the observation period (from 86.309 millions of euros in 2006-2008 to 90.890 millions of euros in 2009-2012), while the share of income stemming from fees and commissions over total assets drops slightly during the study years (from 0.70% in 2006-2008 to 0.66% in 2009-2012). The same decrease holds true for the cost-income ratio, which amounts to 64.02% on average over the period 2006-2012. Our banks are mainly retail-oriented: loans as a percentage of total assets amount to 60.27% on average, but the growth of gross loans decreases significantly in the latter period (2009-2012). Besides, Loan Impairment Charge over Loans ratio remains substantially stable. The capitalization of banks is associated with a high quality of equity (on average, Common Equity/Equity stands above 96% during both the sub-periods); the equity ratio is always above 6%, near to 7% in 2009-2012. Most credit is financed through customer deposits (Loans over Customer Deposits ratio is always near to 119%). Finally, Interbank Assets over Interbank Liabilities ratio decreases quite a lot: on average, this indicator goes from 96.86% in the years 2006-2008 to 84.90% in the years 2009-2012.

Table 2 - Descriptive statistics
(pooled data on the period 2006-2012; millions of euros and percentage values)

Variables	Obs.	Mean	Median	Std. Dev.
ROAA	2,635	0.38	0.26	0.69
ROAE	2,635	5.49	4.33	9.10
Total Assets (millions of euros)	2,635	89,014	5,288	284,127
FEE/A	2,635	0.68	0.60	0.54
EXP/REV	2,635	64.02	64.52	12.63
LOAN/A	2,635	60.27	62.12	16.83
GROWL	2,635	5.89	4.14	11.42
CE/E	2,635	97.28	100.00	13.83
E/A	2,635	6.74	6.20	3.39
LOAN/DEP	2,635	118.99	108.91	56.90
IA/IL	2,635	89.80	66.81	84.57
CHA/L	2,635	-0.70	-0.54	1.39

Source: own elaboration.
Note: For a detailed description of the variables see Section 3.

Table 3 - Descriptive statistics
(pooled data on the period 2006-2008; millions of euros and percentage values)

Variables	Obs.	Mean	Median	Std. Dev.
ROAA	1,079	0.52	0.32	0.72
ROAE	1,079	7.59	5.46	9.47
Total Assets (millions of euros)	1,079	86,309	4,822	283,515
FEE/A	1,079	0.70	0.62	0.55
EXP/REV	1,079	64.41	64.96	12.73
LOAN/A	1,079	60.10	61.74	17.00
GROWL	1,079	8.91	6.57	12.63
CE/E	1,079	96.11	100.00	13.55
E/A	1,079	6.46	5.73	3.38
LOAN/DEP	1,079	119.67	109.1	57.08
IA/IL	1,079	96.86	71.12	88.61
CHA/L	1,079	-0.71	-0.56	1.37

Source: own elaboration.
Note: For a detailed description of the variables see Section 3.

Table 4 - Descriptive statistics
(pooled data on the period 2009-2012; millions of euros and percentage values)

Variables	Obs.	Mean	Median	Std. Dev.
ROAA	1,556	0.29	0.24	0.66
ROAE	1,556	4.03	3.89	8.54
Total Assets (millions of euros)	1,556	90,890	5,506	284,627
FEE/A	1,556	0.66	0.59	0.54
EXP/REV	1,556	63.74	64.18	12.55
LOAN/A	1,556	60.40	62.63	16.72
GROWL	1,556	3.79	3.25	9.98
CE/E	1,556	98.09	100.00	13.97
E/A	1,556	6.94	6.62	3.38
LOAN/DEP	1,556	118.52	108.87	56.79
IA/IL	1,556	84.90	63.65	81.32
CHA/L	1,556	-0.69	-0.52	1.41

Source: own elaboration.
Note: For a detailed description of the variables see Section 3.

Table 5 - Correlation Matrix (period 2006-2012)

	Log A	FEE/A	EXP/ REV	LOAN/A	GROWL	CE/E	E/A	LOAN/ DEP	IA/IL	CHA/L
Log A	1									
FEE/A	-0.1296	1								
EXP/REV	-0.1128	0.1175	1							
LOAN/A	-0.183	-0.1436	-0.1592	1						
GROWL	-0.0018	0.0844	-0.121	0.0776	1					
CE/E	-0.0576	-0.0746	0.0112	0.0248	-0.0418	1				
E/A	-0.3139	0.3282	-0.0934	0.1069	0.0953	-0.147	1			
LOAN/DEP	0.3467	-0.1885	-0.1651	0.3464	0.075	-0.0718	-0.0141	1		
IA/IL	-0.0779	0.1339	0.0301	-0.1823	0.0442	-0.037	0.0793	-0.2948	1	
CHA/L	-0.0529	-0.0976	0.0472	0.0832	0.0896	0.0449	-0.0138	-0.0346	-0.0224	1

Source: own elaboration.
Note: For a detailed description of the variables see Section 3.

Methodology

Our econometric setup aims to identify which bank-level characteristics could explain bank profitability. For this purpose, our specification follows a fixed effects (FE) panel data model, as the Hausman test indicates (Table 6), and therefore our baseline equation is as follows:

$$y_{i,t} = \alpha + \beta x_{i,t} + \varepsilon_{i,t} \qquad \text{i= 1…N; t= 1…T} \qquad (3.1.)$$

where $y_{i,t}$ is a measure of bank profitability (ROAA or ROAE) for bank *i* at time *t*, α is a constant term, $x_{i,t}$ is a matrix of bank-specific explanatory variables, and $\varepsilon_{i,t}$ is the error term.

In detail, our empirical investigation is based on the following specifications:

$$ROAA_{i,t} = \alpha + \beta_1 LogA_{i,t} + \beta_2 FEE/A_{i,t} + \beta_3 EXP/REV_{i,t} + \beta_4 LOAN/A_{i,t} + \beta_5 GROWL_{i,t} + \beta_6 CE/E_{i,t} + \beta_7 E/A_{i,t} + \beta_8 LOAN/DEP_{i,t} + \beta_9 IA/IL_{i,t} + \beta_{10} CHA/L_{i,t} + individual\ effects + disturbance\ (\varepsilon) \qquad (3.2.)$$

and:

$$ROAE_{i,t} = \alpha + \beta_1 LogA_{i,t} + \beta_2 FEE/A_{i,t} + \beta_3 EXP/REV_{i,t} + \beta_4 LOAN/A_{i,t} + \beta_5 GROWL_{i,t} + \beta_6 CE/E_{i,t} + \beta_7 E/A_{i,t} + \beta_8 LOAN/DEP_{i,t} + \beta_9 IA/IL_{i,t} + \beta_{10} CHA/L_{i,t} + individual\ effects + disturbance\ (\varepsilon) \qquad (3.3.)$$

However, since a random effects (RE) model would be better to carry out one regression (ROAE as dependent variable during the period 2009-2012; see below), also a RE panel data model is estimated. It allows a comparison of results, and it is useful as robustness check. We concentrate our analysis on regression estimates derived using the Generalized Least Squares (GLS) method, as suggested by the results of the Breusch and Pagan test and the Fisher exact test for heteroscedasticity of residuals (the variability of the error terms between the various sampling units).

Table 6 - Hausman test

Dependent variable (y), years	Results
y = ROAA, 2006-2012	**chi2(10) = 54.76** **Prob>chi2 = 0.0000**
y= ROAE, 2006-2012	**chi2(10) = 30.15** **Prob>chi2 = 0.0008**
y= ROAA, 2006-2008	**chi2(10) =106.62** **Prob>chi2 = 0.0000**
y= ROAE, 2006-2008	**chi2(10) = 65.25** **Prob > chi2 = 0.0000**
y= ROAA, 2009-2012	**chi2(10) = 39.67** **Prob>chi2 = 0.0000**
y = ROAE, 2009-2012	**chi2(10) =16.37** **Prob>chi2 = 0.0894**

Source: own elaboration.

As outlined above, in a first step we estimate our model over the entire period (2006-2012). Then we split up the sample into two sub-periods (2006-2008 and 2009-2012) in order to investigate the impact of the financial crisis on the determinants of bank profitability**.**

4. Empirical findings

Table 7 reports the regression results for ROAA as dependent variable. The results are indicated in three columns according to the periods under observation: all seven years, the years from 2006 to 2008, and the years from 2009 to 2012. There are some significant differences between the results of the three periods related to both the significance and the size of the coefficients.

Our econometric setup follows a fixed effects panel data model, but – as explained above – the model for ROAE as dependent variable during the period 2009-2012 becomes a random effects model. Therefore, the results which we comment are shown in Table 7, Table 8 (columns two and three), and

Table 10 (column four). Table 9, connected with the random effects model for ROAA as dependent variable, is only reported for completeness of analysis.

Table 7 - Regression results for ROAA as dependent variable (fixed effects model)

Dependent variable: ROAA	All years	2006-2008	2009-2012
Log A	-0.000*** (0.000)	-0.000 (0.000)	-0.000 (0.000)
FEE/A	0.109** (0.048)	-0.173*** (0.066)	0.111 (0.099)
EXP/REV	-0.017*** (0.001)	-0.022*** (0.002)	-0.017*** (0.002)
LOAN/A	-0.006*** (0.002)	-0.009** (0.004)	-0.005 (0.004)
GROWL	0.011*** (0.001)	0.007*** (0.001)	0.004** (0.002)
CE/E	-0.001 (0.001)	-0.003* (0.002)	0.001 (0.001)
E/A	0.064*** (0.008)	0.146*** (0.019)	0.069*** (0.012)
LOAN/DEP	0.000 (0.000)	-0.000 (0.001)	0.001 (0.001)
IA/IL	0.000 (0.000)	-0.000* (0.000)	-0.000 (0.000)
CHA/L	0.104*** (0.009)	0.119*** (0.014)	0.068*** (0.015)
Constant	0.000*** (0.000)	0.000*** (0.000)	0.000* (0.000)
Number of observations	2,635	1,079	1,556
Fisher's test for heteroscedasticity	2.74***	2.24***	2.25***
R-squared within R-squared between R-squared overall	0.2593 0.1639 0.1702	0.3145 0.3360 0.3219	0.1330 0.2267 0.1716

Source: own elaboration.

Note: Standard errors are in brackets. The symbol *** indicates a significance level of 1% or less; ** between 1 and 5%; * between 5 and 10%. For a detailed description of the variables see Section 3.

Table 8 - Regression results for ROAE as dependent variable (fixed effects model)

Dependent variable: ROAE	All years	2006-2008	2009-2012
Log A	-0.000*** (0.000)	0.000 (0.000)	-0.000 (0.000)
FEE/A	2.143*** (0.675)	-0.743 (0.966)	1.560 (1.294)
EXP/REV	-0.287*** (0.018)	-0.361*** (0.028)	-0.246*** (0.026)
LOAN/A	-0.079*** (0.029)	-0.179*** (0.055)	-0.032 (0.051)
GROWL	0.161*** (0.014)	0.118*** (0.022)	0.074*** (0.022)
CE/E	-0.057*** (0.015)	-0.124*** (0.024)	0.001 (0.020)
E/A	-0.209** (0.109)	1.213*** (0.276)	0.066 (0.155)
LOAN/DEP	-0.007 (0.007)	-0.020 (0.013)	-0.009 (0.010)

Dependent variable: ROAE	All years	2006-2008	2009-2012
IA/IL	0.007*** (0.002)	0.005 (0.004)	0.003 (0.004)
CHA/L	1.596*** (0.124)	1.122*** (0.206)	1.176*** (0.195)
Constant	0.006*** (0.001)	0.003*** (0.001)	0.003** (0.001)
Number of observations	2,635	1,079	1,556
Fisher's test for heteroscedasticity	2.55***	2.32***	2.52***
R-squared within R-squared between R-squared overall	0.2528 0.0998 0.1493	0.3225 0.2160 0.2385	0.1191 0.1894 0.1511

Source: own elaboration.
Note: Standard errors are in brackets. The symbol *** indicates a significance level of 1% or less; ** between 1 and 5%; * between 5 and 10%. For a detailed description of the variables see Section 3.

Table 9 - Regression results for ROAA as dependent variable (random effects model)

Dependent variable: ROAA	All years	2006-2008	2009-2012
Log A	0.000 (0.000)	0.000*** (0.000)	0.000 (0.000)
FEE/A	0.185*** (0.030)	0.258*** (0.035)	0.116*** (0.038)
EXP/REV	-0.016*** (0.001)	-0.020*** (0.001)	-0.013*** (0.001)
LOAN/A	-0.004*** (0.001)	-0.002* (0.001)	-0.003*** (0.001)
GROWL	0.011*** (0.001)	0.010*** (0.001)	0.005*** (0.001)
CE/E	-0.003*** (0.001)	-0.004*** (0.001)	-0.002** (0.001)
E/A	0.065*** (0.005)	0.079*** (0.006)	0.067*** (0.006)
LOAN/DEP	-0.000 (0.000)	-0.001*** (0.000)	-0.000 (0.000)
IA/IL	0.000** (0.000)	0.000 (0.000)	0.000 (0.000)
CHA/L	0.095*** (0.008)	0.069*** (0.012)	0.089*** (0.011)
Constant	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Number of observations	2,635	1,079	1,556
R-squared within R-squared between R-squared overall	0.2464 0.4274 0.3470	0.2505 0.6189 0.5075	0.1197 0.3667 0.2546

Source: own elaboration.
Note: Standard errors are in brackets. The symbol *** indicates a significance level of 1% or less; ** between 1 and 5%; * between 5 and 10%. For a detailed description of the variables see Section 3.

Table 10 - Regression results for ROAE as dependent variable (random effects model)

Dependent variable: ROAE	All years	2006-2008	2009-2012
Log A	-0.000 (0.000)	0.000*** (0.000)	-0.000 (0.000)
FEE/A	3.103***	3.806***	2.002***

Dependent variable: ROAE	All years	2006-2008	2009-2012
	(0.389)	(0.523)	(0.507)
EXP/REV	-0.272*** (0.014)	-0.332*** (0.020)	-0.229*** (0.018)
LOAN/A	-0.045*** (0.014)	-0.002 (0.019)	-0.057*** (0.017)
GROWL	0.168*** (0.013)	0.131*** (0.019)	0.096*** (0.019)
CE/E	-0.058*** (0.012)	-0.086*** (0.018)	-0.019 (0.015)
E/A	-0.057 (0.064)	0.077 (0.094)	0.077 (0.080)
LOAN/DEP	-0.008* (0.004)	-0.018*** (0.006)	-0.010* (0.005)
IA/IL	0.006*** (0.002)	0.006** (0.003)	0.001 (0.003)
CHA/L	1.428*** (0.111)	0.803*** (0.170)	1.395*** (0.149)
Constant	0.003*** (0.000)	0.003*** (0.000)	0.002*** (0.000)
Number of observations	2,635	1,079	1,556
R-squared within R-squared between R-squared overall	0.2458 0.3227 0.2789	0.2799 0.4407 0.3843	0.1157 0.2937 0.2106

Source: own elaboration.

Note: Standard errors are in brackets. The symbol *** indicates a significance level of 1% or less; ** between 1 and 5%; * between 5 and 10%. For a detailed description of the variables see Section 3.

Results are shown according to the macro-areas of the factors influencing the performance, as differentiated in Section 2. Results are always presented for ROAA as our key dependent variable; if relevant, we add considerations on ROAE.

Size

Banks size (expressed by the logarithm of Total Assets – Log A) negatively affects performance, even though the coefficient is statistically significant, at the 1% level, only for the whole period. As shown by literature (see Section 2), the effect of the size on profitability is unclear, as impacts could be both positive and negative. For our sample, consisting of large banks, it seems that negative results, connected with agency costs, bureaucracy and in general difficulties in managing large structures, outweigh the positive ones, linked to costs savings (economies of scope and scale as well as lower costs of funding). Particularly with respect to economies of scale, it should be stressed that in the last years large European intermediaries, forming our sample, may have already achieved high level of sophistication in terms of technology and productivity and therefore opportunities from exploiting economies of scale may have been limited in the periods considered.

When the dependent variable is ROAE, it is worth highlighting, for the period before the crisis, a positive result, although not significant. This might depend on the fact that many large banks in those years decided to increase ROAE, in order to maximize their own value, and therefore the shareholders returns, by lowering their capitalization (Dietrich and Wanzenried 2011).

Revenue diversification

Higher business mix indicator (expressed by the Net Fees and Commissions over Total Assets – FEE/A) impacts positively on banks profitability. The declining of the result connected to the core business (net interest margin) requires banks to offer various fee-based services, in order to achieve competitive advantages and to find additional sources of income. We have also to bear in mind that higher product diversification implies greater cross-selling opportunities, and therefore further increase of profits. It should be stressed that the banks we have investigated are maybe more

facilitated in obtaining good performance through the diversification strategies, due to their big size (De Vincenzo and Quagliarello 2005); this may help to comment the positive and significant results during the whole period (as well as the positive but not significant coefficient in the years 2009-2012). On the other hand, the negative and significant impact before the crisis might be explained by the fact that the revenues referred to the non-traditional activities have not been the best driver to perform better. In other words, banks mainly focused on deposit and lending operations have achieved higher profits or, in a background of a reduction of the net interest margin, fees and commissions have not been sufficient to balance such decrease (Lepetit *et al.* 2008). These results are quite surprising, as in the pre-crisis years the M&A and trading activities have been considerable, with positive impacts on performance in terms of fees and commissions.

Efficiency

As expected, the negative and highly significant coefficients (at the 1% level) of the operational efficiency indicator (measured by the Non-Interest Expense over Gross Revenues – EXP/REV) are consistent with most of the studies, suggesting also for our sample that an efficient cost management is a prerequisite for improving profitability regardless of the period considered, covering or not the financial crisis.

Credit portfolio

Consistently with the most of literature, the Growth of Gross Loans indicator (GROWL) always has a positive and significant effect on performance, thanks to the increase of the interest revenues linked to the higher risk (risk-return trade-off), to the possibility of fees and commissions generated by the cross-selling of various services, as well as to the connection with the liquidity risk: the less liquidity assets, the higher the liquidity risk, the higher profits.

The negative results of the Net Loans over Total Assets indicator (LOAN/A) might be explained by the higher costs connected with the credit underwriting and loans monitoring (Iannotta *et al.* 2007); so, these results seem to suggest that returns from loans are overcompensated by costs, although the statistical significance of the coefficients differs depending on the period considered: in the years 2009-2012 the coefficient, even if negative, is not significant.

Looking at the Loan Impairment Charge over Loans (CHA/L), our results show a positive and highly (at the 1% level) significant relationship with banks profitability. This may be explained as a consequence of prudent credit risk management in banking practices, focussed on a timely recognition of weak loans (Heffernan and Fu 2008). This may imply, among others, lower costs of funding and therefore benefits in terms of profits.

To sum up the link between the credit portfolio and banks performance, it is worth pointing out that the positive effect, due to the loans volumes, is held back by high provisions, as factor clearly indicating the high risk of borrowers, but at the same time a prudent credit risk management in banking practices.

Level and structure of capital

When ROAA is the dependent variable, unsurprisingly the coefficient of the capital level indicator (expressed by the Book Value of Equity over Total Assets – E/A) is positive and highly significant (at the 1% level); the result is therefore consistent with the published literature.

Moving to ROAE as dependent variable, the negative coefficient of E/A during the whole period can be explained by the link between the level (and the variance) of ROAE on one side and the banks leverage on the other side: the lower leverage, the lower ROAE. On the other hand, in the two sub-periods coefficients become positive, although not significant in the years 2009-2012. This might depend on the accounting treatment of equity costs (equity is almost a cost-free funding source) and on the low refinancing costs, due, among others, to a better creditworthiness of the bank (Rozga and Kundid 2013).

Examining the relationship between bank profitability and the structure of capital (expressed by the Common Equity over Total Equity – CE/E) negative results prevail; this may depend on the fact that, in order to comply to Basel 3, banks had to make certain choices, such as deleveraging and balance-sheet restructuring, with the result of lowering profits.

Funding

Results for funding are ambiguous when ROAA is the dependent variable. On the other hand, when ROAE is the dependent variable the coefficients show signs in line with the expected ones, even if not significant in some cases. This finding may confirm, as stated by Wagner (2007), that the interbank market may be inefficient in providing liquidity when banks are hit by aggregate liquidity shocks.

Conclusion

This paper has investigated empirically how company-level factors affect bank profitability over the period from 2006 to 2012, split up into two sub-periods in order to analyze the impact of the recent financial crisis on profitability: the period 2006-2008 (before the crisis) and the period 2009-2012 (during the crisis). As already stressed, we have decided to assume 2008 as the dividing year between the two sub-periods: in September, after the failure of Lehman Brothers, the financial crisis first broke out. We have used an unbalanced panel dataset of 2,635 observations of the 400 biggest European banks at year-end 2012 over the whole period; the observations drop to 1,079 and 1,556 in the years 2006-2008 and 2009-2012 respectively. The decision to consider a sample of large European banks is due to the fact that they can, more than the others, affect the systemic stability. Our profitability determinants include bank-specific explanatory variables referred to the following macro-areas: size, revenue diversification, efficiency, credit portfolio, level and structure of capital, and funding.

Regression results clearly indicate that the high bank profitability is associated with good cost management efficiency, a low percentage of net loans over total assets, a high growth of gross loans, and a high loan impairment charge over loans. Furthermore, higher equity over total assets indicator increases bank profitability, but this finding applies when ROAA is the dependent variable. In fact, an increase of the equity to total assets ratio cuts ROAE due to the reduction of financial leverage, although this result holds for the entire period and not for the two sub-periods. Our results show generally a negative impact of the common equity over total equity ratio. When ROAA is the measure of profitability, this indicator is significant only before the crisis. We find a negative impact for size as well, highlighting diseconomies of scale and/or scope in the European banking industry. Finally, our study reveals that the relationship between funding indicators and profitability is ambiguous, although some symptoms of the positive impact of customer deposits compared to funding in the interbank market are evident.

Our findings are important because they contribute to extend the existent knowledge of how bank-specific factors affect bank profitability. In fact, our regression results confirm many findings of previous research carried out on this topic. In addition, we seek to analyze the impact of the recent financial crisis on profitability by splitting up the years observed into two sub-periods (the pre-crisis period and the crisis years, in line with Dietrich and Wanzenried 2011), so that we generate new information about the impact of the crisis on European banks. Finally, our profitability determinants include some variables not considered or little used in previous studies (i.e. common equity over total equity, interbank assets over interbank liabilities, growth of gross loans, and loans over customer deposits).

However, our study presents some limitations. First, it does not consider some factors that might increase our understanding of the profitability determinants: among them, factors related to management, ownership, and M&A operations. Second, our analysis does not deal with several important challenges that the banking system is facing, in particular the impacts of the new banking regulation (Basel 3): the new capital requirements and the new liquidity standards could affect bank profitability. In fact, the former may increase ROAA – but lower ROAE –, the latter may have a negative effect on profitability (Trujillo-Ponce 2013). We propose to address these issues, also considering a longer observation period, in future research.

As regards policy implications, our evidence suggests to carry out programmes aimed to reinforce the capitalization of banks and to rethink the banks size: this seems useful to improve bank profitability in the present economic context, characterized by the persistence of the crisis.

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INDIVIDUAL AND REGIONAL EFFICIENCY IN EMERGING STOCK MARKETS: EMPIRICAL INVESTIGATIONS

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Abstract:

Since an investor could earn abnormal profit, understanding the efficiency of stock markets, particularly the emerging ones, is gaining importance with their integration with the developed markets. In this paper I attempt to test the weak form of the efficient market hypothesis for Central and Eastern European (CEE) stock markets: Romania, Hungary, Croatia, Czech Republic and Poland. In this respect, it were used specific tests (unit root, joint variance ratio test, non-parametric runs test) which are performed using daily data for stock market indexes for the period September 1997–September 2014.

According to joint variance tests and Johansen cointegration test, one can argue the CEE stock markets do not exhibit weak form efficiency, both as individual and regional stock market. Non-parametric Runs test suggest that for two out of five countries (Romania, Czech Republic) the successive returns are not independent, i.e. an opportunity to earn excess return using historical prices. Runs test was employed in-depth for specific sub-samples and lead to the conclusion that efficiency is a characteristic that varies over time and across markets, consistent with adaptive market hypothesis.

Keywords: efficiency, random walk, stock markets, return, autocorrelation, Johansen test.

JEL Classification: G14, G15

1. Introduction

The main aim of the paper is to test the weak form of the efficient market hypothesis for several Central and East European (formerly known as CEE) emerging stock markets over the period September 1997 – September 2014[2]. The second aim is to examine if efficiency evolves over the time for specific sub-samples. The third research question is if these stock markets are weak-form efficient as individual stock markets and as a regional stock market. Stock markets interdependence could serve as the basis for global diversification strategy as well as help guide regional financial policy formulation.

Using appropriate techniques, the results reject Efficient Market Hypothesis (EMH hereafter) in long-run and suggest the presence of strong long-term common trends among stock markets, i.e. regional stock markets. Only non-parametric Runs test indicate a potential random walk for Poland, Hungary and Croatia. When the sample is divided, EMH is not rejected for all stock markets in the short-run (sub-sample 2009-2014), which is consistent with adaptive market hypothesis.

The rest of the paper is organized as follows. The second section summarizes the statistical techniques available for testing EMH hypothesis and the empirical findings for CEE the stock markets. Section 3 describes the data and methodology. Results are presented in Section 4 and Section 6 concludes.

2. Literature review

After mixed and challenging results from the 20th century, EMH still constitutes an ongoing debate in the 21st century. A stock market is considered to be efficient in regard to a set of information if the stock price "fully reflects" the entire set of information (Fama 1970). This classical definition rises up two remarks that provide an endless topic for debates. First, the term "fully" implies that EMH is rejected in all cases since none of the markets is able to achieve it. Second, such hypothesis that is asymptotically true placed it in the contention for one of the strongest hypotheses in the world of the social sciences. Albeit the scientist are concerned in identifying the best hypothesis, until a spurious hypothesis is replaced by a better one, all criticisms gain limited value.

[2] Romania, Hungary, Croatia, Czech Republic and Poland.

In terms of financial investments, the validity or the invalidity of the EMH has implications mainly for investors as well as for regulatory authorities and academicians. If the markets are not efficient, the investors could find mispriced assets in order to earn abnormal profits. Therefore, trading strategies such "beat the market" or "hold the market" have to be designed taking into account if future returns can be predicted based on the past return. Second, market inefficiency causes an inefficient allocation of the capital within an economy through the pricing mechanism. In this respect, regulatory authorities have to take the necessary decisions and reforms in order to correct it. Likewise, academicians are interested in understanding financial theories, stock price behavior and risk-return trade off.

Understanding the efficiency of stock markets, particularly the emerging ones, is gaining importance with their integration with the developed markets. This due to the fact that the creation of stock markets in emerging countries was a striking feature in the last period of the 20th century and are extremely volatile. All statistics provide support for the expansion of emerging stock markets, since a well-functioning market generate substantial positive effects, such as attracting foreign investments, improving capital availability or increasing domestic savings. Furthermore, the activity of stock market increases GDP, both the level and growth rate. Ionescu and Tudoreanu (2014) analyze the impact of corporate governance dimensions on companies' financial structure and find that financial structure is significantly influenced by several dimensions of the governance like transparency, environment or corruption.

Market efficiency influence assets pricing, capital allocation and risk pricing and is based on the characteristics such as stock return and stock prices. The conventional form of the random walk model asserts that the returns to be independently and identically distributed (IID). Such model is too restrictive because there is significant evidence of conditional heteroscedasticity in stock returns. Therefore, a more suitable model is the martingale difference sequence (MDS) that allows for heteroscedasticity and has returns uncorrelated. If the stock returns are not predictable it is likely to follow a MDS but not an IID too.

From methodological viewpoint EMH tests the predictability of stock returns on the basis of past price changes. In this respect empirical studies employ a wide array of statistical tests in order to detect different types of deviations from a random walk process. The most commonly used are auto-correlation, unit root test, variance ratio test, runs test, low-dimensional chaos, long memory and calendar anomalies. Lim and Brooks (2011) provide a description of the various methods that can be used in order to test the EMH.

Autocorrelation measures the relationship between the stock return at current period and its value in the previous period. Unit root tests aim to find out if the time series being analyzed is stationary or not. Variance ratio test proposed by Lo and MacKinlay (1988) is motivated by the fact that the variance of a random walk term increases linearly with time. Wright (2000) states that the Lo–Mackinlay VR tests are biased and right-skewed in finite samples and proposes a non-parametric alternative to conventional asymptotic VR tests, using ranks and signs. The Wright tests can be more powerful than the Lo–Mackinlay tests, with several benefits but could lead to an over rejection of the null hypothesis. To deal with this a joint variance-ratio test was proposed, either based on wild bootstrap (Kim, 2006) or signs-based (Kim and Shamsuddin, 2008). Runs test is a non-parametric test that is designed to examine whether successive price changes are independent or not (Guidi *et al.*, 2011).

In terms of empirical evidence, the pioneer in testing EMH is the seminal work of Fama (1970) which distinguishes three forms of stock market efficiency, weak form, semi-strong form and strong form respectively. Like Fama's work, following studies (Fama and French, 1988; Lo and Mackinlay 1988) state that stock returns do not follow random walks and are not IID. Starting with the 2000's when the expansion of European emerging markets was observed extensive research has been carried out on the efficiency of emerging stock markets, including the European countries. It's noteworthy that a summary of all this empirical studies would be too extensive and is beyond the aim of the paper. A comprehensive description of the literature concerning the informational efficiency studies performed on emerging markets is presented by Dragotă and Ţilică (2014) and Nurunnabi (2012).

According to the previous findings, several remarks could be drawn up. First, a category of studies examine a single stock market (Pele and Voineagu, 2008; Pošta, 2008; Zalewska-Mitura and

Hall 1999) whereas other category examines multiple stock markets (Smith 2012; Karadagaly and Omay 2012). Second, there are several approaches in terms of methodology employed, from one kind of test to a mixed of tests available. Third, it dominates the studies performed over stock market indexes (Heininen and Puttonen 2008; Smith 2009) but there could be found studies performed over specific liquid stocks traded (Pošta and Hackl 2007) as well as mixed indexes and individual stocks (Dragotă and Ţilică 2014).

The motivation of the paper stem to the fact that previous studies provide conflicting support for EMH and to the adaptive market hypothesis, i.e. market efficiency tend to develop over time. Thus, and updating in terms of statistical techniques as well as period examined justify the current work. Furthermore, Barna and Năchescu (2014) conclude that financial markets development level is frequently generated by the level of investors' protection. According to their results, financial crises are not a failure of the markets but rather a proof of the regulating and supervision institutions incapacity of adapting to the market reality and to ensure an adequate investors' protection.

This paper contributes to the literature on EMH in several aspects. First and foremost, the empirical study seek to examine the collective efficiency of the CEE stock markets using cointegration test, that to the best of my knowledge has not been examined in previous studies on the efficiency of the CEE stock markets. Second, this study employs some of the most recent statistical techniques like wild bootstrapping of joint variance ratio (VR) tests and joint signs-based VR tests. Furthermore, since data are non-normal this study is focused on the non-parametric tests and includes a runs test, which have been used less in previous findings. Smith (2009) limits his study over 10 emerging European stock markets only to the joint sign-based variance ratio and joint test with wild bootstrap whereas Dragotă and Ţilică (2014) in their study of 20 East European former communist countries include Lo-MacKinlay variance ratio test and runs test. Third, the data covers a large sample that produces more robust results (Boehmer and Wu, 2013) and very recent years, September 1997-September 2014, which have not been covered in previous studies of Central and East European stock markets. Dragotă and Ţilică (2014) use data between January 2008 and December 2010, Guidi *et al.* (2011) between 1999 and 2009 and Smith (2009) between 1998 and 2007. Finally, the results are obtained both for entire period and for specific sub-samples (1997-2004; 2004-2009; 2009-2014) Testing for different sub-periods, particularly the last sub-sample, is useful in assessing if the capital market evolves from an inefficient to an efficient level or if the efficiency level increases/decrease over time.

3. Data and methodology

The time series data consists of daily closing price of stock market indexes for several CEE countries. The source of data is DataStream International and several criteria were applied in order to create the sample. First, according to the OECD terminology CEE group include 13 countries from which were considered only the stock markets with a domestic market capitalization higher than 10 billion $ (world bank data available for 2012)[3].Second, due to geo-political issues for recent period, Ukrainian stock market has been eliminated from the sample. Third, the sample includes observations from 19September 1997 (when the Romanian stock index was launched) to 26September 2014. Thus, there are five CEE countries analyzed: Romania (BET index), Hungary (BUX index), Croatia (CROBEX index), Czech Republic (PX index) and Poland (WIG 20 index).

Figure 1 plots the stock market indexes for all countries for the entire period where we can see that all markets experienced wide movements, particularly during the financial crisis.

[3]Central and Eastern European Countries (CEECs) is an OECD term for the group of countries comprising Albania, Bulgaria, Croatia, the Czech Republic, Hungary, Poland, Romania, the Slovak Republic, Slovenia, and the three Baltic States: Estonia, Latvia and Lithuania.

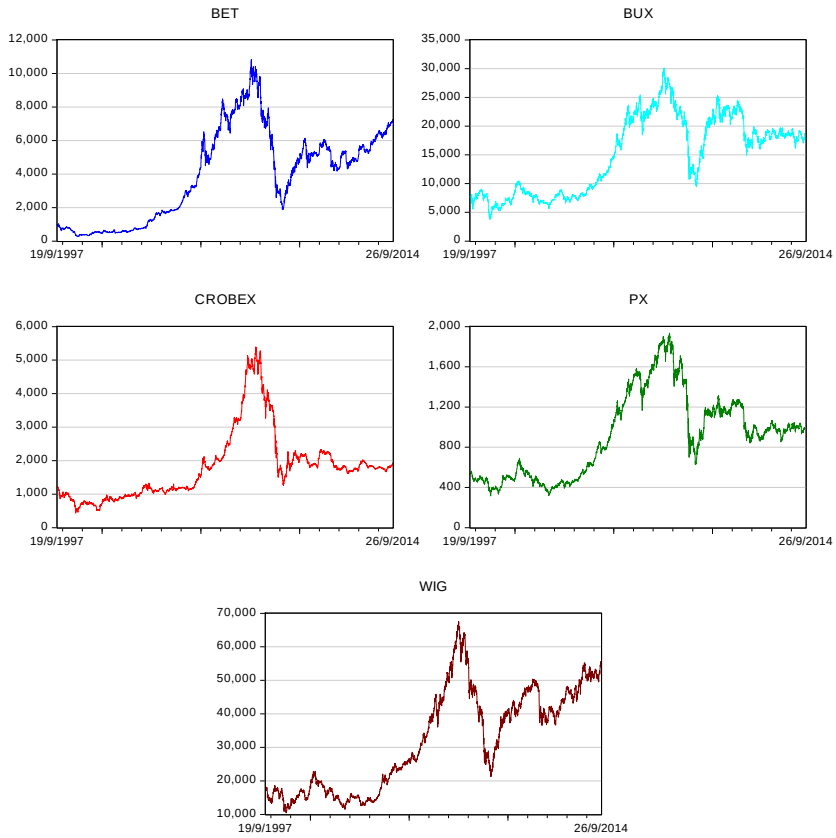

Figure 1 - Daily price in CEE stock market indexes

This behavior constitutes the motivation for the robustness tests where specific sub-samples will be considered. The market return is computed as continuous compounding return using the following formula:

$$R_t = \ln\left(\frac{P_t}{P_{t-1}}\right) \quad (1)$$

where R_t is the index return and P_t and P_{t-1} reflect closing price index at times t and t-1 respectively.

The methodology employed considers both conditions that stem from the implications of EMH as suggested by Fama (1970). First, it was tested for the normality of the CEE stock market returns through descriptive statistics (skewness, kurtosis), Jarque-Bera test and quantile plot. The motivation for this routine is related to the selection of appropriate tests used for the randomness, i.e. parametric and non-parametric test. If time series are not normally distributed then the results generated by parametric tests are biased. Second, it was tested for the independence of successive price returns (no serial correlation) through unit root tests, conventional variance ratio tests and non-parametric tests such as Wright and Runs. Unit root tests is a pre-requisite for the weak-form efficiency hypothesis, since the presence of non-stationarity suggests the randomness behavior (for a complete description of these techniques, see Guidi *et al.* 2011; Jamaani and Roca 2015). Last, in order to examine whether CEE stock markets are efficient individual or as a group, Johansen cointegration test was employed.

In this section, a preliminary analysis is performed in order to test the normal distribution of stock markets. First, Table 1 report descriptive statistics for the continuously compounding returns.

Table 1 - Descriptive statistics

	BET	BUX	CROBEX	PX	WIG
Observations	4440	4440	4440	4440	4440
Mean	0.0004	0.0002	0.0001	0.0001	0.0003
Median	0.0000	0.0000	0.0000	0.0000	0.0000

	BET	BUX	CROBEX	PX	WIG
Maximum	0.115	0.136	0.175	0.124	0.079
Minimum	-0.131	-0.180	-0.134	-0.162	-0.103
Std. Dev.	0.017	0.018	0.016	0.014	0.014
Skewness	-0.283	-0.571	0.060	-0.448	-0.377
Kurtosis	10.474	14.014	19.216	14.589	7.185
Jarque-Bera	10393.87***	22685.22***	48650.54***	24994.24***	3346.134***
BG Test (4)	32.31***	6.84***	3.93***	9.97***	7.81***
ARCHLM(4)	159.88***	135.34***	166.52***	267.94***	125.05***

Source: Authors' calculation

On average, daily market returns for all CEE stock markets analyzed are positive for the period 1997-2014. The highest market returns was recorded in Romania (0.04%) whereas the lowest market returns was recorded in Croatia (0.00103%). When looking to the standard deviation, the highest value was observed in Hungary (1.8%) and the lowest value was observed in Poland (1.422%). Therefore, one can argue that risk-return tradeoff is rejected in CEE stock markets since the highest standard deviation is not achieved by the highest return for the same stock market. Figure 2 exhibits the daily return in the CEE stock market indexes. It's noteworthy that strong volatility is observed in all countries analyzed.

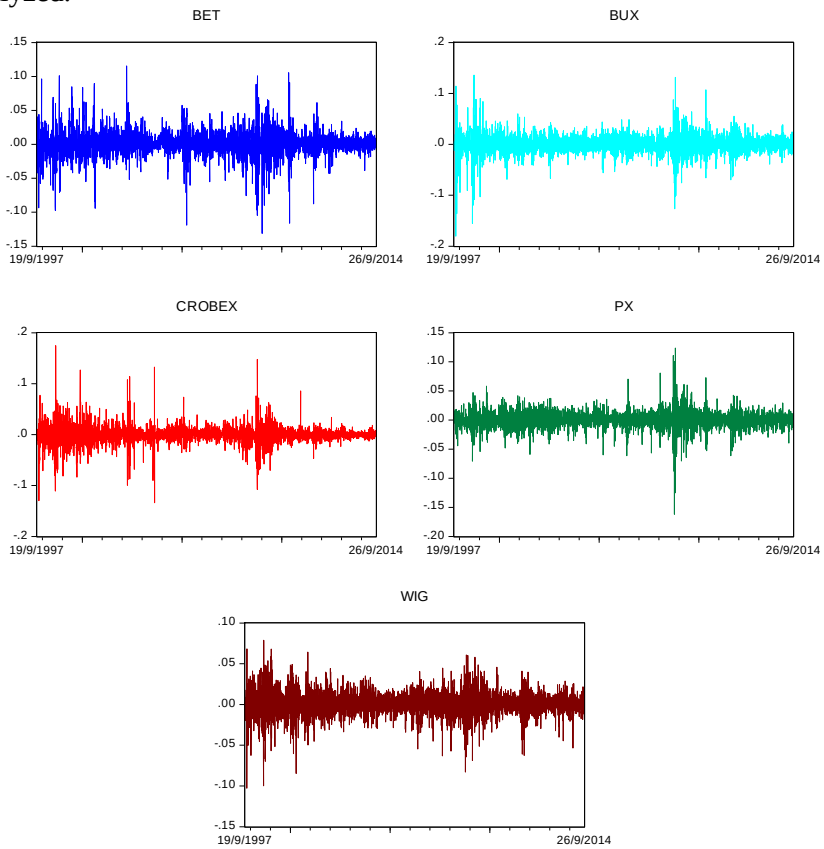

Figure 2 - Daily returns in CEE stock market indexes

Except Croatia, the returns are negatively skewed in all remaining countries, suggesting that large negative returns tend to be larger than the higher positive returns. Daily kurtosis is positive and higher than three for all countries, indicating that the return distributions exhibit fatter tails. These preliminary results reject the Condition 1 of normally distribution for EMH. The deviation from the normality is further supported by Jarque-Bera test which rejects the null hypothesis at 1% level of significance, as well as by normal quantile graph (Figure 3) which display a leptokurtic behavior of the data.

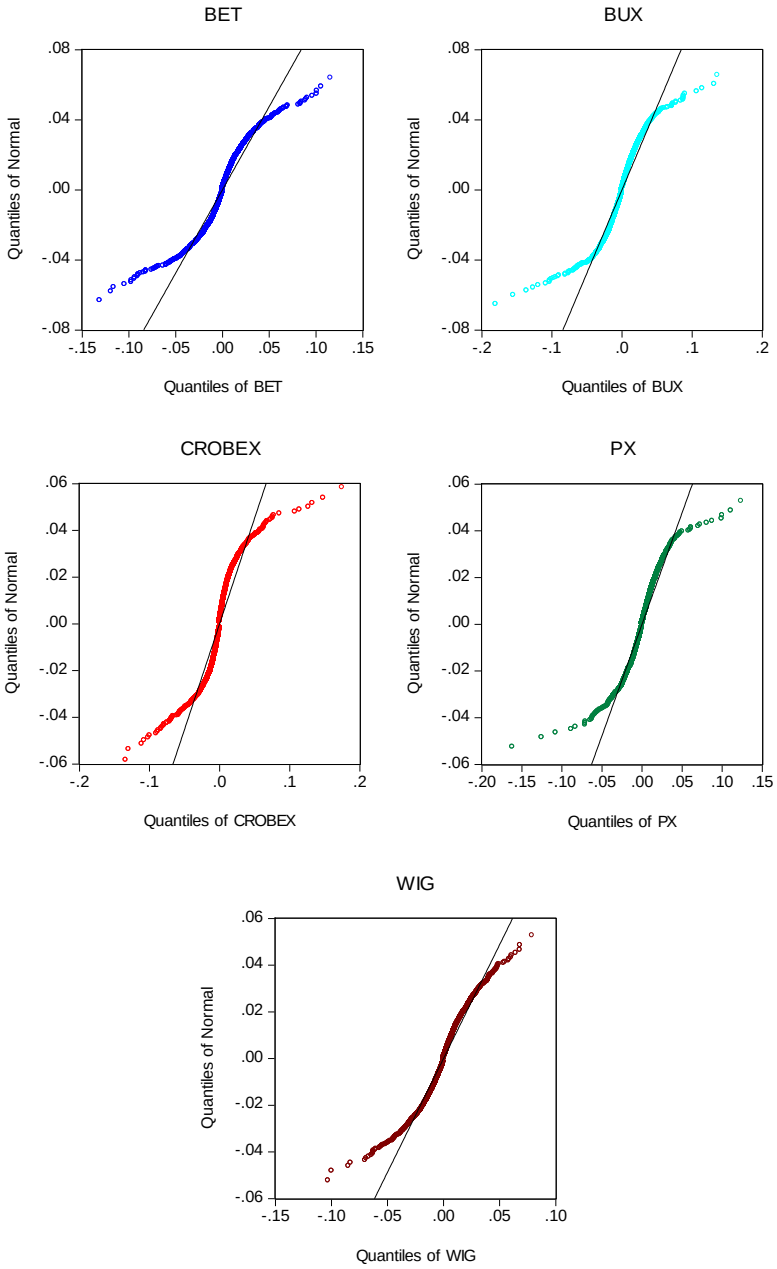

Figure 3 - Normal Quantile-Quantile plot for CEE stock indexes

The Breusch-Godfrey test with four lags rejects the null hypothesis of no serial correlation, while the ARCH LM test with four lags suggests the presence of ARCH effects in the residuals.

4. Results

I examine the presence of a unit root in CEE stock returns using Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) tests with both intercept, and intercept and trend. It could be observed that the test statistics for the each type of test and for each model is considerably higher than the critical values of Mackinnon, as shown in Table 2.

Table 2 - Unit Root Tests

Index	ADF		PP	
	Intercept	Intercept and Trend	Intercept	Intercept and Trend
BET	-38.123***	-38.118***	-38.120***	-38.115***
BUX	-39.082***	-39.121***	-39.125***	-39.177***

Index	ADF		PP	
	Intercept	Intercept and Trend	Intercept	Intercept and Trend
CROBEX	-35.092***	-35.082***	-35.386***	-35.376***
PX	-35.811***	-35.811***	-35.746***	-35.744***
WIG	-35.076***	-35.076***	-34.914***	-34.912***

Note: *** Indicate the rejection at 1% level of significance
Source: Authors' calculation

Based on these results one can argue that all CEE stock market returns reject the null hypothesis of the presence of a unit root, at 1% significance level and therefore the pre-requisite for EMH is accomplished.

The null hypothesis of Condition 2, i.e. the independence of successive returns, is further investigated by variance ratio (VR) tests. Since the data are non-normally distributed, the non-parametric tests are more efficient. For the purpose of comparison, it have been employed both parametric variance ratio tests (Lo-MacKinlay, wild bootstrap) and non-parametric variance ratio tests (rank and rank scores proposed by Wright 2000) but the interpretations are based on the second category. Previous findings support the superiority of Wright tests but at the same time could lead to an over rejection of the null hypothesis. To deal with this, it was employed the joint sign test which is more powerful and show no size distortion (Borges, 2010).

The results for all VR tests conducted using alternative daily intervals (q= 4, 8, 12, 16 and 20 days) are reported in table 3.

Table 3 - Variance Ratio Tests

K	2	4	8	16	20
BET					
M1	0.505***	0.253***	0.122***	0.063***	0.050***
M2	0.505***	0.253***	0.123***	0.064***	0.051***
R1	0.574***	0.341***	0.239***	0.202***	0.197***
R2	0.537***	0.294***	0.183***	0.138***	0.131***
S1	0.725***	0.562***	0.490***	0.453***	0.451***
BUX					
M1	0.522***	0.233***	0.124***	0.063***	0.053***
M2	0.523***	0.234***	0.125***	0.063***	0.053***
R1	0.563***	0.283***	0.179***	0.127***	0.116***
R2	0.537***	0.243***	0.137***	0.079***	0.069***
S1	0.689***	0.512***	0.448***	0.417***	0.418***
CROBEX					
M1	0.560***	0.265***	0.132***	0.074***	0.057***
M2	0.561***	0.266***	0.133***	0.074***	0.058***
R1	0.566***	0.317***	0.215***	0.156***	0.143***
R2	0.556***	0.282***	0.166***	0.110***	0.098***
S1	0.667***	0.490***	0.430***	0.370***	0.360***
PX					
M1	0.569***	0.263***	0.132***	0.067***	0.052***
M2	0.569***	0.264***	0.132***	0.068***	0.053***
R1	0.577***	0.302***	0.190***	0.138***	0.127***
R2	0.569***	0.270***	0.148***	0.090***	0.078***
S1	0.684***	0.484***	0.395***	0.328***	0.319***
WIG					
M1	0.586***	0.279***	0.139***	0.071***	0.056***
M2	0.587***	0.280***	0.140***	0.072***	0.057***

R1	0.589***	0.311***	0.196***	0.139***	0.126***
R2	0.580***	0.281***	0.152***	0.090***	0.077***
S1	0.708***	0.528***	0.441***	0.384***	0.369***

Note: M1 is the homoscedastic of Lo-MacKinlay test; M2 is the heteroscedastic joint test with wild bootstrap distribution; R1 and R2 are joint VR tests for rank and rank score; S1 is a joint test for the sign variance test; *** Indicate the rejection at 1% level of significance.
Source: Authors' calculation

The results of rank and sign based tests (R1, R2 and S1) as well as conventional (M1) or wild bootstrap based test (M2) exhibit significant serial correlation coefficient values indicating a possible predictability between past and current stock price. In other words, for all CEE stock markets analyzed the EMH hypothesis is rejected at the 1% level by all VR tests employed. Furthermore, VRs in daily data is lower than unity, indicating that variances grow less than proportionally with time.

The rejection of EMH is examined in depth through non-parametric runs test. That is, the randomness requires a closer match between the expected and actual number of runs. The results are presented in table 4.

Table 4 - Runs test

Market	# of Obs	Returns < Mean	Returns > Mean	# of Runs	Expected Runs	Z-statistic
Bet	4440	2301	2139	1941	2218.04	-8.33***
Bux	4440	2268	2172	2190	2219.96	-0.9
Crobex	4440	2349	2091	2165	2213.50	-1.46
Px	4440	2247	2193	2127	2220.67	-2.81***
Wig	4440	2258	2182	2215	2220.35	-0.16

Note:*** Indicate the rejection at 1% level of significance
Source: Authors' calculation

Considering the whole period, the number of runs is significantly less than expected in Romania and Czech Republic, which is consistent with positive serial correlation of returns and inconsistent with EMH. The other three countries exhibit more runs than expected, suggesting a random walk behavior.

In order to analyze the potential long-term linkages among CEE stock markets it was implemented the Johansen cointegration test. According to the hypotheses designed Johansen test require that all variables (in this case all indexes) to be integrated at the same order. The unit roots performed over price indexes with both intercept and intercept and trend suggest that all markets are integrated at the first difference at 1% significance level. Therefore, the Johansen test could be performed. Based on the available models, it were selected the most used in the literature, respectively the model that permits intercept in the Cointegration Equation (CE) and VAR and the model that permits intercept in CE and VAR along with linear trend in CE but not for VAR. Simultaneously, for both models it have been selected 4 lags, the results being reported in table 5.

Table 5 - Johansen cointegration test

# of CE	Intercept				Intercept and trend			
	Trace Statistic	5% Critical value	Max-Eigen Statistic	5% Critical value	Trace Statistic	5% Critical value	Max-Eigen Statistic	5% Critical value
None	82.463	69.819***	41.534	33.877***	103.547	88.804***	44.647	38.331***
At most 1	40.929	47.856	20.443	27.584	58.900	63.876	28.635	32.118
At most 2	20.486	29.797	15.477	21.132	30.265	42.915	16.331	25.823
At most 3	5.010	15.495	4.567	14.265	13.934	25.872	10.288	19.387
At most 4	0.443	3.841	0.443	3.841	3.646	12.518	3.646	12.518

Note: *** Indicates the rejection at 1% level of significance
Source: Authors' calculation

All daily CEE stock price data for both models with and without trend, both Trace Statistic and Max-Eigen Statistic rejected the null hypothesis of the presence of no cointegration. One cointegrating equation is present at 1% level of significance, suggesting the presence of strong long-term common trends among CEE stock markets. In other words, one can state that CEE stock markets are not weak-form efficient as a group. Interested investors in this area may be able to predict, for instance, future movement of Hungary stock market from the past movement of the Poland or Czech Republic stock markets.

Since efficiency is a characteristic that varies over time and across markets, i.e. adaptive market hypothesis (Lo 2004), it is of great importance if the behavior for the markets analyzed remains unchanged during the whole period. In this respect, starting from the plot displayed in figure 1, the sub-sample was divided in specific sub-sample. It could be noticed from this figure that all CEE stock markets exhibit wide movements, both increase and decrease, during 2004 and 2009. More specific, the value from the beginning of 2009 was around the value from the beginning from 2004. As a consequence, the sub-samples resulted were during 1997-2004, 2004-2009 and 2009-2014. It's noteworthy that such delimitation has two implications. First, financial crisis pre and post effects were isolated, were increased turbulence occurred. Second, is of interest the sub-sample 2009-2014 since it reflects more closely the current state of development of the markets and it has been covered less in previous studies.

The robustness was performed with runs test, since only this test report mixed results on the CEE stock markets regarding EMH. The results are displayed in table 6 and several remarks could be drawn.

Table 6 - Robustness check - Runs test

Market	# of Obs	Returns < Mean	Returns > Mean	# of Runs	Expected Runs	Z-statistic
Subsample 1997-2004						
Bet	1639	883	756	665	815.58	-7.49***
Bux	1639	837	802	820	820.13	-0.01
Crobex	1639	726	913	819	809.83	0.46
Px	1639	854	785	743	819.05	-3.76***
Wig	1639	847	792	806	819.58	-0.67
Subsample 2004-2009						
Bet	1305	659	646	563	653.44	-5.01***
Bux	1305	651	654	627	653.50	-1.47
Crobex	1305	674	631	602	652.79	-2.82***
Px	1305	621	684	637	651.98	-0.83
Wig	1305	650	655	663	653.49	0.53
Subsample 2009-2014						
Bet	1496	765	731	716	748.61	-1.69
Bux	1496	780	716	745	747.63	-0.14
Crobex	1496	793	703	727	746.29	-1.00
Px	1496	772	724	750	748.23	0.09
Wig	1496	763	733	753	748.70	0.22

Note: *** Indicate the rejection at 1% level of significance
Source: Authors' calculation

First and foremost, for sub-sample 2009-2014 all stock markets follow a random walk process. Such behavior is related to the increased attention accorded to the financial investments after financial crisis, i.e. greater discipline. Second, Hungary and Poland do not reject EMH for all sub-samples which could be explained by their development degree in comparison with the other countries. Third, Croatia and Czech Republic experience different behavior in sub-samples 1997-2004 and 2004-2009.

All this remarks are consistent with adaptive market hypothesis, i.e. EMH may be accepted in some periods while in other periods may be rejected.

The different behavior on EMH for different countries and different sub-samples could be explained by several factors that affects it. Among these, it's noteworthy size, liquidity, the quality of information, the speed it is made available to market participants and the institutional characteristics of the market (Smith, 2009). A distinction between the stock markets included in the sample relates to size, i.e. market capitalization. Based on the selection criteria, these stock markets are the largest from this area in terms of average size, with Poland recording the highest market capitalization (178 US $m in 2012). The second factor is liquidity which facilitates the price formation process. As higher frequent trading is available, there are more opportunities for variations in prices, as a reaction to new information and therefore the market is more likely to exhibit weak-form efficiency. The average liquidity (expressed in turnover ratio, %) is greater in Hungary, Poland and the Czech Republic and smaller in Romania and Croatia. However, these characteristics suggest that liquidity alone is not a sufficient condition for absolute efficiency according to the EMH.

Size and liquidity should be analyzed simultaneously with market quality which is quite difficult to measure it and depend on trading and settlement infrastructure, regulatory environment or information flows. A useful measure is provided by FTSE International which yearly assesses Quality of Markets Criteria for several stock markets[4]. According to the 2013 reports, Poland, Czech Republic and Hungary are classified as "Advanced Emerging Markets" and Romania and Croatia are classified as "Frontier Market". Poland and Hungary meet all criteria for an emerging market (Poland also for a developed market) whereas Czech Republic only the criteria related to Developed Derivatives Market is not met. For Romania and Croatia five respectively six out of 22 criteria are not met. These include four common criteria, (i) Free and well-developed equity market, (ii) Free and well-developed foreign exchange market, (iii) Stock Lending is permitted and (IV) Liquidity.

Overall, the guideline for not rejecting EMH requires the three aforementioned characteristics but could not be generalized. Rather, one can state that as stock markets become larger, more liquid and of better quality they evolve in efficiency. For instance, Poland and Hungary met all three criteria and follow a random walk process whereas Czech Republic meet all criteria but do not follow a random walk process. On the other hand, Croatia met only the size criteria and follows a random walk while Romania met also only the size criteria and do not follow a random walk. Usually, frontier markets are small, illiquid with less information available in comparison with emerging markets.

As a final remark, for long-run the results stands in contrast with previous findings (reject EMH) and for short-run are consistent with previous findings. That is, for small and recent periods, Poland (Smith 2009) or Romania (Dragotă and Ţilică 2014) do not reject EMH. Such information could serve as useful for several investors, according to different time horizon considered.

Conclusion

The main aim of the paper was to examine the efficient market hypothesis for several CEE stock markets, treated as individual and as regional stock market. Secondary, it was of interest if efficiency varies across countries and over time. Using unit root test, parametric and non-parametric variance ratio test and non-parametric Runs test, the results are consistent with adaptive market hypothesis.

For the whole period (September 1997 - September 2014) EMH is rejected, except runs test that suggest random walk for Poland, Hungary and Croatia. Furthermore, Johansen cointegration test suggests that CEE stock markets are not weak-form efficient as a group. For instance, investors in this area may be able to predict, future movement of one CEE stock market from the past movement of the other CEE stock markets. In the recent period (2009-2014), EMH is not rejected for all stock markets. This could be explained through the increased attention accorded to the financial investments after financial crisis.

[4] FTSE International identifies 22 requirements which are classified into four main sectors: market and regulatory environment, custody and settlement, dealing landscape and derivatives. If a stock market meets all 22 quality criteria for a specific category (developed, emerging, frontier), this is described as "Pass", otherwise the number of criteria not met is recorded as a negative number.

Beyond the EMH implications presented in the Introduction section, understanding EMH could serve as a theoretical and predictable model of the operations from the financial markets as well as a tool for issuers' managers to stimulate potential individual and institutional investors for stock market investments.

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THE PRECIOUS METALS VOLATILITY COMOVEMENTS AND SPILLOVERS, HEDGING STRATEGIES IN COMEX MARKET

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Abstract:

This paper examined the precious metals volatility co-movements and spillovers for gold, palladium, platinum and silver in COMEX market. The results of volatility analysis were used to calculate the optimal two-metal portfolio weights and hedging ratios. The data used in this study was the daily data from 2009 to 2014. The three Multivariate GARCH models, namely the VAR (1)-diagonal VECH, the VAR (1)-diagonal BEKK and the VAR (1)-CCC, were employed.

The empirical results overall showed that the estimates of the multivariate GARCH parameters were statistically significant in all cases. This indicates that the short run persistence of shocks on the dynamic conditional correlations was greatest for RGOLD with RSILVER, while the largest long run persistence of shocks to the conditional correlations for RPALLADIUM with RSILVER.

Finally, the results from these optimal portfolio weights base on the VAR (1)-diagonal VECH estimates suggested that investors should had more gold than palladium and other precious metals in their portfolio to minimize risk without lowering the expected return.

Keywords: The precious metals volatility, co-movements and spillovers, multivariate GARCH models, optimal portfolio weights, hedging ratios.

JEL Classifications: G01, G11, G15

1. Introduction

Precious metals can provide the investor with a safe haven in times of economic uncertainty and financial instability and serve as a hedge against unexpected inflation. Moreover, they have been described as a proven asset diversifier that, when included in an investment portfolio, can reduce the overall volatility of one's investment portfolio while enhancing total return. Finally, precious metals have been cited as an excellent stand-alone investment with capital appreciation potential based on supply and demand fundamentals, as well as a host of other market fundamentals. Now, let's discuss the specific characteristics and special uses of each precious metal to gain a better appreciation of why they have been described as "nature's unique gift to mankind".

The precious metals in this study consist of gold, palladium, platinum and silver which are important for the economy and the price movement relatively quickly according to the following details:

Gold

Many holders of gold store it in form of *bullion* coins or *bars* as a hedge against *inflation* or other economic disruptions**.** However, the consumption of gold produced in the world is about 50 percent in jewelry, 40 percent in investments, and 10 percent in industry. According to *World Gold Council* as shown in Table 1, China is the world's largest single consumer of gold in 2013 and toppled India for the first time with Chinese consumption increasing by 32 percent in a year, while that of India only rose by 13 percent and world consumption rose by 21 percent. Unlike India where gold is used for mainly for jewellery, China uses gold for manufacturing and retail.

Table 1 - Gold jewelry consumption by country - in tonnes

YEAR / Countries	2009	2010	2011	2012	2013
India	442.37	745.70	986.30	864.00	974.00
China	376.96	428.00	921.50	817.50	1120.10
United States	150.28	128.61	199.50	161.00	190.00
Turkey	75.16	74.07	143.00	118.00	175.20
Saudi Arabia	77.75	72.95	69.10	58.50	72.20

YEAR / Countries	2009	2010	2011	2012	2013
Russia	60.12	67.50	76.70	81.90	73.30
United Arab Emirates	67.60	63.37	60.90	58.10	77.10
Egypt	56.68	53.43	36	47.80	57.30
Indonesia	41.00	32.75	55.00	52.30	68.00
United Kingdom	31.75	27.35	22.60	21.10	23.40
Japan	21.85	18.50	(30.10)	7.60	21.30
South Korea	18.83	15.87	15.50	12.10	17.50
Vietnam	15.08	14.36	100.8	77.00	92.20
Thailand	7.33	6.28	107.4	80.90	140.10
Other Persian Gulf Countries	24.10	21.97	22.00	19.90	24.60
Other Countries	251.60	254.60	390.40	393.50	450.70
WORLD TOTAL	**1760.30**	**2059.60**	**3487.50**	**3163.60**	**3863.50**

*Source***:** World Gold Council, 2013

Palladium

Palladium is primarily an industrial metal, often used in a number of products as an alloy of platinum. Investment demand for palladium exists, although to a lesser extent than gold and platinum. Approximately 55 percent of the world's total supply of palladium is produced as a co-product of nickel mining in Russia. The second largest source of palladium flows from South Africa, with smaller amounts produced in Canada, the United States, Brazil, Australia, Finland, and Zimbabwe.

The greatest use for palladium is in electric components and connectors. Palladium paste is used in semiconductors found in most personal computers, cellular telephones, and in many types of electronically controlled devices. Palladium is also combined with gold to create dental alloys. Palladium is mixed with gold to lighten the color of the alloy and heighten its corrosion-resistance properties.

The third largest use of palladium is in automobile catalytic converters, where palladium is often combined with platinum. Also, more palladium is now being used in stationary site catalytic devices designed to reduce harmful emissions from certain commercial establishments, such as dry cleaning plants.

Palladium also plays a smaller, but highly important role in the production of jewelry, in chemical process and petroleum refining catalysts, and in brazing alloys.

Platinum

Platinum does just one of six metals comprise the category of metals referred to as the "platinum group metals". The other five are palladium, rhodium, ruthenium, iridium, and osmium. The first known use of platinum dates back to the ancient Egyptians, around the 7th century BC. Although evidence suggests that for many years before metal workers were aware of the presence of another metal in gold they were working with, they were not aware that it was platinum.

The bulk of platinum, 67 percent of total supply comes from South Africa, with significant amounts also recovered in Russia and Canada as a by-product of nickel mining. Other notable areas of platinum production include the United States, Finland, Australia, and the Philippines.

At present, more platinum is consumed in the production of platinum jewelry than in any other application. Demand for platinum jewelry is particularly strong in Japan. The second major use of platinum is in automotive catalytic converters, which are designed to mitigate the pollution caused by exhaust. With tougher auto emission standards being implemented the world over, both developed and developing countries alike are increasingly mandating the use of platinum-bearing catalysts in newly

produced automobiles. Platinum is also widely used in chemical and petroleum refining catalysts, as well as in the electronics and dental sectors.

Platinum's rarity – ten tons of raw ore must be mined on average to produce just one ounce of pure platinum – coupled with its wide industrial usage, renders it an attractive investment alternative to such competing assets as stocks, bonds, and currencies. Some investors actually acquire platinum as a surrogate for gold.

During periods of sustained economic stability and growth, the price of platinum tends to be as much as twice the price of gold, whereas during periods of economic uncertainty, the price of platinum tends to decrease due to reduced industrial demand, falling below the price of gold. Gold prices are more stable in slow economic times, as gold is considered a safe haven and gold demand is not driven by industrial uses.

Silver

Once silver is a standard in the world monetary system, it today plays an important role as both a financial investment asset and industrial commodity. Silver investor purchase physical silver in either bullion bar or coin form, with the majority of the metal presently bought in the United States, Germany, and Canada.

Investment demand for silver also is vibrant in emerging markets. However, in these countries, silver tends to be held in the form of jewelry, ornaments, and religious objects that are easily melted down, recast and resold.

In terms of fabrication demand, silver possesses many physical characteristics that make it a key component in numerous products used in everyday living. The main applications of silver are in jewelry and silverware, photographic films and papers, and electrical contacts and connectors. Silver is also used in mirrors, medical instruments, dental alloys, brazing alloys, batteries, and mechanical bearings.

On a global scale, approximately 58 countries mine silver. The largest silver-producing country is Mexico, followed by the United States, Peru and Canada. Over the past 10 years, the amount of silver extracted from primary silver mines has fallen, while that mined as a co-product of copper, lead, zinc, gold and other metallic deposits has risen. The steady growth in silver bearing products worldwide has also led to increases in the amount of silver recovered from scrap recycling. Most scrap comes from photographic materials, jewelry, and silverware.

Since 1990, there has existed each year a growing imbalance in the amount of silver consumed throughout the globe when compared to that produced. This shortfall in annual silver supplies is presently being accommodated by a drawdown of the "above ground" supplies, which refers to silver already stored in vaults around the world. Recently, this situation has been recognized by some well-known and well reputed investors as an excellent opportunity to acquire silver as a longer term investment strategy, a fact that would seem to indicate their belief the current deficit in annual production supply is likely to persist, and perhaps worsen.

We explain the importance of the precious metals to investors based on the content above. Later, the description of trading in COMEX market which it is the primary market for trading metals. Formerly known as the Commodity Exchange Inc., the COMEX merged with the New York Mercantile exchange in 1994 and became the division responsible for metals trading and has created the world's largest physical trading exchange.

And the price of the precious metals which changes rapidly. Therefore, we are interested in the study by using multivariate GARCH model and hedging strategies which will be explained in the next section by elements of the content from now on, which is related to the literature reviews, research methodology and empirical results.

2. Literature reviews

We have a collection of articles in the analysis of the volatility associated with metals. Bracker and Smith (1999) and Smith and Bracker (2003) apply the GARCH and EGARCH models to copper futures prices, and find these specifications to better explain volatility behavior for copper than do other models. McKenzie *et al.* (2001) explored the applicability of the univariate power ARCH (PARCH) model to precious metals futures contracts traded at the London Metal Exchange (LME),

and found that asymmetric effects are not present, and the model did not provide an adequate explanation of the data.

Batten and Lucey (2007) studied the volatility of gold futures contracts traded on the Chicago Board of Trade (CBOT) using intraday and interday data. They used the univariate GARCH model to examine the volatility properties of the futures returns and the alternative nonparametric volatility static model of Garman and Klass (1980) to provide further insights into intraday and interday volatility dynamics of gold. The results of both measures provided significant variations within and between consecutive time intervals. They also found a low correlation between volatility and volume.

Bhar *et al.*(2008) used the univariate GARCH model to examine the behavior of the short-run stationary components of four oil benchmarks in terms of nonlinearity and chaotic structure, Yang and Brorsen (1993) concluded that palladium, platinum, copper and gold futures have chaotic structures.

In contrast, Adrangi and Chatrath (2002) found that the nonlinearity in palladium and platinum is inconsistent with chaotic behavior. They concluded that ARCH-type models, with controls for seasonality and contractibility, explained the nonlinear dependence in their data for palladium and platinum.

In comparison with other studies on commodities, Plourde and Watkins (1998) compared the volatility in the prices of nine non-oil commodities to the volatility in oil prices. On the basis of several non-parametric and parametric tests, they found that oil prices tend to be more volatile than the prices of gold, silver, tin and wheat, and argued that the differences are more evident in the case of precious metals.

Hammoudeh and Yuan (2008) used three different univariate GARCH models to investigate the volatility and leverage properties of two precious metals (gold and silver) and one base metal (copper). They found that in the standard univariate GARCH model, gold and silver have almost the same conditional volatility persistence, which is higher than that of the pro-cyclical copper. In the EGARCH model, they found that only copper has an asymmetric effect and the transitory component of volatility converges to equilibrium faster for copper than for gold and silver in the CGARCH model. Using a rolling AR (1)-GARCH model, Watkins and McAleer (2008) showed that the conditional volatility for two nonferrous metals, namely aluminum and copper, is time-varying over a long horizon.

Finally, there are few studies that have used multivariate GARCH to examine volatility transmissions across commodities. Hammoudeh *et al.* (2004) use a trivariate BEKK model to examine the volatility between oil prices and oil industry equity indices. Hammoudeh et al. (2010) examines volatility spillovers and optimal portfolio for systems that include the dollar/euro exchange rate together with four important and highly traded commodities - aluminum, copper, gold and oil - in symmetric and asymmetric multivariate GARCH and DCC models. The inclusion of exchange rate increases the significant direct and indirect past shock and volatility effects on future volatility between the commodities in all the models. In the side of the optimal portfolios, suggested that they should have more euro currency than commodities, and more copper and gold than oil.

3. Research methodology

Multivariate GARCH Models

The basic idea to extend univariate GARCH models to multivariate GARCH models is that it is significant to predict the dependence in the comovement of the precious metal returns in a portfolio. To recognize this feature through a multivariate model would generate a more reliable model than separate univariate models.

In the first place, one should consider what specification of a multivariate GARCH model should be imposed. On the one hand, it should be flexible enough to state the dynamics of the conditional variances and covariances. On the other hand, as the number of parameters in a multivariate GARCH model increase rapidly along with the dimension of the model, the specification should be parsimonious to simplify the model estimation and also reach the purpose of easy interpretation of the model parameters. However, parsimony may reduce the number of parameters, in which situation the relevant dynamics in the covariance matrix cannot be captured. So it is important to get balance between the parsimony and the flexibility when designing the multivariate GARCH

model specification. Another feature that multivariate GARCH models must satisfy is that the covariance matrix should be positive definite.

Several different multivariate GARCH model formulations have been proposed in the literature, and the most popular of these are the diagonal VECH, the diagonal BEKK and CCC models. Each of these is discussed briefly in turn below; for a more detailed discussion, see Kroner and Ng (1998).

The diagonal VECH model

The first multivariate GARCH model was introduced by Bollerslev, Engle and Wooldridge in 1988, which is called VECH model. It is much general compared to the subsequent formulations. In the VECH model, every conditional variance and covariance is a function of all lagged conditional variances and covariances, as well as lagged squared returns and cross-products of returns. The model can be expressed below:

$$VECH(H_t) = c + \sum_{j=1}^{q} A_j VECH(\varepsilon_{t-j}\varepsilon'_{t-j}) + \sum_{j=1}^{p} B_j VECH(H_{t-j}), \quad (1)$$

where $VECH(H_t)$ is an operator that stacks the columns of the lower triangular part of its argument square matrix, H_t is the covariance matrix of the residuals, N presents the number of variables, t is the index of the t^{th} observation, c is an $\frac{N(N+1)}{2}\times 1$ vector, A_j and B_j are $\frac{N(N+1)}{2}\times\frac{N(N+1)}{2}$ parameter matrices and ε is an $N\times 1$ vector.

The condition for H_t is to be positive definite for all t is not restrictive. In addition, the number of parameters equals to $(p+q)\times\left(\frac{N(N+1}{2}\right)^2+\frac{N(N+1)}{2}$, which is large. Furthermore, it demands a large quantity of computation.

The diagonal VECH model, the restricted version of VECH, was also proposed by Bollerslev, et al (1988). It assumes the A_j and B_j in equation (1) are diagonal matrices, which makes it possible for H_t to be positive definite for all t. Also, the estimation process proceeds much smoothly compared to the complete VECH model. However, the diagonal VECH model with $(p+q+1)\times N\times\frac{(N+1)}{2}$ parameters is too restrictive since it does not take into account the interaction between different conditional variances and covariances.

The diagonal BEKK model

To ensure positive definiteness, a new parameterization of the conditional variance matrix H_t was defined by Baba, Engle, Kraft and Kroner (1990) and became known as the BEKK model, which is viewed as another restricted version of the VECH model. It achieves the positive definiteness of the conditional variance by formulating the model in a way that is property is implied by model structure.

The form of the BEKK model is as follows:

$$H_t = CC' + \sum_{j=1}^{q}\sum_{k=1}^{K} A'_{kj}\varepsilon_{t-j}\varepsilon'_{t-j}A_{kj} + \sum_{j=1}^{p}\sum_{k=1}^{K} B'_{kj}H_{t-j}B_{kj} \quad (2)$$

where A_{kj}, B_{kj} and C are $N\times N$ parameter matrices, and C is a lower triangular matrix. The purpose of decomposing the constant term into a product of two triangle matrices is to guarantee the positive semi-definiteness of H_t. Whenever $K>1$, an identification problem would be generated for the reason that there are not only single parameterizations that can obtain the same representation of the model.

The first order BEKK model is

$$H_t = CC' + A'\varepsilon_{t-1}\varepsilon'_{t-1}A + B'H_{t-1}B \quad (3)$$

The BEKK model also has its diagonal form by assuming A_{kj}, B_{kj} matrices are diagonal. It is a restricted version of the diagonal VECH model. The most restricted version of the diagonal BEKK model is the scalar BEKK one with $A = aI$ and $B = bI$ where a and b are scalars.

Estimation of a BEKK model still bears large computations due to several matrix transpositions. The number of parameters of the complete BEKK model is $(p+q)KN^2 + \frac{N(N+1)}{2}$. Even in the diagonal one, the number of parameters soon reduces to $(p+q)KN + \frac{N(N+1)}{2}$, but it is still large. The BEKK form is not linear in parameters, which makes the convergence of the model difficult. However, the strong point lies in that the model structure automatically guarantees the positive definiteness of H_t. Under the overall consideration, it is typically assumed that $p = q = K = 1$ in BEKK form's application.

The Constant Conditional Correlations (CCC) model

The CCC model was introduced by Bollerslev in 1990 to primarily model the condition covariance matrix indirectly by estimating the conditional correlation matrix. The conditional correlation is assumed to be constant while the conditional variances are varying.

Consider the CCC model of Bollerslev (1990):

$$y_t = E\langle y_t \,|\, F_{t-1}\rangle + \varepsilon_t \quad , \quad \varepsilon_t = D_t\eta_t \quad (4)$$

$$\text{var}\langle \varepsilon_t \,|\, F_{t-1}\rangle = D_t\Gamma D_t$$

where $y_t = \left(y_{1t},...,y_{mt}\right)'$, $\eta_t = \left(\eta_{1t},...,\eta_{mt}\right)'$ is a sequence of independently and identically distributed (i.i.d) random vectors, F_t is the past information available at time t, $D_t = diag\left(h_t^{1/2},...,h_m^{1/2}\right)$, m is the number of returns, and $t = 1,...,n,$. As $\Gamma = E\langle \eta_t\eta_t' \,|\, F_{t-1}\rangle = E\left(\eta_t\eta_t'\right)$, where $\Gamma = \{\rho_{ij}\}$ for $i, j = 1,...m,$ the constant conditional correlation matrix of the unconditional shocks, η_t, is equivalent to the constant conditional covariance matrix of the conditional shocks, ε_t, from (4), $\varepsilon_t\varepsilon_t' = D_t\eta_t\eta_{t-1}'D_t$, $D_t = \left(diag\ Q_t\right)^{1/2}$, and $E\langle \varepsilon_t\varepsilon_{t-1}' \,|\, F_{t-1}\rangle = Q_t = D_t\Gamma D_t$, where Q_t is the conditional covariance matrix.

The CCC model assumes that the conditional variance for each return $h_{it}, i = 1,...,m$, follows a univariate GARCH process, that is

$$h_t = \omega_t + \sum_{j=1}^{r}\alpha_{ij}\varepsilon_{i,t-j}^2 + \sum_{j=1}^{s}\beta_{ij}h_{i,t-j} \quad , \quad (5)$$

where α_{ij} represents the ARCH effect, or short run persistence of shocks to return i, β_{ij} represents the GARCH effect, and $\sum_{j=1}^{r}\alpha_{ij} + \sum_{j=1}^{s}\beta_{ij}$ denotes the long run persistence.

Model estimation for multivariate GARCH

Under the assumption of conditional normality, the parameters of the multivariate GARCH models of any of the above specifications can be estimated by maximizing the log-likelihood function.

$$\ell(\theta) = -\frac{TN}{2}\log 2\pi - \frac{1}{2}\sum_{t=1}^{T}\left(\log|H_t| + \varepsilon_t'H_t^{-1}\varepsilon_t\right) \quad (6)$$

where θ denotes all the unknown parameters to be estimated, N is the number of the precious metal prices and T is the number of observations and all other notation is as above. The maximum-likelihood estimates for θ is asymptotically normal, and thus traditional procedures for statistical inference are applicable.

4. The purpose of this study

The purpose is to analyze the precious metals volatility comovements and spillovers among major precious metals including gold, palladium, platinum and silver by using multivariate GARCH, namely the diagonal VECH, the diagonal BEKK and CCC model and choose the best way for such analysis. In addition, continue to manage in hedging strategies.

5. Data

The data used in this study is the daily data from 28 October 2009 to 21 August 2014. We will get 1216 observations. The data is derived from www.quandl.com and trade in COMEX market. Moreover, data analysis can be carried out using EVIEWS 8. The four precious metals return is defined as:

$$R_t = \log\left(\frac{P_t}{P_{t-1}}\right) \tag{7}$$

where P_t is the precious metals price at time t and P_{t-1} is the precious metals price at time $t-1$.The R_t of equation (7) will be used in observing the volatility of the precious metals between the selected metals over the period 2009 to 2014. We can create the variables of the return on the precious metals as follows:

The returns of gold = RGOLD, the returns of palladium = RPALLADIUM, the returns of platinum = RPLATINUM and the returns of silver = RSILVER.

In addition, we can show the movement of the daily four precious metal prices and returns according to Figure 1 and Figure 2.

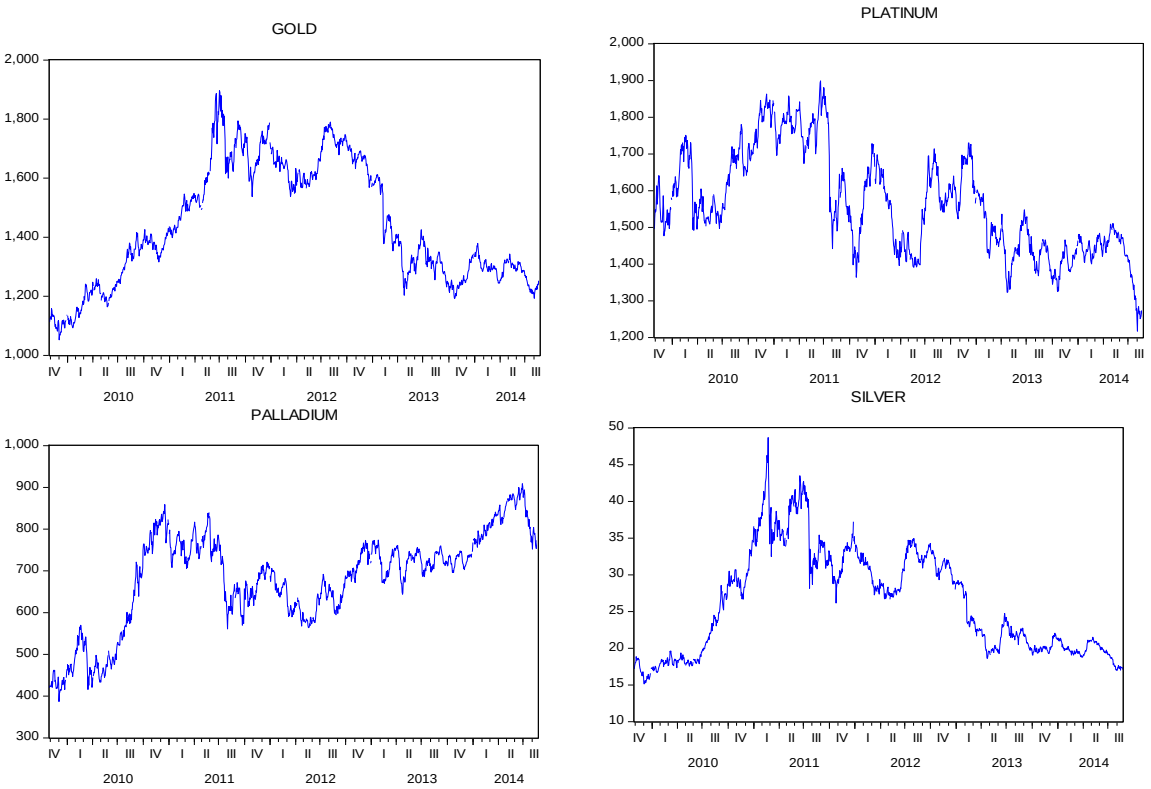

Figure 1 - The daily four precious metal prices

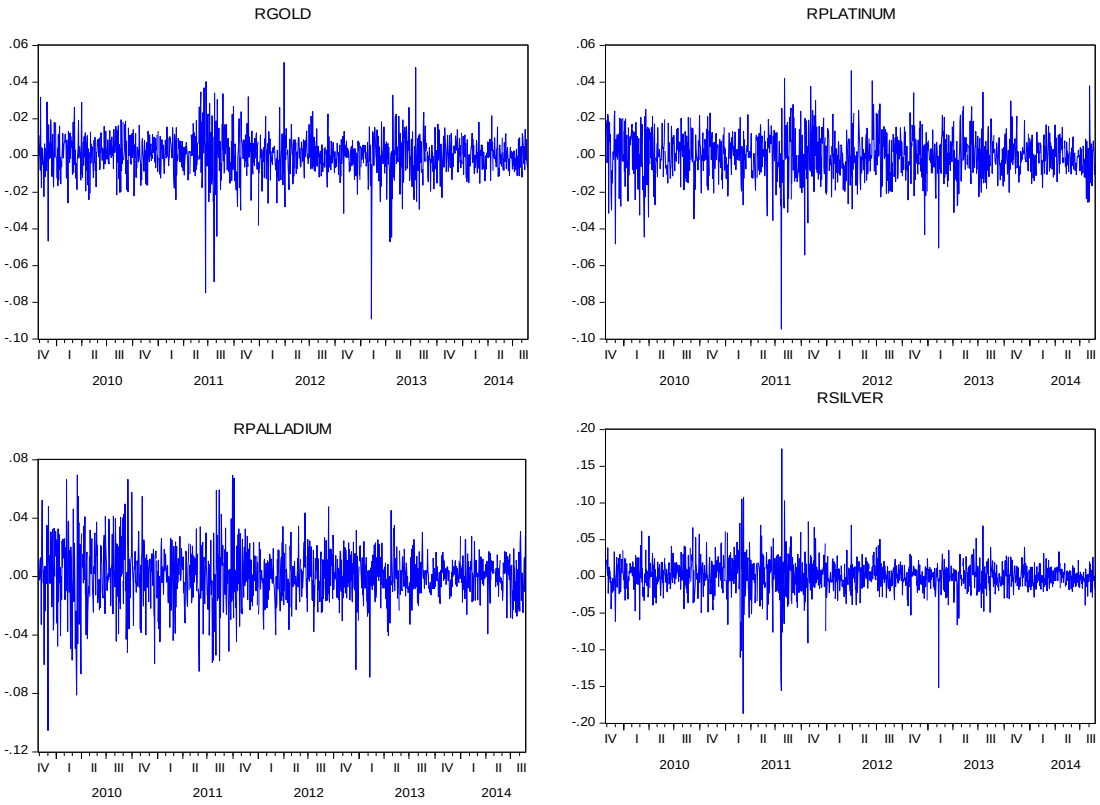

Figure 2 - The daily four precious metal returns

The descriptive statistics are given in Table 2. The daily returns of silver (RSILVER) display the greatest variability with the mean of -4.81E-06%, a maximum of 0.1736%, and a minimum of -0.1869%. Furthermore, the skewness, the kurtosis and the Jarque-Bera Lagrange multiplier statistics of all metal returns are statistically significant, thereby implying that the distribution is not normal.

Table 2 - Descriptive statistics

Returns	RGOLD	RPALLADIUM	RPLATINUM	RSILVER
Mean	8.34E-05	0.000517	-0.000145	-4.81E-06
Median	0.000387	0.00136	0.0000	0.0000
Maximum	0.0507	0.0696	0.0461	0.1736
Minimum	-0.0891	-0.1053	-0.0946	-0.1869
Std. Dev.	0.0112	0.0189	0.0123	0.0238
Skewness	-0.8299	-0.3151	-0.5773	-0.6609
Kurtosis	10.0943	5.3072	6.6583	13.2650
Jarque-Bera	2687.414	289.6139	745.0484	5422.883

Beside all these, the return series will be used to construct the conditional mean and the conditional variances in next.

6. Unit Root Tests

Standard econometric practice in the analysis of financial time series data begins with an examination of unit roots. The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are used to test for all the precious metal returns under the null hypothesis of a unit root against the alternative hypothesis of stationarity. The results from unit root tests are presented in Table 3. The tests yield negative values in all cases for levels, such that the individual returns series reject the null hypothesis at the 1% significance level, so that all returns are stationary.

Table 3- Unit Root Tests

Returns	Augmented Dickey-Fuller Test				Phillips-Perron Test			
	Constant		Constant and Trend		Constant		Constant and Trend	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
RGOLD	-35.783***	-19.408***	-35.854***	-19.399***	-35.850***	-559.616***	-35.948***	-559.251***
RSILVER	-40.084***	-40.164***	-17.620***	-17.612***	-40.178***	-40.347***	-417.250***	-416.863***
RPLATINUM	-33.861***	-17.346***	-33.872***	-17.337***	-33.872***	-399.320***	-33.882***	-398.948***
RPALLADIUM	-34.899***	-17.863***	-34.903***	-17.856***	-35.018***	-387.253***	-35.033***	-386.974***

*** denote significance at the 1% level

7. Empirical results

An important task is to model the conditional mean and conditional variances of the return series. Therefore, the appropriate multivariate conditional volatility models given as VAR (1) - diagonal VECH, VAR (1)-diagonal BEKK and VAR (1)-CCC models are estimated. The conditional mean comes from VAR (Vector Autoregression Model) which can display the source as follows:

Vector Autoregression Model

Let $Y_t = (Y_{1t}, Y_{2t}, ..., Y_{nt})'$ denote a $k \times 1$ vector of the precious metal return series variables. The basic vector autoregressive model of order p, VAR (p), is:

$$Y_t = c + \Pi_t Y_{t-1} + \Pi_2 Y_{t-2} + ... + \Pi_p Y_{t-p} + \mu_t, \quad t = 1,...T, \qquad (8)$$

where Π_t are $k \times k$ matrices of coefficients, c is a $k \times 1$ vector of constants and μ_t is an $k \times 1$ unobservable zero mean white noise vector process with covariance matrix $\sum$.

As in the univariate case with AR processes, we can use the lag operator to represent VAR (p)

$$\Pi(L)Y_t = c + \mu_t, \qquad where \quad \Pi(L) = I_n - \Pi_1 L - ... - \Pi_p L^p$$

If we impose stationarity on Y_t in (8), the unconditional expected value is given by:

$$\mu = (I_n - \Pi_1 - ... - \Pi_p)^{-1} c.$$

Lag Length Selection**:** A reasonable strategy how to determine the lag length of the VAR model is to fit VAR (p) models with different orders $p = 0,..., p_{\max}$ and choose the value of p which minimizes some model selection criteria. Model selection criteria for VAR (p) could be based on Akaike (AIC), Schewarz-Bayesian (BIC) and Hannan-Quinn (HQ) information criteria.

Before we construct the conditional mean, the first thing to do is to find the right lag of VAR model as shown in Table 4. From the various criterions are found to be selected lag that 1, 7 and 0. Most of them will choose lag 1. We therefore conclude that lag 1 should be suitable for the conditional mean.

Table 4 - Lag order selection

Lag	LR	FPE	AIC	SC	HQ
0	NA	3.33e-16	-24.286	-24.269*	-24.280
1	113.029	3.11e-16*	-24.353*	-24.269	-24.332*
2	14.492	3.16e-16	-24.339	-24.187	-24.282
3	18.577	3.19e-16	-24.328	-24.108	-24.245
4	16.192	3.24e-16	-24.315	-24.028	-24.207
5	18.238	3.27e-16	-24.304	-23.949	-24.170
6	23.029	3.30e-16	-24.297	-23.875	-24.138
7	39.359*	3.27e-16	-24.304	-23.814	-24.119
8	14.863	3.32e-16	-24.290	-23.733	-24.080

Note: * indicates lag order selected: LR = Sequential modified LR test statistic, FPE = Final prediction error, AIC = Akaike information criterion, SC = Schwarz information criterion, HQ = Hannan-Quinn information criterion

After all multivariate conditional volatility models in this paper are already estimated. The next step, we will have to explain that the results of each model and select the best model.

The VAR (1)-diagonal VECH estimates of the conditional correlation between the volatilities of the four precious metal returns base on estimating the univariate GARCH (1,1) model for each the precious metals are given in Table 5. The estimates of the VAR (1) - diagonal VECH parameters that θ_1 and θ_2 are statistically significant in all cases. This indicates that the short run persistence of shocks on the dynamic conditional correlations is greatest for RGOLD with RSIL at 0.068 (θ_1), while the largest long run persistence of shocks to the conditional correlations is 0.963 ($\theta_1 + \theta_2$) for RPAL. with RSIL.

The VAR (1)-diagonal BEKK estimates of the conditional correlation between the volatilities of the four precious metal returns are given in Table 6. The estimates of the diagonal BEKK parameters that θ_1 and θ_2 are statistically significant in all cases. This indicates that the short run persistence of shocks on the dynamic conditional correlations is greatest at 0.050 for RGOLD with RSIL., while the largest long run persistence of shocks to the conditional correlations is 0.983 ($\theta_1 + \theta_2$) for RPAL. with RSIL.

Finally, in Table 7 presents the estimates for the VAR (1)-CCC model, with $p = q = r = s = 1$. The ARCH and GARCH estimates of the conditional variance between the four precious metal returns are statistically significant in all cases. The ARCH (α) estimates are generally small (less than 0.2), and the GARCH (β) estimates are generally high (more than 0.8) and close to one. Therefore, the long run persistence ($\alpha + \beta$), is generally to one, indicating a near long memory process. This indicates a near long memory process. In addition, since $\alpha + \beta < 1$, all metals satisfy the second moment and log-moment condition, which is a sufficient condition for the QMLE (quasi-maximum likelihood) to be consistent and asymptotically normal. VAR (1)-CCC estimates of the constant conditional correlation between RGOLD and RSIL with the highest in 0.809. This indicates that the standardized shock on the constant conditional correlation for RGOLD with RSIL is 0.809.

Furthermore, we will choose the best model next by considering the value of log-likelihood, AIC, SIC and HQ. From the Table 5, 6 and 7, we found that the VAR (1) - diagonal VECH model is highest log-likelihood equal 15321.96. AIC and HQ are lowest, equal -25.159, and -25.080, respectively. Thus, it can be concluded that we should choose the VAR (1) - diagonal VECH model in volatility analysis of the precious metal returns and the results of this model are used to calculate the optimal two-metal portfolio weights and hedging ratios.

However, we can show the movement of the conditional covariance and the conditional correlation of the four precious metal returns in each model according to Figure 3, 4, 5, 6 and 7, respectively.

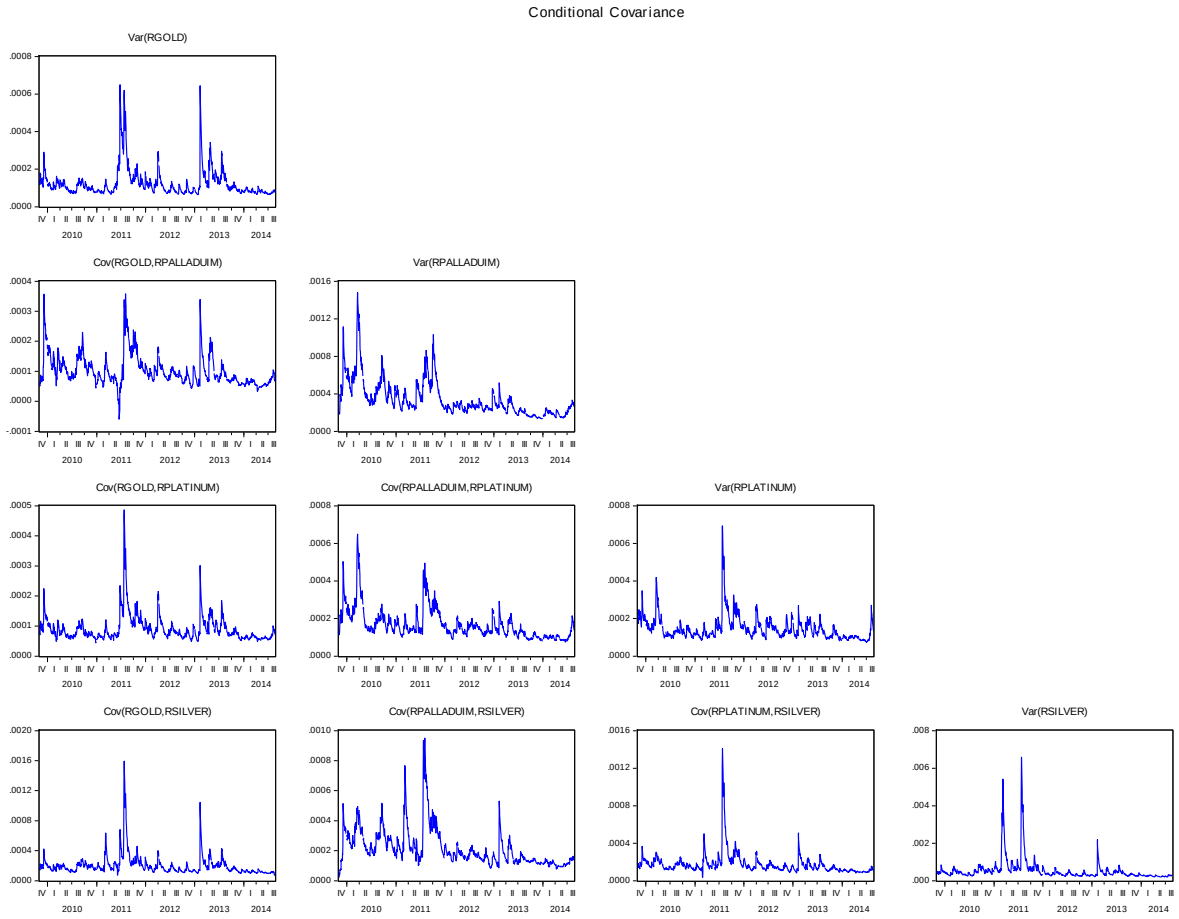

Figure 3 - Conditional Covariance (VAR (1) - diagonal VECH estimates)

8. Multivariate GARCH diagnostic tests

The multivariate GARCH models consist of the VAR (1)-diagonal VECH, the VAR (1)-diagonal BEKK and the VAR (1)-CCC model. We can diagnostic check on the system residuals to determine efficiency of estimator according to the Table 8. We found that system residuals have no autocorrelations up to lag 6 and are not normally distributed. Therefore, it can be concluded that the estimators of multivariate GARCH model are efficient.

Table 8 - Multivariate GARCH diagnostic tests

TEST	VAR(1)-diagonal VECH					
	Lags	Value	Probability	Test	Value	Probability
System Residual Tests for Autocorrelations H_0 = no residual autocorrelation (Q-Stat)	1 2 3 4 5 6	15.212 32.841 49.438 66.914 82.789 109.416	0.509 0.425 0.415 0.377 0.393 0.165	System Residual Normality Tests H_0=Multivariate normal -Skewness (Chi-sq) -Kurtosis (Chi-sq) -Jarque-Bera	 177.622 3154.442 3332.065	 0.000 0.000 0.000
TEST	**VAR (1) – diagonal BEKK**					
	Lags	**Value**	**Probability**	**TEST**		
System Residual Tests for Autocorrelations H_0=no residual autocorrelation (Q-Stat)	1 2 3 4 5 6	13.494 31.726 48.375 65.777 81.065 107.200	0.636 0.480 0.457 0.415 0.445 0.204	System Residual Normality Tests H_0=Multivariate normal -Skewness (Chi-sq) -Kurtosis (Chi-sq) -Jarque-Bera	 196.121 4287.221 4483.342	 0.000 0.000 0.000
TEST	**VAR (1) - CCC**					
	Lags	**Value**	**Probability**	**TEST**		

System Residual Tests for Autocorrelations H_0=no residual autocorrelation (Q-Stat)	1 2 3 4 5 6	16.916 34.574 51.142 68.935 84.893 111.671	0.391 0.345 0.351 0.314 0.333 0.130	System Residual Normality Tests H_0=Multivariate normal -Skewness (Chi-sq) -Kurtosis (Chi-sq) -Jarque-Bera	 220.804 4008.862 4229.666	 0.000 0.000 0.000

9. Implications for portfolio designs and hedging strategies

We provide two examples for constructing optimal portfolio designs and hedging strategies using our best estimates of model VAR (1)-diagonal VECH for the four metals.

The first example follows Kroner and Ng (1998) by considering a portfolio that minimize risk without lowering expected returns. If we assume the expected returns to be zero, the optimal portfolio weight of one metal (or asset) to the other in a two metal (asset) portfolio is given by:

$$w_{12,t} = \frac{h_{22,t} - h_{12,t}}{h_{11,t} - 2h_{12,t} + h_{22,t}} \tag{9}$$

and

$$w_{12,t} = \begin{cases} 0, & if \quad w_{12,t} < 0 \\ w_{12,t}, & if \quad 0 \le w_{12,t} \ge 1 \\ 1, & if \quad w_{12,t} > 1 \end{cases} \tag{10}$$

where $w_{12,t}$ is the weight of the first precious metal in one dollar portfolio of two precious metals at time t, $h_{12,t}$ is the conditional covariance between metals 1 and 2 and $h_{22,t}$ is the conditional variance of the second metal in the one dollar portfolio is $1 - w_{12,t}$.

The average values of $w_{12,t}$ base on VAR (1)-diagonal VECH estimates are reported in the first column of Table 9. For instance, the average value of $w_{12,t}$ of a portfolio comprising gold and palladium is 0.91. This suggests that the optimal holding of gold in one dollar of gold/palladium portfolio be 91 cents and 9 cents for palladium. These optimal portfolio weights suggest that investors should have more gold than palladium and other precious metals in their portfolio to minimize risk without lowering the expected return. When it comes to the two metals between palladium and silver, the optimal portfolio should be 72% to 28% and investors should have more palladium than silver.

Table 9 - Hedge ratios and optimal portfolio weights base on VAR (1) - diagonal VECH

PORTFOLIO	AVERAGE $w_{12,t}$	AVERAGE β_t
GOLD/PALLADIUM	0.91	0.30
GOLD/PLATINUM	0.62	0.62
GOLD/SILVER	1.00	0.37
PALLADIUM/PLATINUM	0.00	1.14
PALLADIUM/SILVER	0.72	0.40
PLATINUM/SILVER	1.00	0.32

We now follow the example given in Kroner and Sultan (1993) regarding risk-minimizing hedge ratios and apply it to our precious metals. In order to minimize risk, a long (buy) position of one dollar taken in one precious metal should be hedged by a short (sell) position of β_t in another precious metal at time t. The rule to have an effective hedge is to have an inexpensive hedge. The β_t is given by:

$$\beta_t = \frac{h_{12,t}}{h_{22,t}} \quad (11)$$

where β_t is the risk minimizing hedge ratio for two precious metals, $h_{12,t}$ is the conditional covariance between metals 1 and 2 and $h_{22,t}$ is the conditional variance of the second metal.

The second column of Table 9 reports the average values of β_t. The results show that the most effective hedging among all the precious metals is hedging long (buy) palladium position by shorting (selling) platinum. The least effective hedging among all the precious metals is hedging long (buy) gold position by shorting (selling) platinum.

Conclusion

This paper investigates volatility co-movements and spillovers for gold, palladium, platinum and silver. The results of volatility analysis are used to calculate the optimal two-metal portfolio weights and hedging ratios. In addition, this paper estimated three popular multivariate GARCH models, namely the VAR (1) - diagonal VECH, the VAR (1) - diagonal BEKK and the VAR (1)-CCC model, for the four metal returns

The empirical results overall showed that the estimates of the multivariate GARCH parameters are statistically significant in all cases. This indicates that the short run persistence of shocks on the dynamic conditional correlations is greatest for RGOLD with RSILVER, while the largest long run persistence of shocks to the conditional correlations for RPALLADIUM with RSILVER.

The next step, we will choose the best model by considering the value of log-likelihood, AIC, SIC and HQ. We found that the best model in volatility and hedging ratios analysis is the VAR (1)-diagonal VECH model.

The results from these optimal portfolio weights base on the VAR (1)-diagonal VECH estimates suggest that investors should have more gold than palladium and other precious metals in their portfolio to minimize risk without lowering the expected return. Such results can be useful as the management the volatility of the precious metals for investors.

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Table 5 - VAR (1) - diagonal VECH model estimates

	RGOLD	**RPAL.**	**RPLA.**	**RSIL.**	ρ (RGOLD_RPAL.)	ρ (RGOLD_RPLA.)	ρ (RGOLD_RSIL.)	ρ (RPAL._RPLA.)	ρ (RPAL._RSIL.)	ρ (RPLA._RSIL.)
VAR (1)										
RGOLD(-1)	0.005	0.199***	-0.053	0.247***	-	-	-	-	-	-
	(0.046)	(0.073)	(0.048)	(0.087)						
RPAL.(-1)	-0.056**	-0.044	-0.063**	-0.050						
	(0.026)	(0.043)	(0.026)	(0.048)						
RPLAT.(-1)	0.049	0.150**	0.098**	0.090						
	(0.048)	(0.069)	(0.049)	(0.083)						
RSIL.(-1)	0.007	0.057*	0.046**	-0.222***						
	(0.019)	(0.031)	(0.019)	(0.039)						
ω (Constant)	5.78E-06*** (8.30E-07)	9.17E-06*** (1.68E-06)	7.80E-06*** (1.50E-06)	1.99E-05*** (2.56E-06)	-	-	-	-	-	-
α	0.069*** (0.007)	0.056*** (0.006)	0.066*** (0.007)	0.083*** (0.006)	-	-	-	-	-	-
β	0.883*** (0.011)	0.914*** (0.009)	0.878*** (0.014)	0.875*** (0.009)	-	-	-	-	-	-
$\alpha+\beta$	0.952	0.970	0.944	0.958	-	-	-	-	-	-
θ_0 (Constant)	-	-	-	-	3.99E-06*** (9.17E-07)	4.85E-06*** (1.04E-06)	9.28E-06*** (1.34E-06)	5.93E-06*** (1.21E-06)	6.82E-06*** (1.48E-06)	8.00E-06*** (1.56E-06)
θ_1	-	-	-	-	0.046*** (0.006)	0.051*** (0.007)	0.068*** (0.006)	0.052*** (0.007)	0.042*** (0.007)	0.053*** (0.008)
θ_2	-	-	-	-	0.911*** (0.013)	0.892*** (0.016)	0.883*** (0.011)	0.909*** (0.011)	0.921*** (0.012)	0.895*** (0.013)
$\theta_1+\theta_2$					0.957	0.943	0.951	0.961	0.963	0.948
Log likelihood	15321.96									
AIC	-25.159									
SIC	-24.949									
HQ	-25.080									

Note: standard error in parenthesis, *** denote significance at the 1% level, **denote significance at the 5% level and * denote significance at the 10% level, RPAL = the returns of palladium, RPLA = the returns of platinum and RSIL = the returns of silver

Table 6 - VAR (1) - diagonal BEKK model estimates

	RGOLD	**RPAL.**	**RPLA.**	**RSIL.**	ρ (RGOLD_RPAL.)	ρ (RGOLD_RPLA.)	ρ (RGOLD_RSIL.)	ρ (RPAL._RPLA.)	ρ (RPAL._RSIL.)	ρ (RPLA._RSIL.)
VAR (1)										
RGOLD(-1)	-0.012	-0.213***	-0.074	0.223***						
	(0.047)	(0.071)	(0.045)	(0.085)						
RPAL.(-1)	-0.044*	-0.036	-0.043	-0.023						
	(0.027)	(0.042)	(0.026)	(0.048)						
RPLAT.(-1)	0.060	0.182***	0.111**	0.115	-	-	-	-	-	-
	(0.049)	(0.069)	(0.049)	(0.084)						
RSIL.(-1)	0.007	0.053*	0.042***	-0.242***						
	(0.019)	(0.031)	(0.016)	(0.039)						
ω (Constant)	3.77E-06*** (4.70E-07)	5.52E-06*** (9.84E-07)	3.04E-06*** (5.69E-07)	8.05E-06*** (9.58E-07)	-	-	-	-	-	-
α^2	0.053***	0.042***	0.039***	0.046***	-	-	-	-	-	-
β^2	0.917***	0.941***	0.941***	0.937***	-	-	-	-	-	-
$\alpha^2 + \beta^2$	0.970	0.983	0.980	0.983	-	-	-	-	-	-
θ_0 (Constant)	-	-	-	-	2.58E-06*** (3.58E-07)	2.41E-06*** (3.63E-07)	4.77E-06*** (5.30E-06)	3.04E-06*** (5.69E-07)	3.65E-06*** (5.56E-07)	3.18E-06*** (5.32E-07)
θ_1	-	-	-	-	0.048***	0.045***	0.050***	0.040***	0.044***	0.042*** (0.008)
θ_2	-	-	-	-	0.929***	0.928***	0.927***	0.941***	0.939***	0.939***
$\theta_1 + \theta_2$					0.977	0.973	0.977	0.981	0.983	0.981
Log likelihood	15293.06									
AIC	-25.131									
SIC	-24.972									
HQ	-25.071									

Note: standard error in parenthesis, *** denote significance at the 1% level, **denote significance at the 5% level and * denote significance at the 10% level, RPAL = the returns of palladium, RPLA = the returns of platinum and RSIL = the returns of silver

Table 7 - VAR (1) - CCC model estimates

	RGOLD	**RPAL.**	**RPLA.**	**RSIL.**	ρ (RGOLD_RPAL.)	ρ (RGOLD_RPLA.)	ρ (RGOLD_RSIL.)	ρ (RPAL._RPLA.)	ρ (RPAL._RSIL.)	ρ (RPLA._RSIL.)
VAR (1)										
RGOLD(-1)	0.036	-0.146**	-0.018	0.286***						
	(0.042)	(0.073)	(0.044)	(0.081)						
RPAL.(-1)	-0.067***	-0.031	-0.061**	-0.058						
	(0.024)	(0.039)	(0.024)	(0.047)						
RPLAT.(-1)	0.047	0.114*	0.082*	0.090	-	-	-	-	-	-
	(0.044)	(0.064)	(0.046)	(0.082)						
RSIL.(-1)	0.005	0.040	0.039**	-0.228***						
	(0.018)	(0.028)	(0.018)	(0.041)						
ω (Constant)	5.97E-06*** (9.71E-07)	8.65E-06*** (1.81E-06)	1.05E-06*** (2.05E-06)	2.36E-05*** (3.16E-06)	-	-	-	-	-	-
α	0.084*** (0.009)	0.063*** (0.008)	0.080*** (0.009)	0.113*** (0.009)	-	-	-	-	-	-
β	0.868*** (0.014)	0.909*** (0.011)	0.848*** (0.020)	0.843*** (0.012)	-	-	-	-	-	-
$\alpha+\beta$	0.952	0.970	0.944	0.958	-	-	-	-	-	-
Constant conditional correlation	-	-	-	-	0.515*** (0.019)	0.688*** (0.015)	0.809*** (0.007)	0.760*** (0.012)	0.548*** (0.020)	0.663*** (0.017)
Log likelihood	15250.76									
AIC	-25.062									
SIC	-24.902									
HQ	-25.002									

Note: standard error in parenthesis, *** denote significance at the 1% level, **denote significance at the 5% level and * denote significance at the 10% level, RPAL = the returns of palladium, RPLA = the returns of platinum and RSIL = the returns of silver

Table 8 - Multivariate GARCH diagnostic tests

TEST	**VAR(1)-diagonal VECH**					
	Lags	**Value**	**Probability**	**Test**	**Value**	**Probability**
System Residual Tests for Autocorrelations **H_0=no residual autocorrelation** **(Q-Stat)**	1 2 3 4 5 6	15.212 32.841 49.438 66.914 82.789 109.416	0.509 0.425 0.415 0.377 0.393 0.165	**System Residual Normality Tests** **H_0=Multivariate normal** **-Skewness (Chi-sq)** **-Kurtosis (Chi-sq)** **-Jarque-Bera**	 177.622 3154.442 3332.065	 0.000 0.000 0.000
TEST	**VAR (1) – diagonal BEKK**					
	Lags	**Value**	**Probability**	**Test**		
System Residual Tests for Autocorrelations **H_0=no residual autocorrelation** **(Q-Stat)**	1 2 3 4 5 6	13.494 31.726 48.375 65.777 81.065 107.200	0.636 0.480 0.457 0.415 0.445 0.204	**System Residual Normality Tests** **H_0=Multivariate normal** **-Skewness (Chi-sq)** **-Kurtosis (Chi-sq)** **-Jarque-Bera**	 196.121 4287.221 4483.342	 0.000 0.000 0.000
TEST	**VAR (1) - CCC**					
	Lags	**Value**	**Probability**	**Test**		
System Residual Tests for Autocorrelations **H_0=no residual autocorrelation** **(Q-Stat)**	1 2 3 4 5 6	16.916 34.574 51.142 68.935 84.893 111.671	0.391 0.345 0.351 0.314 0.333 0.130	**System Residual Normality Tests** **H_0=Multivariate normal** **-Skewness (Chi-sq)** **-Kurtosis (Chi-sq)** **-Jarque-Bera**	 220.804 4008.862 4229.666	 0.000 0.000 0.000

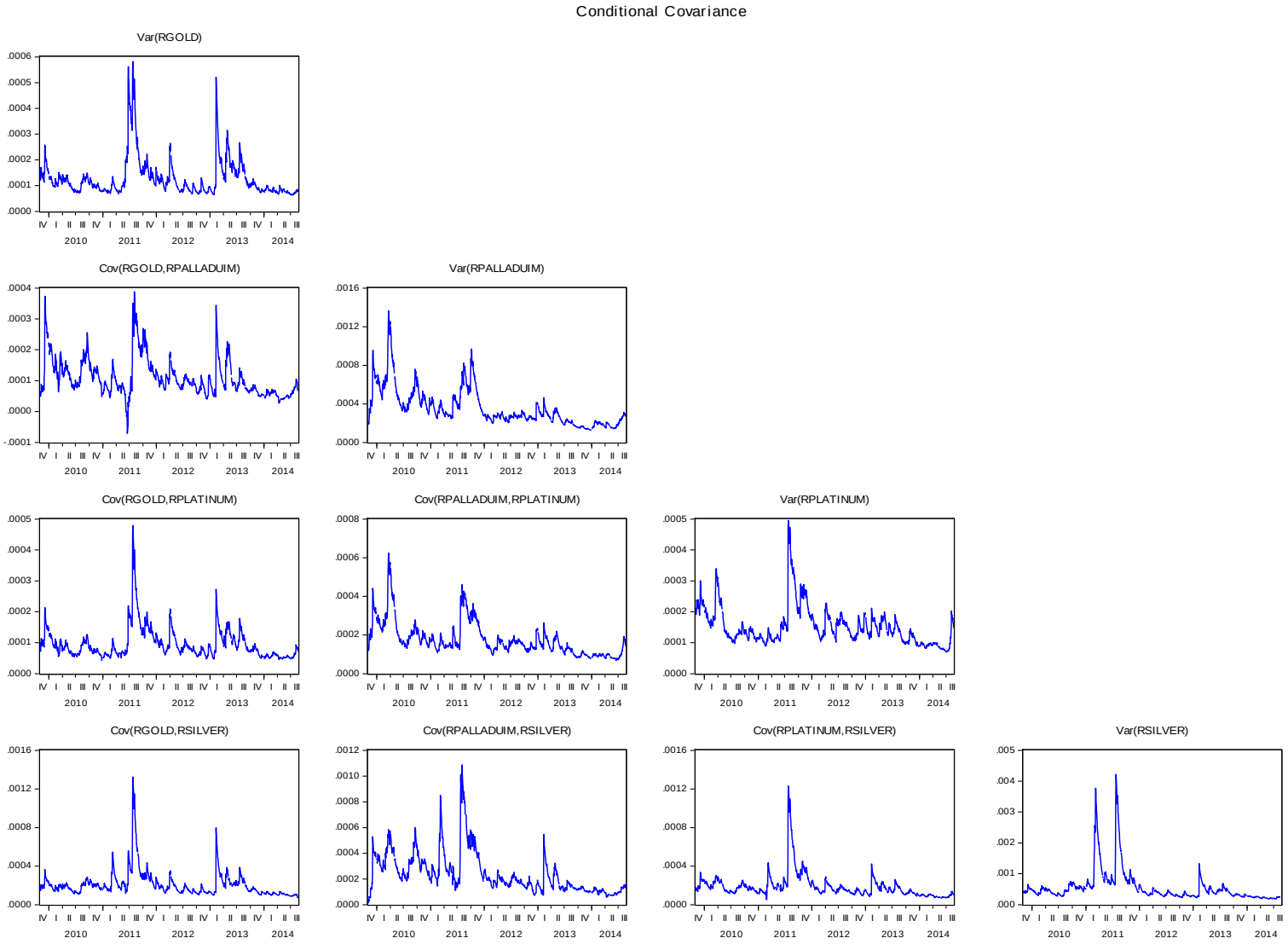

Figure 4 - Conditional Covariance (VAR (1) - diagonal BEKK estimates)

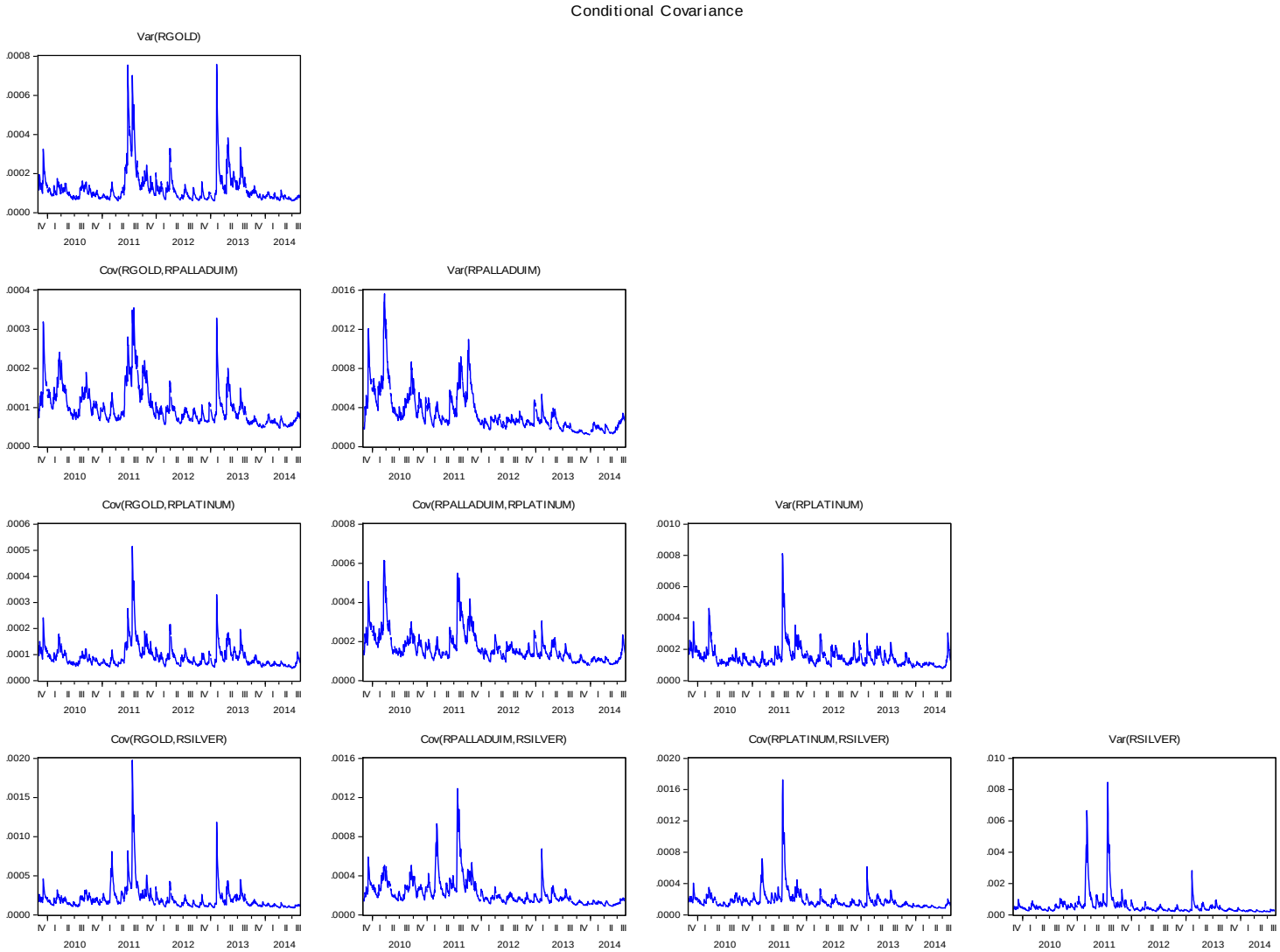

Figure 5 - Conditional Covariance (VAR (1) - CCC estimates)

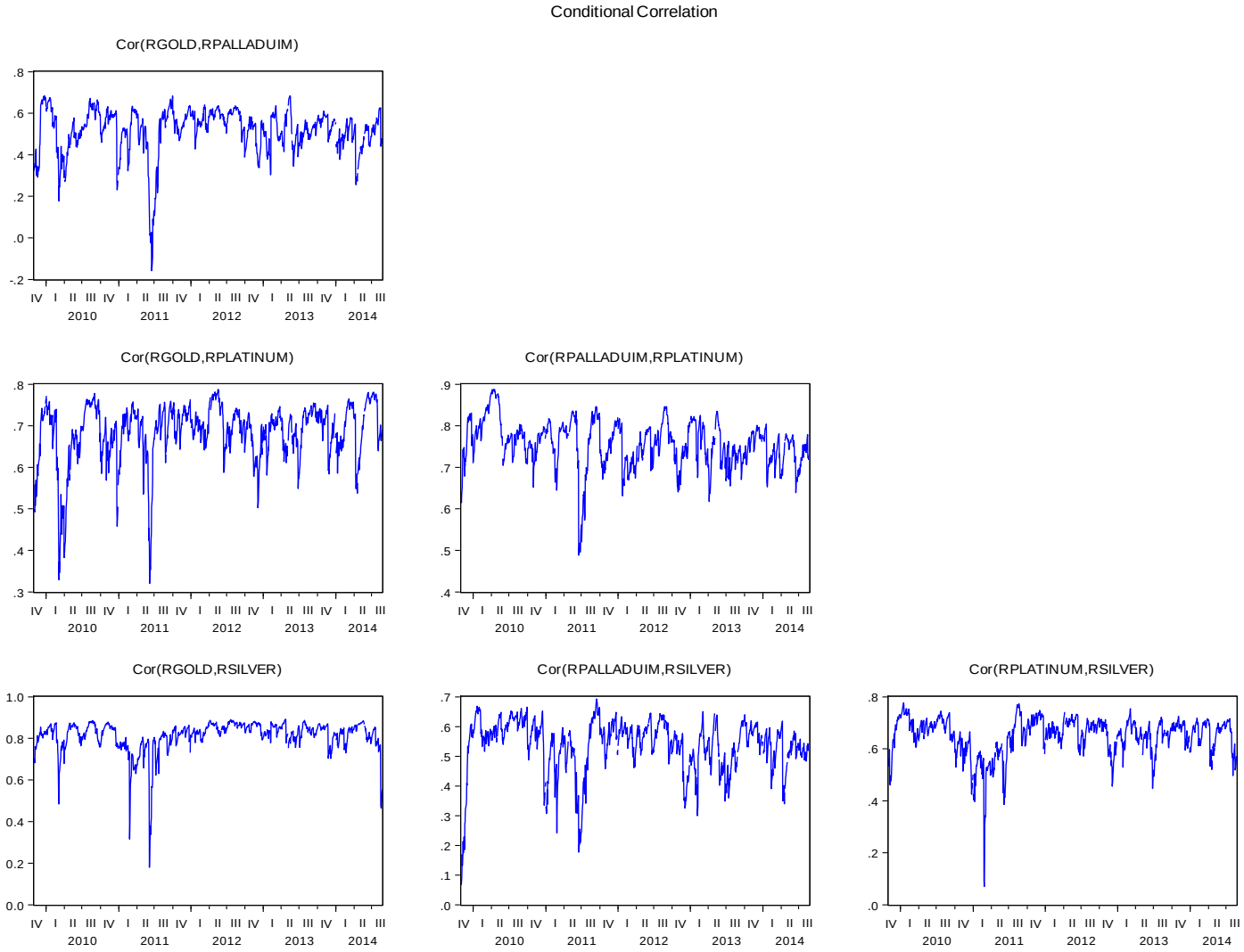

Figure 6 - Conditional Correlation (VAR (1) - diagonal VECH estimates)

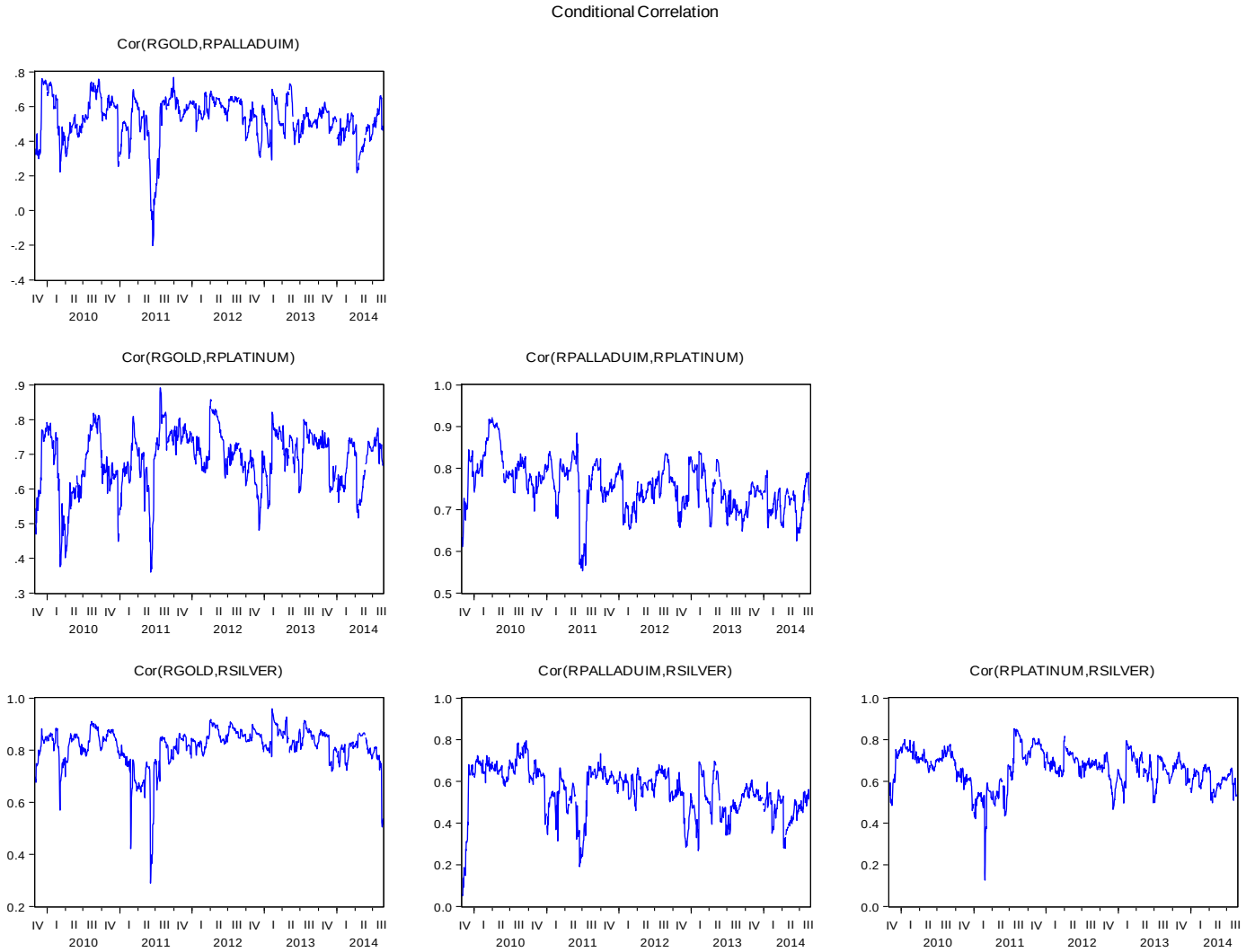

Figure 7 - Conditional Correlation (VAR (1) - diagonal BEKK estimates

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INCOMPLETENESS AND RENEGOTIATION OF CONCESSION CONTRACTS: AN EMPIRICAL EVALUATION

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Abstract:

This paper evaluates the determinants of concession contract renegotiations in a developing country, Peru, for a sample of 50 build-operate-and- transfer (BOT) infrastructure contracts using two complementary empirical approaches: count data models and survival models. Hypotheses derived from the economics of procurement are confirmed. In particular, factors that relate to the design of contracts, such as contract incompleteness and contract complexity, are found to be relevant in explaining the phenomenon of repetitive renegotiations. Other important factors, including political and financial risks, are also revealed to be important determinants of renegotiations in this country, in particular, when the empirical method permits measuring the influence of these variables throughout the life of the contract. However, no evidence has been discovered to support the thesis that resources assigned to contract regulators reduce the incidence of renegotiations. Some policy implications for contract design and renegotiation processes are proposed.

Keywords: concession contracts, incomplete contracts, count data models, survival models.

JEL Classification: L51, L43, K23, H54

1. Introduction

Since the 1990s, concession and privatization processes are mechanisms that have been used extensively by Latin American countries as devices for the promotion of private investment in infrastructure industries. However, the achievement of this objective, considered necessary for the delivery of more efficient and reliable infrastructure services, required the prior implementation of institutional reforms in contexts of scarce tradition of private participation in the provision of infrastructure services and utilities regulation.

Renegotiation of concession contracts has been considered by the recent empirical literature (Guasch 2003, Laffont 2005 and Straub 2007 and Guasch 2004) to be a phenomenon that reflects not only failures in the implementation of these reforms but also difficulties that relate to the imperfect supervision of concession contracts. According to these authors, the lack of resources assigned to regulatory agencies and/or the absence of a regulatory framework prior to the awarding of a concession (among other institutional factors) may facilitate opportunism from private investors and governments, increasing the possibility of modifying the obligations that were established initially by concession contract.

Although the primary reason argued in this literature for these results is the imperfect enforcement of the obligations established in the concession contracts, there exists another branch of literature (which draws on the analysis in procurement contracts (Bajari and Tadelis 2001)) which suggests that renegotiations may reflect other dilemmas that governments face during the process of contract design. In particular, this branch of literature refers to the *trade-off* between two important objectives: avoiding costly *ex post* bargaining and providing incentives. According to this approach, governments will expend resources on contract design to reduce the probability of incurring in costly *ex post* bargaining costs. However, during the process of contract design, the government must balance the costs of completing contracts (which would provide the benefit of reducing the probability of renegotiation) with the objective of introducing incentives in the contract. The probability of *ex post* bargaining and renegotiation cannot be completely eliminated because this would imply prohibitive costs derived from designing complete contracts.

Certainly, the two aforementioned approaches are not mutually incompatible; both the costs of contract design (completing contracts) and the imperfect *ex post* supervision of opportunistic behavior can coexist and drive contract renegotiations.

[5] I would like to express my gratitude to Mark Kennet and Jose Tavara for their comments to earlier versions of this article.

This paper seeks to assess these two hypotheses through an analysis of the Peruvian experience with infrastructure concessions. The Peruvian case presents various aspects of interest. First, Peru implemented institutional reforms during the 1990s that consisted of the creation of both sectoral regulators with some degree of autonomy and an independent investment promotion agency, among other measures. In addition, nearly all of the Peruvian processes for awarding concessions were performed on a competitive basis. A relatively high number of these concessions consisted of long-term contracts, which included build-operate-and-transfer obligations (BOT). Typically, the structure of this type of contract is complex, involves investment in specific assets, and requires high design costs compared with other types of concession contracts (such as pure operation or management contracts). Finally, the renegotiation of concession contracts in Peru has been the rule rather than the exception, offering a suitable scenario for testing the alternative hypotheses mentioned above.

Given these characteristics, our objective is to test the aforementioned hypotheses using two empirical approaches. At first, we estimate a Conditional Poisson Model (CPM) for a sample of 50 BOT infrastructure contracts. Secondly, for the same sample we estimate a Cox Proportional Hazards Model (CPHM) during the period between 1994 and 2011. Since the former consist of a cross section approach and the latter adds the time variable in order to estimate the evolution of the risk of renegotiation (the hazards function), we consider that both approaches are complementary as they allow us to assess the robustness of the results.

The remainder of this document organizes as follows. The next section presents the motivation for the empirical work by briefly reviewing the economics of procurement and developments in Latin America. The third section examines certain relevant characteristics of the Peruvian experience and institutional setting, the methodology that is applied and the results. The fourth section discusses these results and suggests possible extensions of this research. Finally the last section presents some concluding remarks.

2. Concession contracts and renegotiation

The recent literature on concession contracts in Latin America has considered renegotiation of contracts as a phenomenon that can primarily be explained by the opportunistic behavior of operators or governments. Weak institutions and organizations lack of credibility of organizations, according to this view, are idiosyncratic factors that can help to explain these results. The main consequence of this opportunistic behavior is a less efficient outcome for infrastructure projects, particularly if the frequency of renegotiation is high[6].

However, renegotiations will not always produce inefficient outcomes. Given the incomplete nature of long-term contracts, fortunate contingencies could make it desirable to renegotiate in order to achieve Pareto improving efficiencies. The literature on this topic applied to concession contracts is scarce but some important developments can be found in other fields[7].

Even though renegotiations can generate positive effects in the short term, it is important to consider other indirect and negative effects of renegotiations, particularly on government reputation. Government credibility and reputation are important for at least two reasons. The first one is that a government's reputation influences bidders' expectations regarding the likelihood of future renegotiations. These expectations may undermine the bidding process, encouraging prospective operators to submit "unrealistic" offers expecting to reverse the outcome *ex post* through a renegotiation. This behavior obscures the *ex ante* selection (competition) process and reduces the allocative and productive efficiencies that the operator could achieve during contract execution. A

[6] This reasoning was stated in the following manner by Guasch (2004), p. 34: *"In principle, renegotiation can be a positive instrument when it addresses the inherently incomplete nature of concession contracts. Properly used, renegotiation can enhance welfare. Although some renegotiation is desirable, appropriate, and to be expected, this high incidence exceeds expected and reasonable levels and raises concerns about the validity of the concession model. It might even indicate excessively opportunistic behavior by new operators or by governments. Such behavior undermines the efficiency of the process and the overall welfare, because renegotiation takes place between the government and the operator only, so it is not subject to competitive pressures and their associated discipline.*"

[7] For example, in an analysis of the labor market, Dewatripoint and Maskin (1989) demonstrate that the revelation of information through the negotiation of a contract can create Pareto-improving opportunities.

second and more important concern is that a lax or permissive regime with respect to *ex post* renegotiations may increase the perceived risk for investors in the long term, undermining and de-legitimizing the concession system as a whole.

Beyond the normative discussion, this paper seeks to evaluate the influence of different factors on the incidence of renegotiations in Peru and to contrast these findings with the main results from the recent literature. In particular, we postulate that three groups of factors may explain the high frequency of renegotiations with respect to Peruvian concession contracts: *i)* factors that relate to the design of the project and the award process, particularly the degree of contract completeness, complexity and the incentive scheme; *ii)* factors that relate to facts and events occurred during the execution of the contract and -at least partially- attributable to the imperfect enforcement of contractual obligations, *iii)* other factors related to the resources assigned to contract supervision. The first group of factors is derived from the procurement economics literature[8], whereas the second and third group of factors is related to factors highlighted by recent empirical literature applied to Latin American countries.

2.1. The trade-off between contract incentives and costly *ex post* bargaining

The literature of procurement economics has addressed the problem of renegotiation as a consequence of decisions that are reached by governments with respect to the definition of the bidding process and the design of contracts. Laffont and Tirole (1993) developed a model in which the government seeks to design optimal contracts by trading efficiency objectives (that are achieved through incentive schemes) in exchange for rent extraction. In their model, the primary objective of the government is to develop an *ex ante* optimal scheme that enables it to choose the most efficient seller (through a revelation process) and simultaneously to maximize the seller's degree of effort. One important general conclusion of the Laffont and Tirole model is that high-powered incentives could produce an inefficient solution (that involves unnecessarily higher informational rents). Thus, according to this model, an appropriate balance must be kept between the objectives of promoting incentives and reducing rent extraction.

In contrast, Bajari and Tadelis (2001) modeled the government's procurement decision as a *trade-off* between the efficiency of high-powered incentives and *ex post* bargaining friction that is created by these incentives. According to their model, the procurement problem is characterized by avoiding *ex post* adaptation costs rather than by reducing informational rents in the context of the seller (bidder) screening process. Thus, whereas Bajari and Tadelis emphasized the incomplete character of contracts and the effects of this character on *ex post* adaptation costs, Laffont and Tirole focused on *ex ante* problems of information asymmetry that arise during the award process[9]. Horton (2008) finds evidence that a positive relationship exists between the use of high-powered incentives and the phenomenon of renegotiation, supporting the predictions of Bajari and Tadelis.

Bajari and Tadelis (2001) modeled the contracting decisions of the government as a function of selected relevant attributes of these contracts: completeness, complexity and incentives. Other important factors, such as the level of competition that is experienced during the bidding process, were also considered. The simple model that we present below builds on the model of Bajari and Tadelis and extensions developed by Gil and Oudot (2008).

As noted by Bajari and Tadelis, contract design reflects a tension between *ex ante* incentives and *ex post* transaction costs. The value of a project is denoted by $\bar{v}$ and its level of complexity by *T*. The level of completeness of contract design and the level of effort are denoted by τ, and *y*, respectively. Both τ and *y* are control variables for the government and assume values between 0 and 1. The expression $(1-\tau)$ accounts for the share of possible contingencies that are not specified in the

[8] Although indirectly, the second group of variables may also reflect evidence the procurement economics hypothesis, to the extent that renegotiations originated from unexpected events can be a consequence of the incomplete design of the contract.

[9] Using the framework created by Bajari and Tadelis, Gil and Oudot (2008) found evidence in two different institutional settings for a negative relationship between the use of competitive bidding and the frequency of *ex post* renegotiation. This conclusion differs from the predictions of Bajari and Tadelis, introducing the damaging effects of renegotiation for government reputation as an additional channel of transmission between competition and the likelihood of renegotiation.

contract. Higher values of *y* denote stronger incentives, whereas lower values of *y* represent weaker incentives.

If renegotiated, the contract loses value for the government, taking on the value of $\underline{v}(y)$ where $\underline{v}'(y)>0$. The cost of the contract includes two components. The first is the cost of design ($d(\ )$), which is a positive function of the level of completeness (τ) and the level of complexity (T), satisfying $\frac{\partial^2 d}{\partial \tau \partial T} > 0$. The second component is $t(N)$, the cost of the service.

The prospective seller's preferences must also be accounted for in the government decision on contract design. Using Tirole and Laffont's notation (1993), the seller's utility function can be modeled by $U = t(N) - \varphi(y)$, where t is the tariff paid by the government; $\varphi(\ )$ is the disutility of effort, which satisfies $\varphi'(\ )>0$ and $\varphi''(\ )>0$; and N is the number of bidders[10].

Therefore the government objective function can be represented as:

$$Max_{y,\tau}\ \tau\,\bar{v} + (1-\tau)\underline{v}(y) - d(\tau,T) - t(N) - \varphi(y)$$

The first-order conditions with respect to τ and y are as follows:

$$\tau: \quad \bar{v} - \underline{v}(y) - \frac{\partial d}{\partial \tau} = 0 \qquad\qquad y: (1-\tau)\frac{\partial \underline{v}}{\partial y} - \frac{\partial \varphi}{\partial y} = 0$$

The first condition indicates that the optimum level of completeness occurs if the marginal influence of τ on the design cost function is equal to the marginal reduction in the loss of value for the project. The second condition states that the marginal effect of the reduction of incentives on the cost of the project must equal the marginal disutility of the effort. Finally, to solve the government problem, it is necessary that the following participation condition for the prospective seller be satisfied: $t(N) - \varphi(y) \geq U_0$.

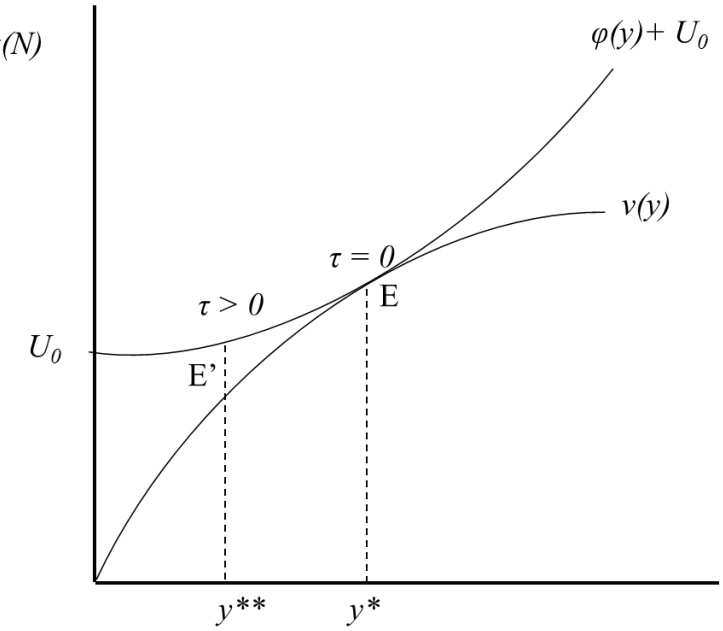

Diagram 1

Diagram 1 depicts the relationship between the prospective seller's disutility of effort and the outcome curve. If the level of completeness (τ) is zero, the equilibrium effort will be y^*, which occurs exactly at the point of tangency of the outcome and disutility functions. If the level of completeness is greater than zero, then the equilibrium effort is lower, reflecting the *trade-off* between completeness and incentives stressed by Bajari and Tadelis[11]. However, the optimal choice of τ will depend on the

[10] According to the version of Gil and Oudot, the second component is the cost ($C(\ )$) of the project, which is positively related to *y* and negatively related to the number of bidders (*N*).

[11] This conclusion is the centerpiece of the argument that is offered by Bajari and Tadelis (2001). This argument departs from other lines of reasoning, such as the rationale of Laffont and Tirole (1993), which emphasizes the importance of *ex ante* informational asymmetries for awarding and designing a contract. In particular,

design function and the level of *y*. According to the first-order conditions, higher levels of *y* will produce smaller differences between $\bar{v}$ and $\underline{v}$.

Implicit in this model is the fact that the choice of higher incentives and, correspondingly, lower levels of completeness are necessarily associated with a higher probability of *ex post* renegotiation. Less intense incentives are thus correlated to a lower probability of *ex post* bargain.

This simple model permits us to draw some important propositions (Gil and Oudot 2008, 11).

P1. If all other factors remain equal, then stronger incentives may lead to more renegotiations *ex-post*. In the optimum, increasing the level of *y* will necessarily lead to a reduction in the level of τ, (i.e. a change in the contract). A lower level of completeness has the effect of increasing *ex post* adaptation costs, and the likelihood of renegotiation.

P2. If all other factors remain equal, then more complexity (*T*) leads to more renegotiations *ex post*. Higher levels of *T* correspond to larger differences between $\bar{v}$ and $\underline{v}$, which imply a lower level of *y* (softer incentives). This relationship indicates that if *y* remains constant, additional complexity will produce a higher probability of *ex-post* renegotiations.

P3. If all other factors remain equal, then an increase in the number of bidders will reduce the cost paid by the government (*t(N)*) and will produce a lower level of *y*. Thus, if *y* remains constant, greater competition will be associated with additional *ex-post* renegotiation.

2.2. The lack of supervision as a cause of renegotiation

Infrastructure concession contracts generally show the following features:

- They are expected to frame long-term relationships, rendering it rather difficult to include all possible contingencies (increasing the likelihood of incompleteness)
- They involve specific investments that may result in sunk costs for the concessionaires
- They are affected by asymmetric information between the government and the concessionaire with respect to the costs of the contracted service, the demand for the services and other relevant variables of the concession.

As mentioned above, recent empirical literature assess the incidence of renegotiations in Latin America, and the theoretical foundations for these assessments are the work of Guasch, Laffont and Straub (2006) (GLS). According to the GLS model, renegotiation arises primarily as a result of insufficient supervision, low spending in enforcement and the absence of regulatory institutions prior to the implementation of reforms.

In the theoretical GLS framework, the probability of renegotiation is specified by $(1-\delta)(1-\pi(x))$, where δ is the probability that the prospective concessionaire is a low-cost type, and π is the probability of failing to renegotiatiate (because of a tough enforcement), which is a function of *x*, the quantity of governmental investment in enforcement (with $\pi'(x)>0$ and $\pi''(x)<0$). Renegotiation arises when a high-cost concessionaire realizes that its earnings will be negative under the current contract. If *x* is sufficiently low (for example, if the government refuses to invest in a regulator) then the probability of renegotiation may be high, which increases the possibility that a high-cost (inefficient) company hides its true costs *ex ante*, with the expectation of engaging in *ex post* renegotiations. In this context, renegotiations could reflect either a failure of the screening mechanisms that the government uses to select the concessionaire or a reduced amount invested in enforcement of contract obligations. A lack of efficient and effective enforcement mechanisms can undermine the credibility of a regulator and increase the likelihood of *ex post* renegotiation. As mentioned by GLS (2006), their model can be adapted to include other factors of renegotiation, such as unanticipated exogenous shocks. In this context, the probability of renegotiation will be $(1 - \delta - \varepsilon)(1- \pi(x))$, where ε describes a demand or

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Bajari and Tadelis (2001) offer the following assertion (p. 389): *"These observations suggest that the procurement problem is primarily one of ex post adaptations rather than ex ante screening. While it is probably true that there is some asymmetric information about costs before the contract is signed, the choice of contract may not be the mechanism that deals with such asymmetries. Other mechanisms seem to be important in solving the adverse selection problem. These include competitive bidding, reputation, and bonding companies that insure the buyer against default by the contractor".*

cost-related shock. If ε is negative, then the probability of renegotiation increases; by contrast, if ε is positive, then this probability declines[12].

According to GLS findings, the following proposition can be stated:

- *P4*. If all other factors remain equal, then lower governmental spending on enforcement (x) will increase both the risk of selecting a high-cost concessionaire and the likelihood of renegotiation. A positive unanticipated event ( ) can reduce the likelihood of renegotiation, whereas a negative unanticipated event can increase this likelihood.

Of course, there are other institutional factors that may also positively correlate to the number of renegotiations, including the rule of law and political and state capture forms of corruption. The GLS model has been tested in a number of papers (e.g., Guasch, Laffont and Straub (2003, 2005) and Guasch (2004)) using cross-section analyses. A summary of their main results are outlined in Appendix 1.

3. The Peruvian case: methodology and results

As in many countries in the region, the utility and infrastructure industries in Peru were traditionally administered by state-owned companies (or government dependencies) in vertically integrated settings. Since the 1990s, a broad reform process ensued which comprised two main policy lines: the promotion of private investment and the introduction of competition.

Concessions for infrastructure projects and utilities were one of the pillars of this process. However, prior to the awarding of concessions, it was necessary to introduce certain institutional reforms, such as the creation of regulation agencies. In Peru, regulators[13] were created as agencies independent from the ministries; having the roles of setting tariffs, enforcing concession contracts and supervising the performance of concessionaire obligations. The development of an institutional and regulatory framework in Peru has been a discontinuous process, in which some periods characterized by the introduction of key legal provisions to reinforce and guarantee some desirable characteristics of regulatory agencies, like transparency, independence and accountability; can be identified. Most of these provisions were notably adopted during the so called "Government of Transition" (November 2000 -- July 2001). During this period, transparent mechanisms for appointing board members, protection from arbitrary dismissal, public hearings and other participatory processes for tariff setting, among others, were introduced. A detailed analysis of this transition can be found in Tavara (2006).

For designing and promoting concessions, another independent agency (Proinversión[14]) was also created. In accordance with this agency's mandate, two arrangements for investment promotion were implemented. The first consisted of the sale of state-owned assets (a privatization process), whereas the second involved the awarding of concessions and the creation of public-private partnerships.

As a general rule, the mechanisms for awarding concessions that have been used by Proinversión have been competitive and subject to previous qualification processes, which have generally required the accreditation of prospective bidders' experience and economic solvency. Thus, only qualified bidders have been allowed to compete in the award processes, offering an economic proposal[15].

A large group of concession contracts in Peru has involved (BOT) obligations. Depending on the complexity and the amount of investment for each concession, the contract terms for these concessions could fluctuate between 12 and 33 years in length. The obvious positive relationship

[12] Guasch, Laffont and Straub (1996), p. 64-65. It is interesting to observe that this conclusion regarding the influence of *ex post* shocks discards the possibility of renegotiations that relate to fortunate shocks (i.e. for example, an increase in international commodity prices for an exporter in a developing economy).

[13] In particular, regulators were created to oversee concession contracts in transport infrastructure (OSITRAN), energy and mining (OSINERGMIN), water and sanitation (SUNASS) and telecom (OSIPTEL).

[14] This agency was formerly known as COPRI.

[15] In certain specific cases (such as the concession of the Lima International Airport), a technical proposal was jointly evaluated in combination with an economic proposal.

between the term and the investment reflects the necessity of longer terms for the financing of larger and more costly projects (see Figure 1).

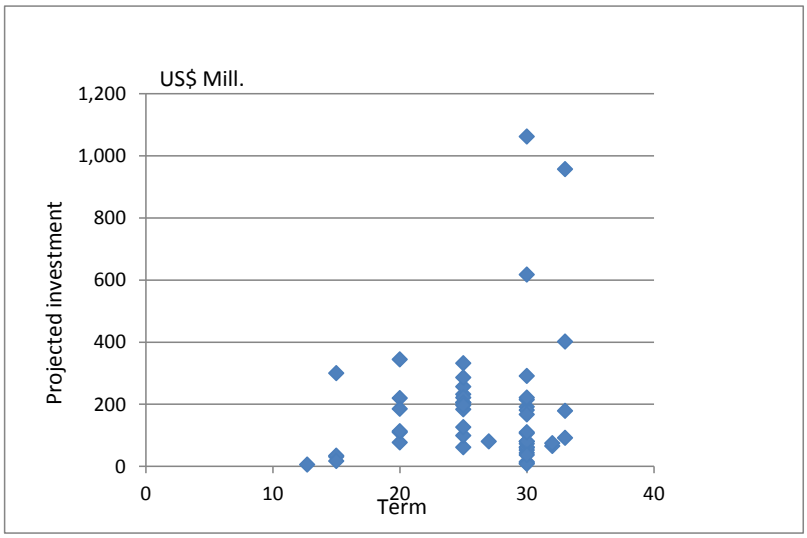

Figure 1 - Projected investments and contract terms

In order to facilitate the implementation of project financing mechanisms, Peruvian concession contracts have typically included clauses that allow a concessionaire to use the concession right or its future earnings as collateral for the assumption of long-term debt.

Depending on the source of financing, concession contracts can be classified as either self-sustainable or co-financed. The former are contracts completely funded by concessionaire earnings, whereas the latter (co-financed contracts) involve public funding for the building process and/or the operation of a concession. Public funding in co-financed contracts is awarded using (binding) income guarantees in order to fill the gap between concessionaire earnings and total costs.

3.1. The sample

As mentioned, the objective of this paper is to determine the factors that explain the renegotiation of concession contracts in Peru. Appendix 2 shows the sample data which includes 50 BOT concession contracts in the fields of transportation (50%), electric power and transmission (42%), water and sanitation (4%), and irrigation (4%) during the 1994-2011 period. Between the signature of these contracts and December 2011, the number of renegotiations that have been successfully concluded for the sampled contracts is 141. The total projected total investment for the sampled contracts is valued at US$9 billion. The average amounts of projected investments are close to US$180 million per contract, with the exception of water and sanitation contracts, which involve substantially lower average investments.

Table 1 - Summary statistics

	Renegociations	Avg Duration	Investment	Numb. of contracts	Self sustainable	Avg bidders
Energy	53	28.6	3,611.9	21	21	2.2
Irrigation	11	22.3	608.8	3	0	2.3
Water and Safety	11	25.0	149.9	2	1	1.5
Transport	72	24.8	5,014.6	25	12	2.3
	147	26.3	9,385.2	51	34	8.3

As shown in Figure 2, more than 50% of the sampled contracts have undergone two or more renegotiations. Around 30% of contracts until de endpoint date of the study (December 2011) had not been renegotiated.

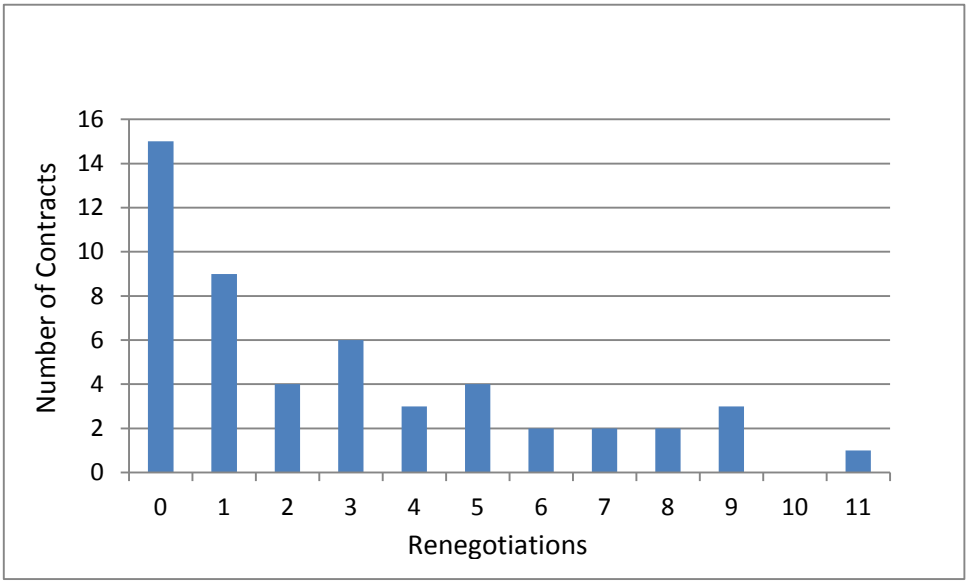

Figure 2 - Number of Renegotiations per contract

3.2. The conditional Poisson model

A renegotiation typically involves a proposal by one of the parties, a negotiation stage, and an agreement regarding the terms of contractual changes. The analysis of the number of renegotiations (that is, the number of times that these processes occur) is relevant, particularly for contexts in which a high number of contract modifications are a predominant trend. In these cases, the renegotiation incidence can be assessed as a "degree" problem, reflecting the extent to which some important factors (including but not limited to the completeness and complexity of the contract) influence these outcomes. As mentioned above, in the case of Peru, the renegotiation of concession contracts has been the rule rather than the exception; therefore, the methodology that is commonly used in recent literature, which considers renegotiation in terms of a binary dependent variable (renegotiate/not renegotiate), may not be appropriate. Instead, we propose the use of the number of renegotiations of concession contracts as the dependent variable.

Given the characteristics of the distribution of this variable (count data), the methodology to be used at a first instance is the estimation of a count data model (CDM). The most obvious advantage of this methodology is that it permits us to distinguish between contracts with low or high numbers of renegotiations; this distinction is lost in traditional binary dependent variable models (which typically utilize probit or logit approaches[16]), as these binary models only seek to explain the existence of renegotiation rather than renegotiation frequencies. This fact has consequences on the value of the estimated parameters; in particular, in a CDM, explanatory variables that frequently arise for contracts with high number of renegotiations will have greater values than explanatory variables that are associated with a low number of renegotiations. In contexts that involve a high number of renegotiations per contract, the use of a binary dependent model has an effect that is equivalent to truncate the distribution of the "renegotiation" (the dependent variable), artificially establishing a ceiling of 1 for this variable.

The conditional Poisson model (CPM) (Berk and McDonald 2007) is a classical CDM. The following Poisson expression is commonly used in estimations:

$$P\,(\,Y_i = y_i \mid X_i\,) = e^{-\lambda i}\ \lambda_t^{Yi} / y_i\,!$$

[16] For instance, see Guasch (1994).

In this case, *i* denotes the numerical designation of the examined contract, for i = 1…50 λ_i is the mean of the distribution; Y_i is the dependent (count data) variable (the number of renegotiations of contract *i*); and X_i is a vector of explanatory variables. According to this method, the mean (λ_i) may be specified by a semi-logarithmic function:

$$log\ \lambda_i = \beta\ X_i$$

In this expression, β parameters are semi-elasticities. An important assumption of the Poisson distribution is that the parameter λ_i represents both the mean and the variance of y_i.[17]

In our case, the vector of explanatory variables X_i will be divided into three groups of variables: i) variables that relate to the contract design and award processes, ii) variables that represent *ex post* events and iii) variables related to the participation of the regulatory agency. In addition, a variable of duration for each contract (measured in logarithms of years), as an exposure variable, was included. The parameter associated with this parameter was set in 1, which implies that the value of the estimated parameters must be interpreted as the influence of each explanatory variable on the number of renegotiations *per year*.

Factors relating to the contract design and award processes

As discussed in previous sections, contract design can significantly influence *ex post* bargaining costs. Propositions *P1*, *P2* and *P3* refer to completeness, complexity and the number of bidders, respectively, which are factors that are related to the levels of incentives that exist in concession contracts and the likelihood of incurring in ex post renegotiation. Thus, this first group of variables includes the tariff regime, $Regtariff_i$, which capture the incentives involved in the contract distinguishing between price caps and cost plus schemes. To describe the degree of completeness of the contract, we use the dummy variable $Engineer1_i$, which differentiates among cases involving pre-feasibility, feasibility or detailed engineering levels of prior engineering analyses from the cases which only involve profile or no previous studies. Alternatively, the variable $Engineer2_i$ distinguishes contracts with engineering levels superior to pre-feasibility from the rest of contracts. It is expected that in BOT contracts, the main source of uncertainty will relate to building costs; thus, the presence of more detailed engineering studies should reduce the risk that is associated with avoidable variations in building costs. So, $Engineer1_i$ and $Engineer2_i$ are used as proxies of contract completeness[18].

To account for the complexity of the contract, two alternative variables are used. The first of these variables is $LInvestment_i$, which represents the logarithm of the estimated amount of investment that is required for the project at the start of the concession. The second variable is $Term_i$, which refers to the total length of the contract. It is assumed that larger investments and longer terms will be associated with more complex contracts[19]. In addition, $Competition_i$ is a variable that accounts for the degree of *ex ante* competition during the award process[20].

Finally, a variable $Sust_i$ is included to differentiate financially self-sustainable contracts from government co-financed contracts. With respect to this variable, the empirical literature has found that if governments participate in the funding of the contract, renegotiations may be easier to arise[21].

Facts and events occurring ex post

[17] However, this assumption may not necessarily be true in situations involving the overdispersion of y_i. In fact, depending on the characteristics of the dependent variable, a stochastic term ε_i may be added to equation: $log\ \lambda_i = \beta\ X_i + \varepsilon_i$. This specification requires us to specify a density function for λ_i. The typical specification is the gamma distribution, which implies that y_i has a negative binomial distribution with a mean λ_i and variance $\lambda_i (1 + (1/\theta) \lambda_i)$, where θ is a parameter that represents the degree of overdispersion.

[18] Montesinos and Saavedra (2011a) shows that the main topic treated in renegotiation process of transport infrastructure was related to the building obligations of concessionaires.

[19] Other attempts to represent the degree of contract completeness can be found in Kosnik and Taylor (2012) (who use textual analysis and computational linguistics); and Aubert et al (2006) (who use questionnaire responses to assess informational technology outsourcing contracts).

[20] This variable has been calculated as the average of the number of participants during the bidding process and those which participated in earlier stages of the processes.

[21] See Guasch (2004), p. 89-90.

As discussed in previous sections and stated in proposition *P4*, for a given contract design, the *ex post* occurrence of unexpected events can trigger a renegotiation proposal from one of the contractual parties. An unexpected event can be produced by various sources, including but not limited to economic, political, or natural occurrences. Regardless of the initial conditions and the characteristics of a contract, parties may attempt to mitigate the adverse effects of these events through the pursuit of renegotiations during the execution of the contract in question. Guasch (2004) and Guash et al (2003, 2005) tested the influence of macroeconomic *shocks* on the incidence of renegotiations and demonstrated the importance of these shocks for explaining renegotiations. These researchers also revealed the influence of political factors (e.g., elections) on renegotiations[22].

In our case, we included variables that were related to economic and political risks. One important source of economic risk in developing countries are cost *shocks* which can be *proxied* through the inflation rate ($Inflation_i$)[23]. This variable can reflect the degree in which costs shifts related to nontradable goods (as wages, local inputs, utility's services, among others) can impact on prospective earnings of concessionaires and in turn on their propensity to initiate a renegotiation.

In order to account for the effect of political cycle, we use two alternative variables. Firstly, the number of electoral processes ($election_i$) as an indicator of the exposure to political risks that occurs during the life of a concession. Alternatively, we use the average rate of presidential approval during the life of the contract[24].

Participation of a regulatory agency

As mentioned above, an important variable identified by the literature as a factor that can affect the likelihood of a renegotiation is the presence of a regulatory agency. Indeed, the results from Guasch (2004) and Guasch *et al*.(2003, 2005) suggest that a higher incidence of renegotiations may reflect failures in the governmental supervision of concessionaires. Thus, a specific dummy ($Agency_i$) has been included in order to distinguish between sectors in which there exists a regulator from others. Alternatively, given that the hypothetical explanation of the aforementioned assertion states that renegotiations may reflect the allocation of insufficient resources to contract supervision, we use the yearly average budget per contract (as measured by the resources that are allocated to the relevant regulatory agency during the life of each contract, $Avgbudget_i$) as a *proxy* of this factor.

In order to control for the time of exposure of each contract (which could be an important source of variability of the dependent variable, *Reneg*), a variable which represents the time elapsed since the signature of the contract to the endpoint date of the study was introduced. The parameter of this variable was set at 1, so the parameters estimates should be interpreted as the influence of each explanatory variable on the *yearly* number of renegotiations.

With the objective of testing the degree of likelihood of different specifications and to assess the robustness of the results, eight alternative sets of explanatory variables were used:

Model 1 (M1):

Contract design and award process: *Sust, Competition, Engineer1,Regtariff, Term,*
Ex post events: *Elections, Inflation*
Participation of the regulator*: Agency*

Model 2 (M2):

Contract design and award process: *Sust, Competition, Engineer1, Regtariff, LInvestment,*
Ex post events: *Elections, Inflation*
Participation of the regulator*: Agency*

Model 3 (M3):

Contract design and award process: *Sust, Competition, Engineer1, Regtariff, Term,*
Ex post events: *Approval, Inflation*
Participation of the regulator*: Agency*

[22] See also Aguirre (2013).
[23] In this case, we use the average annual inflation rate, calculated during the life of each concession.
[24] The series were taken partially from Arce and Carrion (2010).

Model 4 (M4):

Contract design and award process: *Sust, Competition, Engineer1, Regtariff, LInvestment,*
Ex post events: *Approval, Inflation*
Participation of the regulator*: Agency*

Model 5 (M5):

Contract design and award process: *Sust, Competition, Engineer1, Regtariff, Term,*
Ex post events: *Approval, Inflation*
Participation of the regulator*: Avgbudget*

Model 6 (M6):

Contract design and award process: *Sust, Competition, Engineer1, Regtariff, LInvestment,*
Ex post events: *Approval, Inflation*
Participation of the regulator*: Avgbudget*

Model 7 (M7):

Contract design and award process: *Sust, Competition, Engineer2, Regtariff, Term,*
Ex post events: *Elections, Inflation*
Participation of the regulator*: Agency*

Model 8 (M8):

Contract design and award process: *Sust, Competition, Engineer2, Regtariff, LInvestment,*
Ex post events: *Elections, Inflation*
Participation of the regulator*: Avgbudget*

Appendix 3 presents the results for the estimation of the conditional Poisson (CP) model for M1 to M8. A Böhning test[25] on $Reneg_i$ was performed, obtaining a $Chi^2(49)$ of 12,02, which does not reject the null hypothesis of equality between the mean and the variance. In all cases, either Deviation and Pearson goodness of fit statistics fail to reject the CPM specification instead of alternative specifications. Alternative specifications for M1-M8, as negative binomial and zero inflated, were also estimated; however in no case could the null hypothesis of CPM be rejected (see Appendix 5).

There were no great differences found between the statistics of informational criterion of Akaike and Bayesian between these eight specifications. However the specification which achieved the best statistical criteria was M6[26].

In the case of the design variables, the parameters $Sust_i$, the variable that was related to the source of funding, was significant, demonstrating that a shift from a regime that is partially financed by the government to a regime that is exclusively financed by concessionaire earnings significantly reduces the number of predicted renegotiations. This result is consistent with the findings in the literature (Guasch 2004).

In addition, $Engineer1_i$ and $Engineer2_i$ (which measure completeness) are statistically significant and show the expected sign. Proxies for complexity ($term_i$ and $Linvestment_i$) were not found significant. $Competition_i$ was found significant but with a negative sign, indicating that the more competition during the awarding process, the likelihood of renegotiation declines. This contrasts with the implications of the literature of procurement. A possible explanation of this result is that in the case of the Peruvian awarding processes, bidders participates not only in the bid process but also in the previous process of consultation regarding the design of contract and other documents related to the contest. This previous feedback process contributes to reduce the probability of error, attenuate uncertainty lower possible misunderstandings regarding the meaning of some clauses of the contract or to complete partially the contract in order to avoid *ex-post* opportunistic behavior.

$Regtariff_i$ was not found to be significant in the majority of equations.

[25] The Böhning (1994) statistic is $O= \{(n- 1)/2\}^{1/2} \{(S^2/)-1\}$ and possesses n-1 degrees of freedom.
[26] Akaike Informational Criterion (AIC) and Bayesian Informational Criterion (BIC) (see Burnham and Anderson (2004)) for 50 observations were 170.1 and 187.3, respectively.

With respect to *ex post* events, the inflation risk ($inflation_i$) and political risk variables ($elections_i$) were found to be non-significant.

Finally, the variable $Avgbudget_i$ that accounts for quantity of resources that are assigned to supervision displays an unexpected sign[27], undermining the hypothesis that low spending by regulatory agencies causes a greater number of renegotiations. Instead, the result suggests that the more resources allocated to regulatory agencies, the higher the number of renegotiations per year during the length of the contract.

Table 3 shows in column (1) a final reduced CPM model, which confirms the results mentioned above. In addition, an estimation (1a) was included in order to compare with the results obtained in Table 3.

Table 2 – Conditional Poisson Model for Reneg

	(1)	(1a)
Sust	-0.90***	-0.92***
	0.22	0.24
Competition	-0.09***	-0.08***
	0.03	0.03
Engineer1	-0.62***	-0.63***
	0.20	0.20
Term	0.00	0.01
	0.02	0.02
Elections		
Approval		-0.02
		0.05
Inflation		0.20
		0.42
Agency		
Avgbudget	0.05***	0.05***
	0.02	0.02
Constant	0.11	0.08
	0.43	1.72
Log likelihood	-77.5	-77.4
LR Chi2	30.8***	31.1***
P> Chi 2	0.00	0.00

Given the specification of the CPM, the parameters are interpreted as semi-elasticities. For instance, the value of the parameter that is associated with the completeness variable ($Engineer1_i$) is -0.62 which represents the impact of including previous engineering studies in the design process on the percentage change of the number of renegotiations (specifically, introducing engineering studies decreases the number of renegotiations by 62%). This result is consistent with the findings in the transaction cost literature.

Consistent with the data from the sample, the mean of the predicted probability of a lack of renegotiation is near 30%. The predicted probability of holding one renegotiation is approximately 10%. The remaining 60% corresponds to the predicted probabilities of more than one renegotiation for a concession contract. This result indicates the relevance of count model analysis (in contrast to binary dependent analysis) for studying the determinants of the repetitive renegotiation of contracts.

3.3. Survival Models

While cross section approaches like those provided by CDM, can be more accurate than binary models (like probit or logit) in contexts in which renegotiations are the rule rather than the exception, they also could face some limitations when there are some time-specific variables that can

[27] The same result was found using a dummy with the value of 1 if a regulatory agency exists and 0 otherwise; this dummy variable is frequently used by model specifications in cross-section empirical studies.

influence the probability of renegotiation throughout the life of the contract. In fact, CDM can only account for factors that statistically can contribute to explain the number of renegotations over the whole life of the contract.

Survival analysis focuses in explaining the factors that influence the occurrence of an event in a specific date, month or year. Designed originally for biological or medical research, this method can be also applied to the current analysis of renegotiations. One important advantage of survival analysis, compared to CDM, is that it permits explaining the probability of renegotiation as a function which varies over time and that can also be influenced by *ex-post* factors like economic or political shocks.

According to the literature[28] the hazard function or conditional failure rate is the instantaneous probability that an event (T) occurs in a given interval (t, t+Δt), provided that the subject has survived until the beginning of the interval (T > t):

$$h(t) = \lim_{\Delta t \to 0} \frac{\Pr(t + \Delta t > T > t \ / \ T > t)}{\Delta t}$$

The hazard rate can also be defined as the estimated number of failures on a specific unit of time. This rate can change over time, influenced by diverse factors, some of which can also change during the period of observation of the dependent variable. In our case, the dependent variable is number of renegotiations per year and our unit of time is a year.

In this section, we present the results of the estimation of a Cox Proportional Hazards Model (CPHM), which represents an extension of the analysis presented in the previous section. CPHM permits the estimation of a hazard rate function, which depends on exogenous explanatory variables as well as time:

$$h(t/x_1, x_2, \dots, x_k) = h_0(\mathrm{t})\exp(\beta_1 x_1, \beta_2 x_2, \dots, \beta_k x_k)$$

CPHM is considered a semi-parametric model in which the first component $h_0(t)$, the base rate is directly estimated from the data and the exponential component is estimated from the data through Maximum Likelihood. Although survival analysis is frequently used for the estimation of "one failure" analysis, it can be easily adapted for situations of multiple or recurrent failures. In these cases, the hazard rate interpretation is similar to the cases of 'one failure' analysis but relaxing the assumption of T > t.

CPHM permits the estimation of the influence of explanatory variables on the hazard rate. This influence can be measured in terms of hazard ratios, comparing the hazard rates resulting from including the explanatory variable with the estimated hazard rate when the variable is excluded.

In this case, in order to permit only correlation among the failures corresponding to each subject (in our case, to each contract) it is necessary to introduce the following adjustment to the Variance-Covariance Matrix of the parameters:

$$\widehat{Var(\hat{\beta})}\ (R'sRs)\widehat{Var(\hat{\beta})}\ ,$$

in which, $Var(\beta)$ is the information matrix and Rs is the matrix of score residuals which imposes restrictions of correlation only among failures corresponding to the same subjects (or contracts).

In our case, for simplicity we use the same notation for the variables used for the estimation of CPM, but must be taken into account that for the CPHM estimation, the number of observations is 141 (the total number of renegotiations). In order to exploit the possibility of introducing a variation in explanatory variables, we allow the variation of the political cycle ($elections_i$, $approval_i$) and economic shocks variables ($inflation_i$). This variation means that for some events (renegotiations) these variables can adopt different values, depending on the period in which the event occur. In the case of political cycle variables, $elections_i$, adopt a value of 1, when the renegotiation was signed during a post-electoral year, and $approval_i$ reports the average percentage of presidential approval during the previous year. In other cases the variables remain constant for each contract renegotiation.

[28] Here we will only refer to the essential elements of the methods of survival analysis, to the extent that it can permit to understand the CPHM estimation and their implications in terms of the study of renegotiations. For further references on survival analysis see Aalen et al (2008) or Fleming and Harrington (2005).

Furthermore, $inflation_i$, our proxy of variation in costs, is included as the annual rate registered during the year previous to the signature of a renegotiation. The remaining explanatory variables hold the same value throughout the life of each contract.

Appendix 4 shows the results of the CPHM estimation using this restriction for an analog specification of M1-M8 to that estimated in the previous section. As we can see, the likelihood ratio of joint significance is statistically significant in all specifications. In this case, AIC and BIC reports very close results from M1 to M8, but M8 reports the lower values[29].

The estimations confirm some of the results obtained in CPM. Indeed, variables $Sust_i$ and $Engineer_i$ are reported as significant and with the expected sign. In the case of our complexity proxies, only $Term_i$ is reported as significant in M3 and M5, and $LInvestment_i$ is statistically not significant in all cases. In the case of $Competition_i$, this variable was found to be significant in M8 but this result was not robust.

An interesting result is that our proxies of *ex post* shocks in this estimation appear as statistically significant in all estimations. Indeed, in the case of political cycle variables, both $elections_i$ and $approval_i$ are statistically significant. Similarly, $inflation_i$ is statistically significant in all specifications. Interpreting these results jointly with the significance of $Engineer_i$ permit us to highlight the relevance of incompleteness and adaptation costs as one of the major factors which drives renegotiations in Peru.

Table 3 shows a reduced estimation of the CPHM. In this equation, the proxies of complexity and completeteness ($Engineer1_i$, $Engineer2_i$ and $Term_i$) are significant. In addition, variables related to political cycle and *ex post* costs shocks are significant. These results confirm the importance of incompleteness and adaptation costs as a cause of renegotiations highlighted by the procurement literature.

Table 3 – Cox proportional hazards model for Reneg

	Coefs	Hazard Ratios
Sust	-0.88***	0.42***
	0.18	0.07
Competition	-0.05***	0.95***
	0.04	0.04
Engineer1	-0.47**	0.63**
	0.22	0.14
Term	0.03***	1.03***
	0.01	0.01
Elections		
Approval	0.02**	1.02**
	0.01	0.01
Inflation	0.11***	1.11***
	0.03	0.04
Avgbudget	0.01	1.01
	0.02	0.02
Log likelihood	-442.83	
LR Chi2	74.83***	
P> Chi 2	0.00	

The interpretation of CPHM coefficients is not straightforward. The influence of each explanatory variable will depend on their influence over the hazard function. This influence is reflected in the hazard ratios reported in Table 3. A hazard ratio higher than one means a positive influence of the explanatory variable over the risk while a value between zero and one reflect a negative influence. For example, for Engineer1, those contracts which were awarded with previous engineering studies will have a 37% less probability of being renegotiated than those awarded with no previous studies.

[29] For 191 observations AIC and BIC in M1 model are 891.2 and 917.2, respectively.

Finally, from the CPHM estimation, no evidence has been found on the relationship between the quantity of resources that are dedicated to contract supervision or the presence of a regulator and the number of contract renegotiations. This result appears to contradict one of the major hypotheses of the GLS model. This could be a consequence of the special characteristics of the renegotiation process in the Peruvian context; in particular, once a renegotiation proposal has been advanced (either by the government or by the concessionaire), the Peruvian regulators issue an evaluation report that is nonbinding for the contractual parties. Thus, recommendations offered by the regulators may not be incorporated or may be only partially reflected in the final version of the contract addenda. Given this characteristic of the Peruvian renegotiation processes, instead of implying that regulator participation is irrelevant to renegotiations, the observed results may indicate that the powers and attributions of regulators during the renegotiation process should be strengthened. Strengthening the regulator's role in renegotiations could discipline both opportunistic concessionaires and governments, aligning the incentives of these parties to the objectives of efficiency and consumers' satisfaction.

Moreover, the fact that design factors exert an important influence on renegotiation could be related to the particular structure of the Peruvian concession system, which involves interactions among different public organizations with divergent incentives and objectives. Although an independent investment promotion agency (Proinversion) spearheads the process of designing concession contracts, regulator participation in this process consists of merely issuing a report about contract contents. The regulator opinions are generally non-binding[30], and the maximum term for issuing these opinions is relatively short. These specific characteristics of the Peruvian awarding process are important and contribute to explain our results. To the extent that the investment promotion agency objective (which directs the process of contract design) is oriented toward reaching the goal of increasing the number of awarded contracts, the incentives of this agency may not necessarily be aligned with the objectives of regulators. Regulator interests and objectives are more closely related to minimizing *ex post* renegotiation; however, in Peru, the participation of these regulators in the process of contract design is limited. This fact implies that, given the degree of significance achieved by the variable $Engineer1_i$ and $Engineer2_i$ the high number of renegotiations in Peru may reflect an imperfect balance between the objectives of minimizing costly *ex post* bargaining (and completing contracts) with the Government interests of accomplishing their investment promotion goals. Despite the fact that completing concession contracts may be costly in time and resources, the results reported may reflect that Peruvian Governments have discounted excessively the future costs of renegotiations.

It is important to mention that some authors (i.e. Montesinos and Saavedra (2011b)[31]) use an alternative method to model the dynamics of renegotiations, which consist of estimating a panel with a binary variable (renegotiate/not renegotiate) for each year of lifetime of the contracts. However, there is consensus on the superiority of survival methods over binary dependent variable panels, being the most evident the inclusion of time as a determinant of the failure (renegotiation) and the possibility of including time censoring[32].

4. Discussion

The results shown in Section III show the significance of certain renegotiation determinants and the lack of significance for renegotiation of other examined factors. In particular, we revealed that factors that are associated with contract design (e.g., completeness) play a significant role in determining the occurrence of renegotiation. This result generally supports the hypothesis that the *trade-offs* that are faced by governments with respect to imposing high incentives, designing complete contracts and avoiding *ex post* bargaining costs affect renegotiations. In addition, factors related to unanticipated *ex post* political and economic events (i.e., costs shifts or elections) were found to be significant determinants of renegotiations. In contrast, the variables associated with the resources assigned to regulators were not found to be relevant as determinants of renegotiations. These results

[30] Until the approval of Legislative Decree 1012 (in 2008), the opinion of the regulator was non-binding for all aspects of concessions. Since the approval of this decree, only regulator opinions regarding tariffs and quality of service are binding.

support the Bajari and Tadelis model and only partially support the model of Guasch, Laffont and Straub.

On the other hand, the evidence found regarding the significance of using public funding in infrastructure projects and of not having previous studies in explaining the higher rates of contract renegotiations, is consistent with the literature that associates ex post opportunistic behavior with Government soft budgets. Engel *et al.* (2009) suggests that if there is no explicit limit on future expenditure in projects financed by Government, opportunistic concessionaires may lowball their offers with the expectation of breakeven through renegotiation. To the extent that any increase in budget requires a new revision and approval of previous feasibility studies, and that Peruvian law establish upper limits for modifying these budgets; it would be expected that the renegotiation rate be lower in the case of contracts with previous studies.

As discussed above, the notion that renegotiations are a consequence of adaptation costs faced during the execution of the contract allows for different explanations for the origins of renegotiations to be suggested. Bajari and Tadelis conceive renegotiation as the consequence of an evaluation during contract design that compares the costs of contract completion with the benefits of *ex post* renegotiation. If the outcome of this evaluation is a degree of completeness that is less than 1 (that is, if $\tau < 1$), then *ex post* renegotiation will occur[33].

In addition, Guasch, Laffont and Straub attribute renegotiation to problems that arise during contract design, particularly issues involving failures of the screening process. These failures, in turn, are influenced not only by various policy variables, such as the quantity of resources that are devoted to enforcement, but also to other institutional factors (the credibility and autonomy of authorities are among the most important of these considerations). However, as mentioned above, the GLS model also concedes that unanticipated *ex post* events can influence renegotiations.

An alternative explanation for the origins of the renegotiation processes can arise from divergences in the relative valuations of the government and concessionaire for various contractual attributes, such as the intensity of incentives, completeness or complexity. In Figure 1, we depicted the solution from the Bajari and Tadelis model in which the marginal disutility of effort by the concessionaire exactly equals the marginal effects of effort on the product (v). This situation may hold if the contract design results from a negotiated process, but it may not if the contract results from a competitive process. In this latter situation, despite the fact that the government is able to interact with bidders during the award process[34], the contract will be approved according to an appropriate objective function, which may be related to public interest considerations and/or certain regulatory policy goals. In the case of a competitive award, it will not always be possible to achieve a solution of exact equivalence between the marginal rates of valuation of y by the bidder and the government.

[33] A limitation of this approach is the assumption that the degree of completeness of the contract uniquely corresponds to a rational decision by the government, ignoring the possibility of bounded rationality. This issue is discussed by Tirole (2007) and by Anderlini and Felli (2003).

[34] In the case of Peru, the award is preceded by a consultation process that examines the contract and the rules of the award. As a result of this process and the evaluation of the authority, certain characteristics of the contract and the rules of the award can be modified. These consultations and the modifications of the processes are published in other documents.

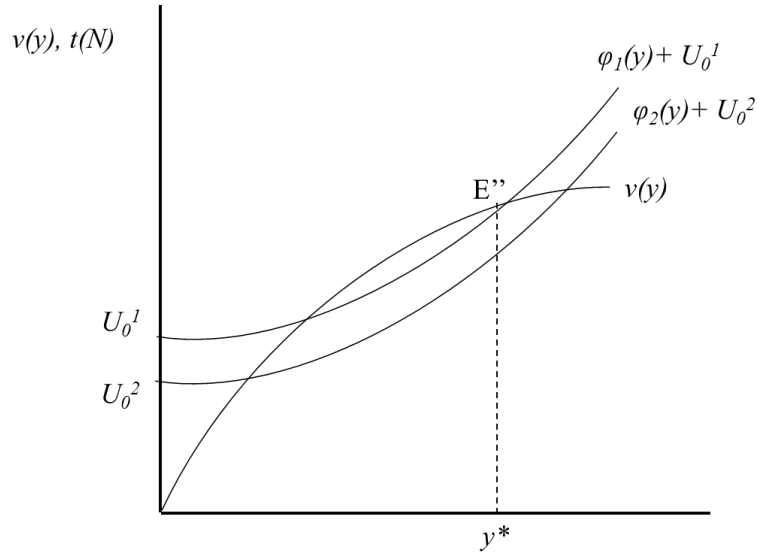

Diagram 2

Figure 2 presents a diagram with the utility functions of bidder 1 and bidder 2. Assuming that both bidders possess perfect information[35], bidder 2 will offer a level of effort slightly superior to that offered by bidder 1 and will win the award. At point E'', $\frac{\partial v(y)}{\partial y} < \frac{\partial \varphi_2}{\partial y}$ thus, bidder 2 (the new concessionaire) will have an incentive to request a renegotiation to increase its utility and reduce its level of effort. Similar reasoning could apply to the valuation of other characteristics of the contract, including its completeness and complexity.

This situation is not a consequence of failures in the screening process (between prospective bidders), the outcome of an unanticipated *shock*, or the result of a failure in the design process from the perspective of the government. Instead, it is a plausible consequence of the fact that the government and the concessionaire possess different valuations of the different contract attributes and characteristics. One important cause of this mismatch in marginal valuations can be a lack of competition during the contest. Indeed, in these instances, the probability of a match between marginal valuations could be notably low[36]. Given the multidimensional nature of concession contracts, even in contexts involving strong competition, it will be rather difficult to find a perfect match between the government and a concessionaire for every contractual attribute.

In these contexts, subject to the condition that the transaction costs of renegotiating are lower than the potential benefits of adapting the contract to the concessionaire's marginal valuations, there will be a demand for renegotiation. The signs of the parameters for the explanatory variables found in our estimations, related to the design of the contract (found in the previous section) can be understood as the directions in which both parties (government and concessionaire) adjust the terms of the contract in manners that are consistent with their relative valuations of the different attributes of the contract.

Concluding remarks

The performance of infrastructure projects is critically dependent on the design of the respective concession contract. Renegotiation, which is a change of the original the terms of a contract, may be a consequence of designing incomplete contracts or a method of adapting these terms to new conditions resulting from the occurrence of unexpected events. From the analysis of a sample of 50 concession contracts, this article has presented evidence that these factors are relevant for explaining the high incidence of contract renegotiation.

The evidence presented in this article does not permit us to discard incidences of opportunistic behavior from concessionaires or the government because incompleteness and –to a lesser extent-

[35]This assumption is not essential.

[36]This fact has been highlighted by the literature as one of the complexities that are faced by governments that promote concession awards through competitive processes. See Goldberg (1977) for a discussion of this topic.

complexity were found to be relevant for explaining repetitive renegotiations. Opportunism is a natural consequence of both of these contract characteristics. However, other possible explanations can be also set forth involving responses to favorable contingencies, such as the need to adapt contracts in ways that represent technological advancements.

The main policy implication of the study results is the need to reassess and improve the design of contracts to avoid the costs of *ex post* bargaining and repetitive renegotiation. This situation will necessarily imply a shift towards a greater completeness in contract design. Second, it is necessary to strengthen the participation of regulators in renegotiations and contract design. In the case of Peru, the reduced influence of resources that are dedicated to supervision on the number of renegotiations may reflect the fact that the regulatory agencies have only a limited participation in renegotiation processes. More importantly, there is a need for more active regulator participation in the process of contract design. Because the objective of the investment promotion agency (which spearheads the process of contract design) may be oriented towards increasing the number of achieved awards, the incentives of this agency may not necessarily be aligned with regulator objectives. The regulator interests and objectives are more closely related to minimizing *ex post* renegotiation and ensuring the long-term sustainability of projects, but these regulators are hampered by their limited participation in the process of contract design. The high number of renegotiations in Peru may reflect the imperfect balance between the objective of avoiding costly *ex post* bargaining (consequently, the desire to complete contracts) and the the Government interests of accomplishing their investment promotion goals. This imbalance results from the divergent objectives and incentives of the two different public organizations that lead the process of contract design and regulation.

The strengthening of the Peruvian regulators' roles in renegotiations and contract design could discipline both opportunistic concessionaires and governments, thus causing the incentives of the investment promotion agencies and regulators to be better aligned with the objectives of efficiency and with the interests of the users of public services.

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APPENDIX I.
MAIN RESULTS OF GUASCH, LAFFONT AND STRAUB (2003, 2005) AND GUASCH (2004))

- Renegotiations are negatively correlated with the presence of an autonomous regulator. This situation is consistent with the theoretical GLS model, which emphasizes that renegotiation is caused by insufficient or inefficient supervision.
- Renegotiations are positively correlated with the inclusion of price caps (high-powered incentives) in concession contracts.
- Renegotiations are positively correlated with contract length. This conclusion is consistent with the literature that addresses incomplete contracts. Contract length can also be used as a proxy for contract complexity: greater required investment amounts will need longer periods for project financing.
- Renegotiations can be either positively or negatively correlated with the levels of investment that are involved in a project. Similarly to contract length, this variable can be used as a proxy for complexity.
- Renegotiations can be either positively or negatively correlated with the quality of bureaucracy. This finding is consistent with the main hypothesis of GLS model, which states that the incidence of renegotiations is caused by a lack of sufficient supervision.
- Renegotiations are positively related to electoral cycles, suggesting that a correlation may exist between the political support of a new governmental authority and the achievement of a renegotiation following the election of the authority in question.
- Renegotiations are negatively correlated to macroeconomic shocks, suggesting that greater uncertainty with respect to the macroeconomic environment produces higher likelihoods of requiring contract adjustments.
- Renegotiations are positively correlated with the use of competitive mechanisms of awarding contracts. As mentioned previously, mixed evidence exists in the procurement literature regarding this hypothesis.
- Renegotiations can be either positively or negatively correlated with corruption and private financing.
- Corruption has a negative effect on the likelihood of firm-driven renegotiation and a positive effect on the likelihood of government-led renegotiation.
- The incidence of renegotiation is high if the concessionaire is a national company.

APPENDIX 2- SAMPLE

N°	Contract	Investment (US$ m.m.)	Date of signature	Concessionaire	Sector	Subsector
1	Concesión de Aeropuerto Jorge Chavez	1,061.5	14/02/01	LAP	Transport	Airports
2	Primer Grupo de Aeropuertos Regionales	232.0	11/12/06	Swissport GBH	Transport	Airports
3	Segundo Grupo de Aeropuertos Provincias	256.6	05/01/11	Aeropuertos Andinos	Transport	Airports
4	Carretera Arequipa Matarani	5.8	19/09/04	CONCAR	Transport	Roads
5	Red Vial N° 5: Tramo Ancón-Huacho-Pativilca	61.4	15/01/03	NORVIAL	Transport	Roads
6	Tramos Viales del Eje Multimodal Amazonas Norte (IIRSA Norte)	205.8	17/06/05	Odebrecht	Transport	Roads
7	Corredor vial Interoceánico Sur: Tramo 2	221.0	04/08/05	Odebrecht G&M y JJC	Transport	Roads
8	Corredor vial Interoceánico Sur: Tramo 3	332.0	04/08/05	Odebrecht G&M y JJC	Transport	Roads
9	Corredor vial Interoceánico Sur: Tramo 4	205.0	04/08/05	Intersur Andrade Gutierrez, Camargo Correa y Queiroz&Galvao	Transport	Roads
10	Red Vial 6: Puente Pucusana-Cerro Azul-Chilca-Pisco-Ica	192.1	20/09/05	COVI Peru (Casa, Hidalgo&Hidalgo)	Transport	Roads
11	Tramo Empalme 1B: Buenos Aires - Canchaque	31.1	09/02/07	G&M	Transport	Roads
12	Corredor Vial Interoceánica Sur: Tramo 1: San Juan de Marcona-Urcos	98.9	23/10/07	Survial (G&M)	Transport	Roads
13	Corredor vial Interoceánico Sur: Tramo 5: Matarani-Azangaro – Ilo- Juliaca	183.4	24/10/07	COVI Sur	Transport	Roads
14	Programa Costa – Sierra: Ovalo Chancay – Desvío Variante Pasamayo – Huaral – Acos	34.3	20/02/09	Conalvias e Infracon	Transport	Roads
15	Red Vial 4: Pativilca - Santa - Trujillo	286.2	18/02/09	OHL Concesiones	Transport	Roads
16	Programa Costa Sierra: Nuevo Mocupe – Cayaltí – Oyotún	17.4	30/04/09	Obrainsa	Transport	Roads
17	Autopista del Sol Tramo Trujillo-Sullana	196.3	25/08/09	CASA e Hidalgo&Hidalgo	Transport	Roads
18	Tramo 2 del Eje del Amazonas Centro	126.0	27/09/10	CONCAY S.A., INCOEQUIPOS S.A., NEXUS Banca de Inversión, y Viviendas del Perú S.A.C. (filial de COLPATRIA Constructora)	Transport	Roads
19	Etecen-Etesur	10.5	05/09/02	ISA Colombia. Transelca, Empresa Electrica Bogota	Energy	Electricity - Transmission
20	Líneas Eléctricas: Pachachaca-Oroya, La Oroya-Carhuamayo-Derivación Antamina y Aguaytía Pucallpa	65.4	26/04/01	ISA Colombia	Energy	Electricity - Transmission
21	Línea de Transmisión Eléctrica Carhuamayo – Paragsha – Conococha – Huallanca – Cajamarca – Cerro Corona – Carhuaquero	106.1	22/05/08	Abengoa Transmision Norte	Energy	Electricity - Transmission
22	Gaseoducto Regional de Ica	60.0	07/03/09	Empresa Energía de Bogotá (EEB) y Transportadora de Gas del Interior (TGI) de Colombia.	Energy	Transportation-Gas
23	Líneas de Trasmisión Eléctrica Mantaro – Caravelí - Montalvo y Machu Picchu Cotaruse	181.0	22/08/08	Grupo Isolux Corsan de España	Energy	Electricity - Transmission
24	Línea de Transmisión Eléctrica Chilca – La Planicie – Zapallal	52.2	08/09/08	ISA Colombia	Energy	Electricity - Transmission
25	Concesiones de Suministro de Energía Eléctrica destinada al Servicio Público de Electricidad de nuevas centrales hidroeléctricas	300.0	03/12/09	Generación Eléctrica Cheves S.A	Energy	Electricity - Transmission
26	Concesión del proyecto: "Reforzamiento del Sistema de Transmisión Centro-Norte Medio en 500 kV (L/T/ Zapallal – Trujillo)	167.5	18/02/10	ISA Colombia	Energy	Electricity - Transmission
27	Línea de Transmisión Tintaya-Socabaya en 220 Kv y subestaciones asociadas	43.6	30/09/10	Consorcio REI-AC	Energy	Electricity - Transmission
28	Línea de transmisión 220 Kv entre Talara y Piura	14.6	26/08/10	Consorcio Transmantaro	Energy	Electricity - Transmission
29	L.T. Machupicchu-Abancay-Cotaruse de 220 kV	62.5	22/12/10	ISA Colombia	Energy	Electricity - Transmission
30	Reserva Fría de Generación Talara	110.0	08/01/11	Endesa	Energy	Electricity - Transmission
31	Reserva Fria de Generación Ilo	220.0	20/01/11	GDF Suez / Enersur	Energy	Electricity - Transmission
32	Concesión del Proyecto: LT SGT en 500 kV Chilca-Marcona-Montalvo	291.0	22/07/10	ASA Iberoamericana	Energy	Electricity - Transmission
33	Proyecto Olmos	184.8	22/07/04	Odebrecht	Irrigation	Irrigation
34	Nuevo Terminal de Contenedores en el Terminal Portuario del Callao - Zona Sur (Muelle Sur)	617.1	24/07/2006	DP World	Transport	Ports
35	Terminal Portuario de Matarani	7.8	17/08/99	Tisur	Transport	Ports
36	Concesión del Terminal Portuario de Paita	214.9	09/09/09	Terminales Euroandinos (Tertir - Terminais de Portugal SA , Cosmos Agencia Maritima SAC y Transtei SA)	Transport	Ports
37	Servicios de Agua y Desagüe de Tumbes	73.0	30/09/05	Aguas de Tumbes (Consorcio Latinaguas Arg -Concyssa Per)	Water and Sanitation	Water and Sanitation
38	Abastecimiento de Agua Potable para Lima (Huascacocha – Rímac)	76.9	17/01/09	OAS	Water and Sanitation	Water and Sanitation
39	Ferrocarril Central	80.0	19/07/99	Ferrovias Central Andina	Transport	Railways
40	Ferrocarril del Sur y Sur Oriente	80.0	19/07/99	Orient Express (Transnacional), Peruval	Transport	Railways
41	Tren Urbano (Linea 1)	221.0	11/04/11	GYM Ferrovias	Transport	Railways
42	Terminal Portuario de Yurimaguas	37.0	31/05/11	Concesionaria Puerto Amazonas Construcción y Administración S.A e Hidalgo & Hidalgo	Transport	Ports
43	Linea de Transmisión Eléctrica Mantaro Socabaya	179.0	27/02/98	ISA	Energy	Electricity - Transmission
44	Reforzamiento de Sistemas de Transmisión del Sur	74.5	19/03/99	Red Electrica de España	Energy	Electricity - Transmission
45	Aprovechamiento óptimo de las aguas superficiales del Rio Chillon	80.0	07/04/00	ACEA/Impregilo/Fisia Utalimpianti/Castalia/Cosapi /Consorcio Agua Azul	Irrigation	Irrigation
46	Transporte Gas Natural de Camisea al City Gate	957.2	09/12/00	Transportadora de Gas y otros	Energy	Transportation-Gas
47	Transporte de Liquidos Camisea hasta la costa	401.9	09/12/00	Transportadora de Gas y otros	Energy	Transportation-Gas
48	Distribución de Gas Lima y Callao	91.9	09/12/00	Transportadora de Gas y otros	Energy	Transportation-Gas
49	Linea de Transmisión Eléctrica Trujillo Chiclayo	110.0	26/05/11	ISA Colombia	Energy	Electricity - Transmission
50	Reserva Fría de Generación: Planta Eten 200 Mw	113.0	21/07/11	Cobra	Energy	Electricity - generation

APPENDIX 3
Conditional Poisson Model for Reneg

	M1	M2	M3	M4	M5	M6	M7	M8
Sust	-0.51 **	-0.35	-0.62 **	-0.46 *	-1.03 ***	-0.96 ***	-0.64 **	-1.22 ***
	0.26	0.24	0.27	0.25	0.33	0.35	0.25	0.34
Competition	-0.05 *	-0.06 *	-0.06 *	-0.07 **	-0.09 ***	-0.10 ***	-0.05	-0.07 **
	0.03	0.03	0.03	0.03	0.04	0.04	0.03	0.04
Engineer1	-0.72 ***	-0.69 ***	-0.71 ***	-0.73 ***	-0.58 ***	-0.60 ***		
	0.26	0.26	0.23	0.23	0.22	0.23		
Engineer2							-0.50 ***	-0.45 **
							0.18	0.19
Regtariff	-0.43 *	-0.49 *	-0.34	-0.39	0.14	0.12	0.01	0.43
	0.25	0.24	0.25	0.25	0.30	0.30	0.21	0.26
Linvestment		0.04		0.07		0.05		-0.07
		0.09		0.09		0.09		0.09
Term	0.02		0.02		0.01		0.03	
	0.02		0.02		0.03		0.03	
Elections	-0.04	0.01					-0.02	0.01
	0.24	0.24					0.05	0.05
Approval			-0.06	-0.07	-0.02	-0.03		
			0.04	0.05	0.05	0.05		
Inflation	0.32	0.14	0.55	0.49	0.17	0.17	0.10	-0.24
	0.36	0.27	0.40	0.36	0.42	0.35	0.33	0.27
Agency	0.30	0.34	0.36	0.40			-0.18	
	0.29	0.30	0.29	0.28			0.32	
Avgbudget					0.06 **	0.06 **		0.06 ***
					0.02	0.02		0.02
Constant	-1.39	-0.57	0.36	0.56	0.32	0.52	-0.71	1.12
	1.45	1.01	0.29	1.28	1.80	1.28	1.38	1.02
Log Likelihood	-77.9	-78.2	-77.1	-77.1	-77.3	-77.2	-80.8	-78.0
LR Chi 2	27.95 ***	27.3 ***	29.5 ***	29.5 ***	31.3 ***	31.48 ***	24.2 ***	29.78 ***
P>Chi 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

APPENDIX 4

Cox Proportional Hazards Model

	M1	M2	M3	M4	M5	M6	M7	M8
Sust	-0.72 ***	-0.65 ***	-0.80 ***	-0.64 ***	-1.09 ***	-1.02 ***	-0.71 ***	-1.10 ***
	0.22	0.21	0.20	0.18	0.23	0.29	0.22	0.32
Competition	-0.04	-0.04	-0.05	-0.05	-0.06 *	-0.07 *	-0.04	-0.07 **
	0.03	0.04	0.03	0.04	0.04	0.04	0.03	0.04
Engineer1	-0.50 ***	-0.58 ***	-0.49 ***	-0.62 ***	-0.43 **	-0.44 *		
	0.18	0.22	0.19	0.24	0.22	0.23		
Engineer2							-0.49 ***	-0.35 *
							0.18	0.21
Regtariff	-0.04	-0.09	0.03	-0.07	0.23	0.23	-0.04	0.28
	0.24	0.23	0.22	0.21	0.20	0.22	0.25	0.22
Linvestment		0.01		0.04		0.05		0.03
		0.11		0.13		0.10		0.09
Term	0.02		0.04 ***		0.03 **		0.02	
	0.01		0.01		0.01		0.01	
Elections	0.77 ***	0.78 ***					0.77 ***	0.81 ***
	0.26	0.27					0.26	0.26
Approval			0.02 **	0.01 *	0.02 **	0.01 *		
			0.01	0.01	0.01	0.01		
Inflation	0.14 ***	0.13 ***	0.11 ***	0.09 ***	0.11 ***	0.09 ***	0.14 ***	0.13 ***
	0.04	0.03	0.03	0.03	0.03	0.03	0.04	0.03
Agency	0.13	0.25	-0.02	0.23			0.13	
	0.21	0.27	0.20	0.32			0.21	
Avgbudget					0.03	0.04		0.05 *
					0.02	0.03		0.03
Log Likelihood	-438.5	-438.8	-443.1	-444.4	-442.46	-443.40	-438.61	-437.62
LR Chi 2	87.01 ***	90.6 ***	86.7 ***	78.8 ***	91.1 ***	82.63 ***	88.1 ***	91.15 ***
P>Chi 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

APPENDIX 5

Negative Binomial Modelo for Reneg

	M1	M2	M3	M4	M5	M6	M7	M8
Sust	-0.49 **	-0.31	-0.58 **	-0.42	-1.03 ***	-0.96 ***	-0.56 **	-1.13 ***
	0.26	0.25	0.27	0.26	0.33	0.35	0.26	0.33
Competition	-0.05 *	-0.05	-0.06 *	-0.07 *	-0.09 ***	-0.10 ***	-0.04	-0.07 **
	0.03	0.03	0.03	0.04	0.04	0.04	0.03	0.04
Engineer1	-0.76 ***	-0.73 ***	-0.74 ***	-0.75 ***	-0.58 ***	-0.60 ***		
	0.27	0.27	0.24	0.24	0.22	0.23		
Engineer2							-0.52 ***	-0.46 **
							0.18	0.19
Regtariff	-0.38 *	-0.45 *	-0.31	-0.36	0.14	0.12	-0.16	0.28
	0.26	0.26	0.26	0.26	0.30	0.30	0.23	0.28
Linvestment		0.04		0.07		0.05		-0.06
		0.09		0.09		0.09		0.09
Term	0.03		0.02		0.01		0.03	
	0.03		0.03		0.03		0.03	
Elections	-0.08	-0.02					0.30	0.29
	0.24	0.25					0.21	0.21
Approval			-0.06	-0.07	-0.02	-0.03		
			0.05	0.05	0.05	0.05		
Inflation	0.37	0.12	0.59	0.48	0.17	0.17	0.06	-0.23
	0.37	0.28	0.41	0.37	0.42	0.35	0.34	0.27
Agency	0.26	0.32	0.32	0.37			-0.14	
	0.32	0.32	0.32	0.31			0.28	
Avgbudget					0.06 **	0.06 **		0.06 ***
					0.02	0.02		0.02
Constant	-1.62	-0.51	-0.34	0.62	0.32	0.52	-0.72	0.86
	1.51	1.06	1.85	1.36	1.80	1.28	1.43	1.04
Log Likelihood	-79.9	-80.4	-79.2	-79.3	-77.28	-77.19	-79.99	-77.06
LR Chi 2	18.76 **	17.7 **	20.2 *	19.9 **	24.0 ***	24.17 ***	18.6 ***	24.42 ***
P>Chi 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
/Lnalpha	-4.90	-4.10	-5.04	-4.20	-15.56	-15.82	-14.17	-16.87
	10.16	4.58	12.29	5.23	1322.03	1703.67	936.02	1214.44
alpha	0.01	0.02	0.01	0.02	0.00	0.00	0.00	0.00
	0.08	0.08	0.08	0.08	0.00	0.00	0.00	0.00
LR Chi 2 (alpha=0)	0.01	0.05	0.01	0.04	0.00	0.00	0.00	0.00

Zero Inflated Model for Reneg

	M1	M2	M3	M4	M5	M6	M7	M8
Sust	-0.49 **	-0.30	-0.58 **	-0.42 *	-1.05 ***	-0.98 ***	-0.56 **	-1.20 ***
	0.26	0.24	0.27	0.25	0.33	0.36	0.26	0.33
Competition	-0.05 *	-0.05 *	-0.06 *	-0.07 **	-0.09 ***	-0.10 ***	-0.04	-0.07 *
	0.03	0.03	0.03	0.03	0.03	0.04	0.03	0.04
Engineer1	-0.77 ***	-0.74 ***	-0.74 ***	-0.76 ***	-0.59 ***	-0.60 ***		
	0.27	0.26	0.23	0.23	0.23	0.23		
Engineer2							-0.53 ***	-0.52 ***
							0.19	0.19
Regtariff	-0.39	-0.46 *	-0.31	-0.37	0.16	0.14	-0.15	0.39
	0.25	0.24	0.25	0.25	0.31	0.32	0.24	0.29
Linvestment		0.03		0.06		0.04		-0.08
		0.09		0.09		0.10		0.09
Term	0.03		0.02		0.01		0.03	
	0.03		0.03		0.03		0.03	
Elections	-0.08	-0.02					0.30	0.30
	0.24	0.24					0.22	0.21
Approval			-0.06	-0.07	-0.02	-0.03		
			0.04	0.05	0.05	0.06		
Inflation	0.38	0.14	0.59	0.48	0.15	0.16	0.07	-0.24
	0.36	0.27	0.40	0.36	0.43	0.38	0.35	0.26
Agency	0.27	0.34	0.32	0.38			-0.14	
	0.30	0.30	0.30	0.29			0.29	
Avgbudget					0.06 **	0.06 **		0.06 ***
					0.03	0.03		0.02
Constant	-1.65	-0.55	-0.38	0.56	0.15	0.46	-0.77	0.96
	1.46	1.01	1.77	1.27	1.88	1.36	1.48	1.04
Inflate								
Constant	-15.07	-16.55	-15.64	-15.91	-4.24	0.46	-4.93	-3.36
	966.38	1591.37	803.08	817.44	3.23	6.75	7.14	1.23
Log Likelihood	-79.9	-80.4	-79.2	-79.4	-77.23	-77.18	-79.98	-76.43
LR Chi 2	25.91 ***	24.8 ***	27.4 *	27.0 ***	31.3 ***	31.36 ***	25.8 ***	32.85 ***
P>Chi 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vuong Test	0.00	0.00	-0.01	0.00	0.14	0.05	0.07	0.49

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STRUCTURAL CHANGE AND BUSINESS CYCLE DYNAMICS IN TRANSITION ECONOMIES

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Abstract:

Presented research focuses on the consideration and analysis of peculiarities of the course of business cycles in the countries with transition economy. As starting point, a hypothesis on the business cycles nature change in the countries with transition economy after the financial crisis of 1997-1998 in consequence of capital formation changes and structural changes within economy sectors was put forward. A cross-correlation analysis was defined and applied to the analysis of economic fluctuations and testing of put hypotheses. The empirical part of the research deals with data of GDP and output by sector of economic activity. The data were taken from UNCTADstat United Nations Conference of Trade and Development, National Bureau of Statistics of the Republic of Moldova and Federal State Statistics Service of the Russian Federation.

Keywords: a business cycle, system changes in the business cycle, structural changes in the business cycle, cyclical fluctuations, business cycle dynamics, and transition economies.

JEL Classification: C22, E32

1. Introduction

The analysis of economic processes dynamics is an important task nowadays, because on its basis the changes forecasting of one or another economic phenomenon, state market conditions and the global economy as a whole are possible. The object character of business cycles allows the improvement of scientific and methodological approaches to the forecasting of economic indexes of the country and structural changes within economic activity sectors for short- term prospects as well as for long-term one. The purpose of this research is to study the business cycle dynamics in transition economies. The task is to find out the possibility of using the process of capital formation and structural changes within the economic sectors to describe the business cycle dynamics. In this research the number of interrelated tasks is determined to achieve the set purpose and the principal tasks are as follows: to identify the peculiarities of the course of business processes in the countries with transition economy; to study the nature of the relationship between GDP change dynamics of the countries with transition economy and the output change dynamics of the principal sectors of these countries; to analyze the impact of Gross Capital Formation (% of GDP) changes on the nature of the business cycle dynamics;

The solving of these tasks would allow to draw a conclusion on the possibility of using of the business cycles analysis for forecasting under the conditions of transition economy.

2. Literature review

The topicality of the problem of business cycles of transition economy countries and significant attention of scientists to it are connected with the intensification of transition economy cooperation with the European Union: political association and economic integration. Therefore, there appeared the necessity of ability assessment of these countries' economies to integrate to the euro area, the determining of optimal currency area and the synchronization of economic activity. And it was proved by Jagric T. (2002, 2004) that business cycles in small open economies which have strong trade links with major economies are likely to be more synchronized with the major economies than in case of larger, more closed economies. As noted by Tamla K. (2003) smaller and more open accession countries are already integrated with the euro area economy at least as closely as some outlying member countries before they joined the European Union.

Zoidov K.Kh., Gubyn V.A., Kondrakov A.V., Zoidov Z.K. (2011, 2012) while researching the development cyclicity of the countries with transition economy pointed out following 6 periods:

- transformational cyclical recession of economy (1992 – 1995);
- overcoming of the transformational cyclical recession (1996 – 1997);
- cyclical recession or growth reduction because of financial crisis (1997 – 1999);
- economy recovery because of raw material resources price increasing (2000 – 2008);
- cyclical recession or growth slowdown because of financial and economic crisis 2008 (2008 –2009);
- post crisis development in the context of modernization (2010 – 2020 predicted).

Methodological apparatus of the forecasting and analysis of business cycles is well developed for advanced market economy and this is confirmed by great number of scientific researches (Schumpeter J.A, 1939; Burns F., 1969; King Robert G., Plosser Charles I., 1988; David K. Backus and Timothy J. Kehoe, 1992; Rebelo Sergio T., 2005). At the same time, the conditions of transition economy (and before that the conditions of the planned economy too) add the significant specificity to the problematic. The authors (2012) characterized the countries with transition economy with the presence of system cyclical crises that affect all aspects of economic life, provided the decline of production output and investment, rampant inflation, the critical level of the budget deficit, the growth of domestic and external debt.

Savchenko T.G, Manzhula I.P. (2011) noted that the imperfection of the collection and processing of statistical data of these countries as well as limited resources for data revealing are the principal reasons of the difficulty of the business cycles research of the countries with transition economy.

Earlier the authors of this research investigated the impact of cycle dynamics on some macro-economic processes. Kolosok S.I. (2014) established the system cycle character of production and export goods and services of economy of Ukraine as a whole and its separate sectors. Myroshnychenko Iu.O.(2013) has suggested and proved scientific and methodical approach to the formation of investment strategies, based on the assessment and forecasting of capital profitability in separate economic sectors, taking into account the macro-economic processes, meso- and microlevels, as well as the phases of cyclical fluctuations.

3. Materials and methods

Express analysis between the dynamics of GDP of the countries with transition economy and the dynamics of the production output of their sectors was carried out with the help of chain rates of increase, as that particular method allows identifying visually the trends of structural changes of economic processes.

Further on, the dependence was proved with help of the calculated values of the pair of linear correlation. GDP indicator was chosen for the research due to the fact that it is the most effective accumulating integral indicator of economic activity and development of the countries. Besides, GDP is a simple time series that consists of trend, seasonal and cyclical fluctuations, and also the random component i.e. it is convenient for mathematical transformations depending on the purpose of the research.

The research put forward a hypothesis on the business cycles character change in the countries with transition economy after the financial crisis of 1997 – 1998 due to:

Hypothesis H_0: capital formation changes;

Hypothesis H_1: structural changes within economy sectors (and economy sections).

The different public databases were used to conduct the research:

- the statistical databases of the UN Conference on Trade and Development (UNCTADstat United Nations Conference on Trade and Development) were used for express analysis of GDP dynamics of the countries with transition economy and the dynamics of the production output of their sectors;
- National Bureau of Statistics of the Republic of Moldova and Federal State Statistics Service of the Russian Federation were used for detailed analysis of the economies system changes of the Republic of Moldova and the Russian Federation respectively. Currency

exchange rates were determined according to the data of UNCTADstat United Nations Conference on Trade and Development.

The course of study was influenced by such difficulties and limitations as:

- significant delay in the data publication;
- the difficulty of an adequate comparison of the results of statistical observation of the countries by economic activity types, as some countries use NACE Rev. 1.1 for the economic activities statistics, and some have already come to the use of NACE Rev. 2;
- for detailed analysis of economies system changes there appeared the necessity of calculation of exchanging rates of national currencies and the reduction of indexes to one currency basis (e.g.: US dollar) as information placed in statistical databases of national economies was measured in appropriate national currency.

4. Results

We investigated the dynamics of statistics data changes of 16[37] transition economies during 20 years from 1992 to 2011 throughout the express analysis phase (Appendix A). In most cases, we found out the existence of not only the dependence between the accession rate of GDP and the accession rate of production output of country's separate sectors, but also the dependence between the accession rate of all country's sectors production output and its GDP that provide evidence of existence of system changes in the business cycle[38]. Bosnia and Herzegovina, Croatia, Georgia, Kazakhstan, the Republic of Moldova, the Russian Federation, Ukraine, and Uzbekistan were the countries with the system changes in the business cycle. Kazakhstan had the biggest business cycle fluctuations of GDP, and the minimal fluctuations had Belarus among the countries with a transition economy, whose data we analyzed for a definite period of time. The tendency to bigger fluctuations synchronization of economies and their sectors after the financial crisis 1998 – 1999 can be easily seen by a graphical analysis (Appendix A). The production output slump of transition economies occurred almost at the same time, and the periods of output increase took place at closely timed intervals. Even the duration and the amplitudes in the business cycles phases of the gross domestic product of transition economies were most similar inter se. At the average, each country had 6 – 7 phases of increase and slump during analyzed period. It was the result of the socioeconomic situation similarity of national economies and presence of permanent interconnections between the economies.

At the same time, the unidirectional and cyclical nature of sector economies accession rate of output is corroborated by positive values of pair linear correlation between accession rates of GDP and accession rates of sector production output in transition economies during 1992 – 2011 (see Table 1). The results examination of the correlation analysis led to the following findings:

- industry (including mining, manufacturing, utilities subsector and manufacturing subsector) and services were the most procyclical.
- wholesale retail trade restaurants, hotels subsector and construction sector were the least dependent on the general economic situation;
- recession and expansion occurred simultaneously in almost all sectors (and in some countries they identically occurred in all sectors), that facilitates the forecasting of their state during different phases in the business cycle, but at the same time, makes economic situation more complicated in the countries, especially during the crisis.

[37] The Federal Republic of Yugoslavia was excluded from the analysis (in 2003, it was reconstituted as the State Union of Serbia and Montenegro), because during the study period the country ceased to exist.

[38] In this research, under the system changes in the business cycle we mean the same character of the change of all sector outputs of the economy and the economy's GDP; if there are similarities between output changes of only separate sectors and the economy as a whole (or similarities do not exist at all) then we consider that there were structural changes in the business cycle.

Table 1 – The pair linear correlation values between the accession rate of GDP and the accession rate of sector production output of the countries with transition economies during 1992 – 2011

The sector	Albania	Armenia	Azerbaijan	Belarus	Bosnia and Herzegovina	Croatia	Georgia	Kazakhstan	Kyrgyzstan	Republic of Moldova	Russian Federation	Tajikistan	TFYR of Macedonia	Turkmenistan	Ukraine	Uzbekistan
Gross domestic product (GDP)	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**
Agriculture, hunting, forestry, fishing	**0.7**	0.5	**0.9**	**0.9**	**0.8**	**0.7**	**0.7**	**0.8**	**0.9**	**0.7**	**0.9**	0.6	**0.8**	0.2	**0.8**	**0.7**
Industry	**0.8**	**0.9**	**1.0**	**1.0**	**1.0**	**0.8**	**0.8**	**0.9**	**0.8**	**0.9**	**1.0**	**0.9**	**0.9**	**0.7**	**0.9**	**0.9**
Mining, manufacturing, utilities	**0.8**	**0.8**	**0.9**	**0.9**	**1.0**	**0.7**	**0.7**	**0.9**	0.6	**0.8**	**1.0**	**0.8**	**0.9**	**0.7**	**0.9**	**0.9**
Manufacturing	**0.8**	**0.8**	**0.8**	**0.9**	**1.0**	**0.8**	**0.8**	**0.8**	0.6	**0.9**	**1.0**	**0.8**	**0.9**	**0.7**	**0.9**	**0.9**
Construction	0.6	**0.7**	0.3	**0.9**	**0.9**	**0.9**	**0.9**	**0.8**	0.6	**0.8**	**0.9**	**0.9**	**0.8**	0.2	**0.9**	**0.9**
Services	**0.7**	**0.8**	**0.8**	**0.7**	**0.9**	**0.9**	**0.9**	**0.9**	**0.8**	**0.9**	**1.0**	**0.9**	0.5	0.5	**0.9**	**0.9**
Wholesale, retail trade, restaurants and hotels	**0.7**	0.3	**0.9**	0.6	**0.9**	**0.9**	**0.9**	**0.8**	**0.7**	**0.7**	**0.9**	0.3	0.3	0.4	**0.7**	**0.8**
Transport, storage and communications	**0.8**	**0.8**	0.5	**0.7**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.9**	0.6	**0.8**	0.4	**0.7**	**0.8**
Other activities	**0.7**	**0.8**	0.6	**0.7**	**0.9**	**0.9**	**0.9**	**0.7**	**0.8**	**0.9**	**0.9**	**0.8**	0.4	0.5	**0.9**	**0.9**

Source: own computations

The null hypothesis H0 (the changes of capital formation) has the key significance, among the possible factors of fluctuations in the business cycle. The proof of this hypothesis involved two aspects verification: firstly, the relations between changes of capital formation and GDP; secondly, the impact of changes of Gross capital formation (% of GDP) on the cycle dynamics character in total. In accordance with the general procedure of statistical hypotheses proving, the correlation analysis between the accession rate of gross capital formation and the accession rate of GDP was conducted. It showed the existence of positive linear correlation between these indexes for the countries with transition economies, and these values are especially significant in countries with system changes in the business cycle (see Table 2).

At the same time, larger or smaller share of Gross capital formation (% of GDP) not always impacts the cycle amplitude and duration, the cycle shape. Cycle troughs and peaks for the most of transition economies coincide after the financial crisis during 1998-1999 despite the percentage of capital formation in the country (see Table 3). The significant gaps (more than 5%) in the values of indexes are also typical for the countries with transition economies. In comparison with other groups of economies, the nature of GDP cycle and capital formation differ a little.

Table 2 – The values of pair linear correlation indexes between the accession rate of GDP and the accession rate of gross capital formation

Country	The correlation index
Albania	0.6
Armenia	-0.1
Azerbaijan	0.4
Belarus	**0.9**
Bosnia and Herzegovina	**0.7**

Country	The correlation index
Croatia	**0.8**
Georgia	**0.8**
Kazakhstan	**0.7**
Kyrgyzstan	0.6
Republic of Moldova	**0.9**
Russian Federation	**0.9**
Tajikistan	**0.8**
TFYR of Macedonia	**0.8**
Turkmenistan	0.1
Ukraine	**1.0**
Uzbekistan	0.6

Source: own computations

Table 3 – Gross capital formation (% of GDP) in transition economies

Transition economy	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Albania	5	13	18	21	14	17	21	24	32	38	38	40	37	37	39	39	41	43	32	31
Armenia	2	10	23	18	20	19	19	18	19	20	22	24	25	30	36	38	41	35	33	28
Azerbaijan	-1	22	15	24	29	34	33	26	21	21	35	53	58	42	30	22	19	19	18	20
Belarus	32	41	33	25	24	27	27	24	25	24	22	25	29	28	32	34	38	37	41	36
Bosnia and Herzegovina	29	32	34	20	41	42	34	27	27	26	19	19	28	28	22	30	32	24	22	22
Croatia	12	13	16	16	20	25	21	20	19	21	25	27	27	27	29	29	30	25	22	21
Georgia	25	1	17	24	20	18	27	26	27	30	28	31	32	33	31	32	26	13	22	26
Kazakhstan	28	20	29	23	16	16	16	18	18	27	27	26	26	31	34	36	28	29	25	22
Kyrgyzstan	20	12	9	18	25	22	15	18	20	18	18	12	14	16	24	27	29	27	27	25
Republic of Moldova	60	56	29	25	24	24	26	23	24	23	22	23	26	31	33	38	39	23	24	24
Russian Federation	35	27	26	25	24	22	15	15	19	22	20	21	21	20	21	24	26	19	23	25
Tajikistan	27	32	30	23	18	16	13	14	9	10	9	10	12	12	16	25	27	25	24	25
TFYR of Macedonia	14	16	15	21	20	21	22	20	22	19	21	19	22	21	21	25	27	26	26	25
Turkmenistan	43	37	44	34	50	49	45	40	35	32	28	25	23	23	20	19	32	51	59	47
Ukraine	34	36	35	27	23	21	21	17	20	22	20	22	21	23	25	28	28	17	18	21
Uzbekistan	44	15	18	24	23	19	21	17	20	20	20	20	24	27	19	21	25	26	26	27

- Gross capital formation in % of Gross domestic product was less than 20 %
- Gross capital formation in % of Gross domestic product was between 20 % and 30 %
- Gross capital formation in % of Gross domestic product was more than 30 %

Source: own computations

Comparing the cycle curves nature between transition economies during 1993-2011, the following should be noted:

- Gross capital formation for the biggest European economies were typically possessed the value within 17 – 25 % of GDP (e.g., France 17 – 22 %, Germany 17 – 23 %, and Italy 17 – 22 %); at the same time there are no significant changes (more than 5 %) of values of the accession rate of GDP as well as the accession rate of capital formation from year to year;
- Countries with a high value of the accession rate of GDP were characterized by a high value of the accession rate of gross capital formation (e.g., China 35 – 49 %, Turkmenistan 19 – 59 %, and Mongolia 19 – 64 %).

The next step of our scientific research was to test the hypothesis H1 and to evaluate the structural changes in the economies with system changes in the business cycle.

We chose the Republic of Moldova and the Russian Federation for the purpose of the differences estimation of the behavior of economic agents in the countries with different income levels. The graphical results of analysis are presented in the Appendix B. During the comparison we took into account two groups of indexes such as:

- Profitability (sales profitableness; financial result before taxation);
- Risk (loss-making enterprises, in % to the total)[39].

During the analysis of the last business cycle of the Republic of Moldova and the Russian Federation (the bottom of the cycle was in 2009) we found similarities and differences. Both Moldova and Russia are characterized by such features as:

- the insignificant decrease of profitability accession rate (up to 1 – 2 %) was observed during 2011-2012 for the most types of activity in Moldova and Russia; it indicates, firstly, that the sales profitableness index had acyclic nature, and, secondly, " normal level of profitability" existed for the majority of economic activities of Moldova and Russia, which did not considerably change its level in the first 3 years of economic growth phase of business cycle;
- our studies showed the increase of risk under increasing of the profitability of economic activity in Russia and Moldova (in our case the bigger value of percentage of sales profitableness corresponds the bigger value of percentage of loss-making enterprises);
- the economies of Russia and Moldova receive the largest amount of income amount from all activities of group G NACE Rev. 1.1 (wholesale and retail trade; repairing of motor vehicles, motorcycles personal and household goods); it is also characteristic of global economy as a whole: every year the share of services sector in the world GDP grows and now it exceeds the value of 60 %;
- the levels of profitability and risk of economies of Russia and Moldova were lower than the industry average level for such activities as construction, and health and social work; Real estate renting and business activities sectors were the most appropriative for doing business (see Table 4).

But at the same time, the economy of Moldova was characterized by much greater profitability by economic activities (and, consequently, by a risk) in comparison with the economy of Russian: the highest level of profitability in Russia was 31.3 % for mining and quarrying section (and the lowest was -1.1 % for other community social and personal service activities section), the maximum rate of profitability in Moldova was 48.9 % for education section (and the lowest was 8.5% for electric and thermal energy gas and water section).

Table 4 – The characteristics of risk and profitability by economic activities sections NACE Rev. 1.1 (2012)

Section of an economic activity	Section code	Republic of Moldova	Russian Federation
Agriculture hunting and forestry	A		
Fishing	B		
Mining and quarrying	C		
Manufacturing industry	D		

[39] This indicator is determined by bubble diameter on the chart (see Appendix B): the bigger bubble the bigger risk pro tanto.

Section of an economic activity	Section code	Republic of Moldova	Russian Federation
Electric and thermal energy gas and water	E		
Construction	F		
Wholesale and retail trade; repairing of motor vehicles motorcycles personal and household goods	G		
Hotels and restaurants	H		
Transport and communication	I		
Financial intermediation	J		
Real estate renting and business activities	K		
Education	M		
Health and social work	N		
Other community social and personal service activities	O		

the risk and profitability of economic activity were under industry average in the country
the risk of economic activity was above industry average and profitability was under industry average in the country
the risk of economic activity was under industry average and a profitability was above industry average in the country
the risk and profitability of economic activity were above industry average in the country

*Source***:** own computations

Conclusion

The countries with system and structural changes in the business cycle were identified in the research. The similarity over the course of business cycle became more intensive for the countries with transition economies, especially after the financial crisis of 1997-1998. One of the main hypotheses on the business cycles character change in the countries with transition economy because of capital formation changes was not confirmed (hypothesis H0). Despite the fact that the increase in volume of capital formation in GDP structure in the countries with transition economy impacted on GDP growth during 1992-2011, the bottom of the cycles in these countries didn't appear due to the decrease of capital formation, but through the shocks of the economy.

During short-term period, from 1992 to 2011, the significant structural changes were not found in the studied countries with transition economy (hypothesis H1). In order to stabilize the situation in economy there was only the expansion of core industries (that mainly belonged to the raw materials sector) in times of crisis. Such policy and behavior led to the increase of risk and profitability decrease of named activity types, i.e. the decrease of their overall investment attractiveness.

Virtually, only core industries are developed in all countries with transition economy, and still the raw materials sector predominates in the economy, including the export structure. The strategy of foreign currency attraction through the raw materials sector of the export commodities has not proved itself under the conditions of the crisis cyclicity.

Difficulty in identifying and proving of the hypotheses connected with the existence of common features and reasons of business cycles changes in the countries with transition economy primarily was conditioned by the lack of comparable statistical data, for example, in accordance with such a less-aggregated measure classification such as NACE. Therefore, for more detailed study of structural changes within the business cycles of the countries with transition economy the further monitoring and using of the detailed data for longer period of time are needed.

Despite the difficulty of the research subject of this article, the study and use of the objective nature of business processes cyclicity in transition economies will allow to reform their system of

economic relations taking into account the horizontal connections of production and consumption of EU member countries.

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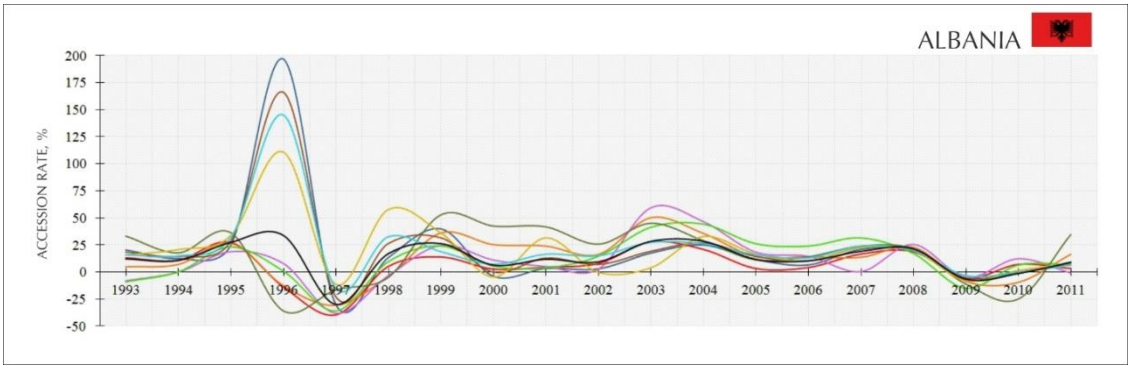
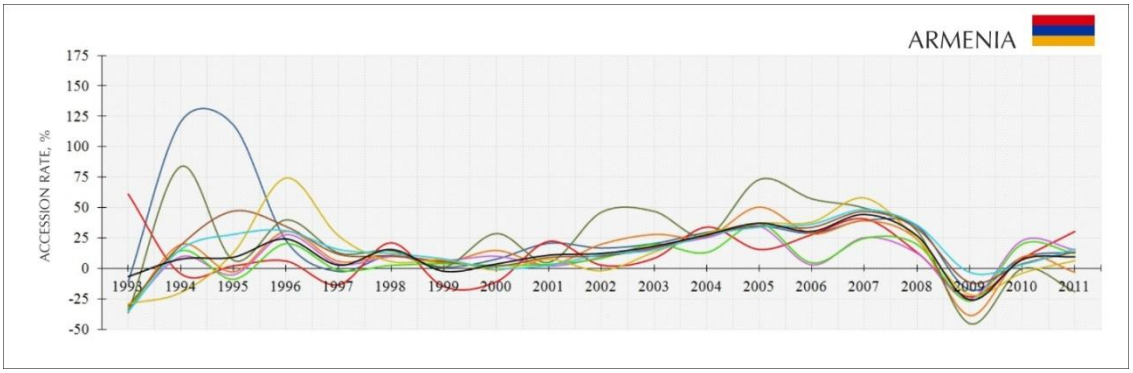
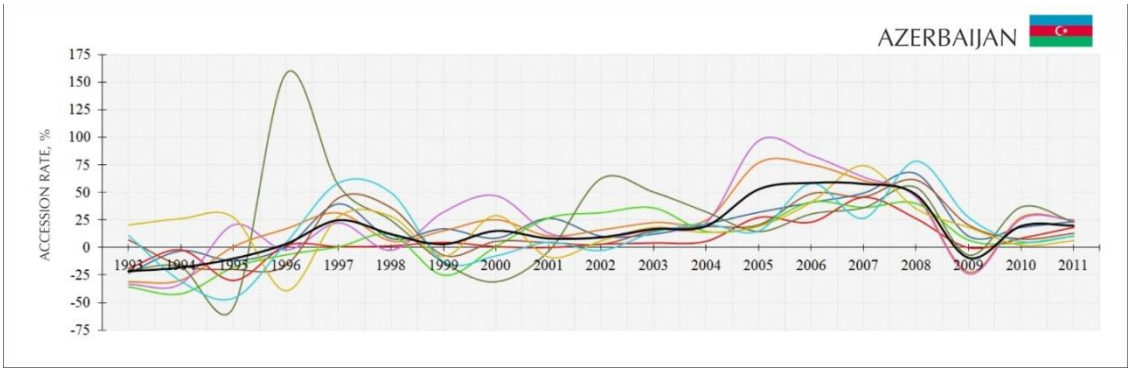
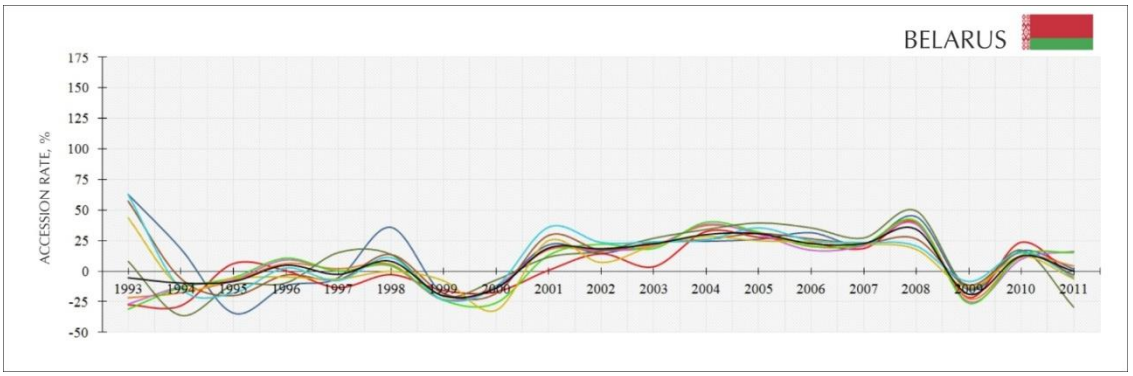
APPENDIX A

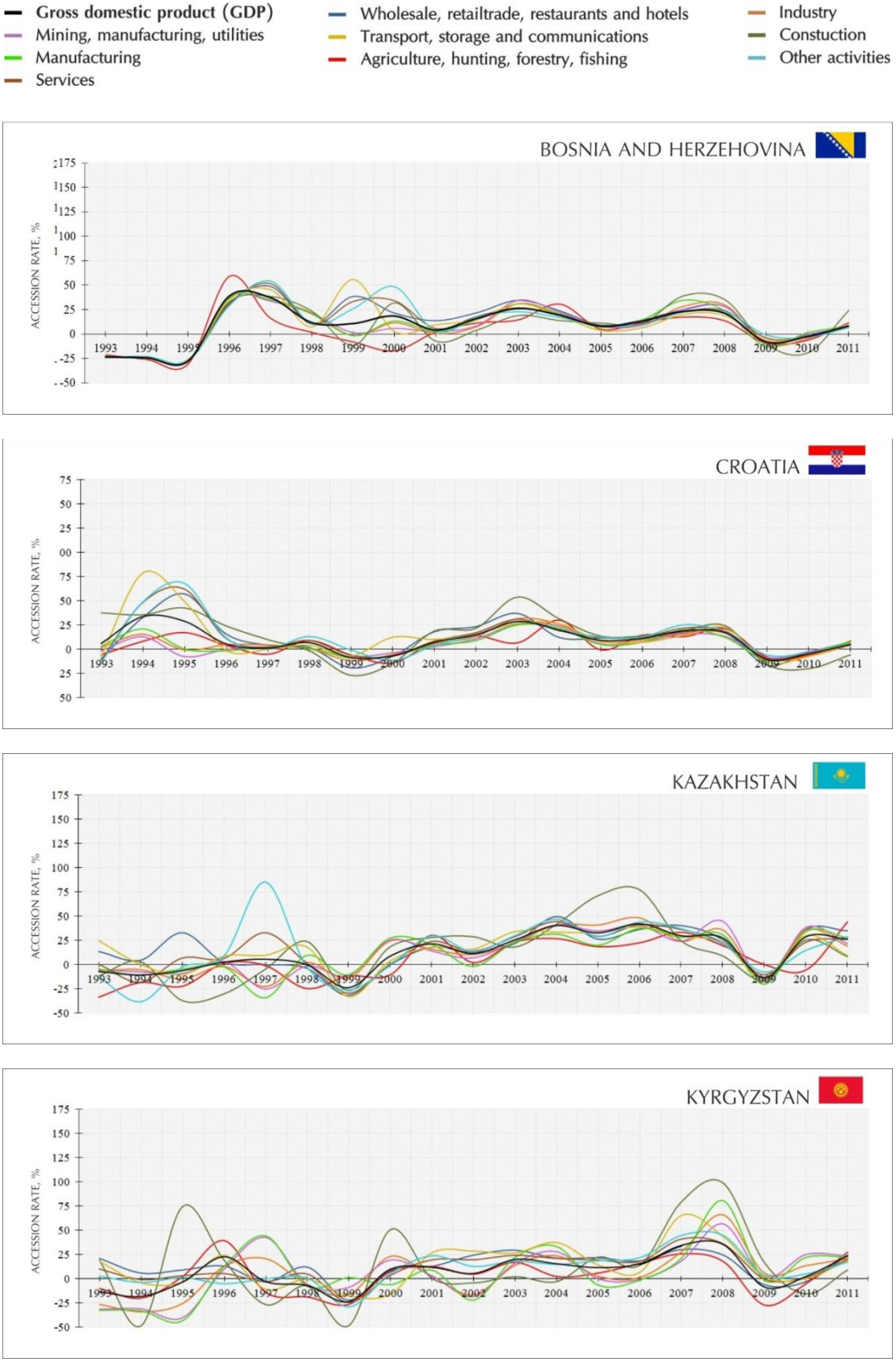
Figures 1 – 16: The accession rate of GDP and the accession rate of production output of country's separate sectors, 1993-2011

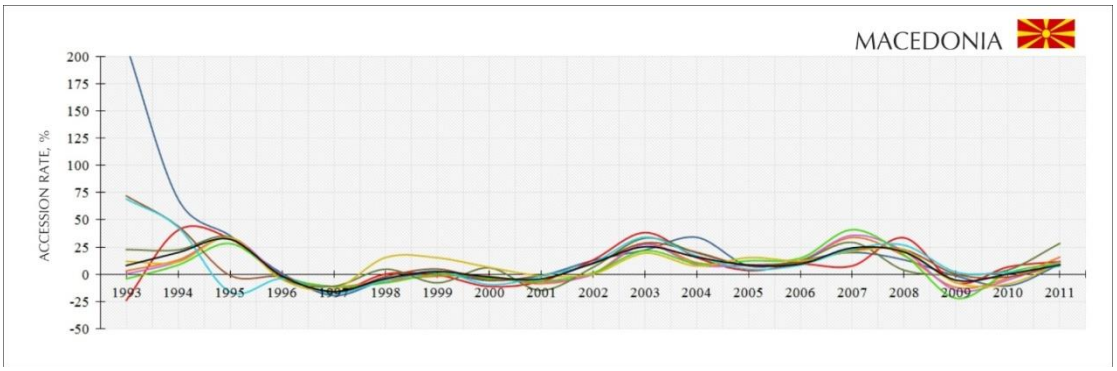


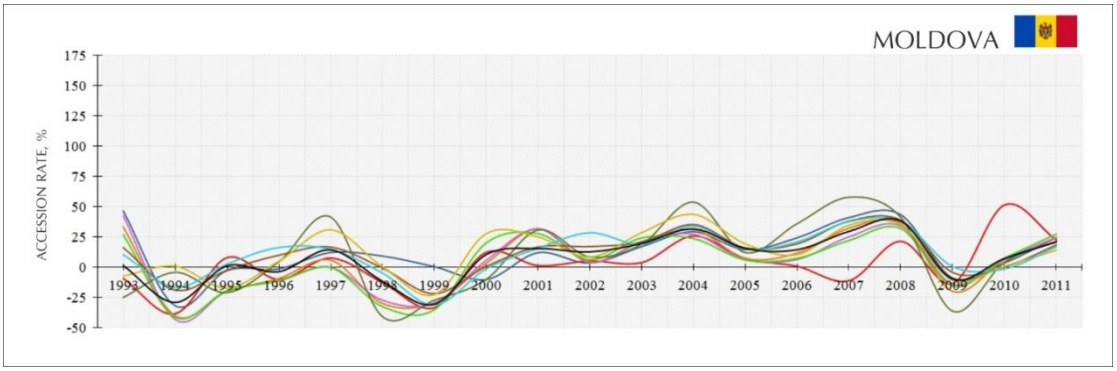


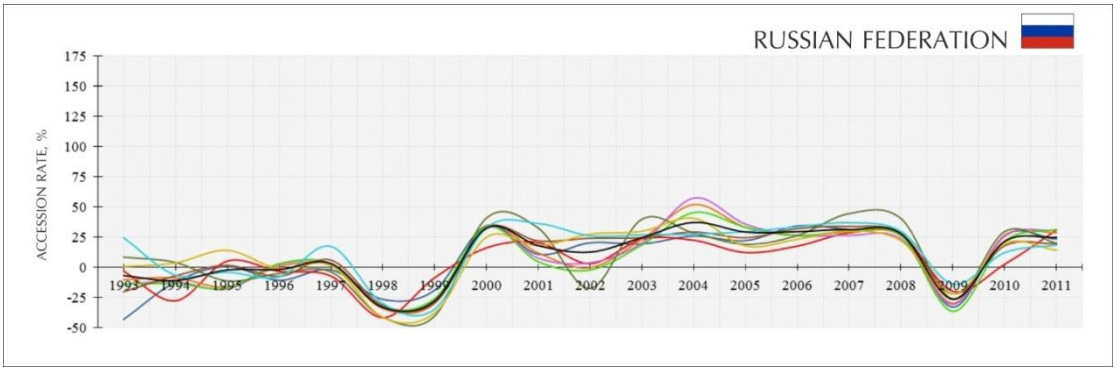


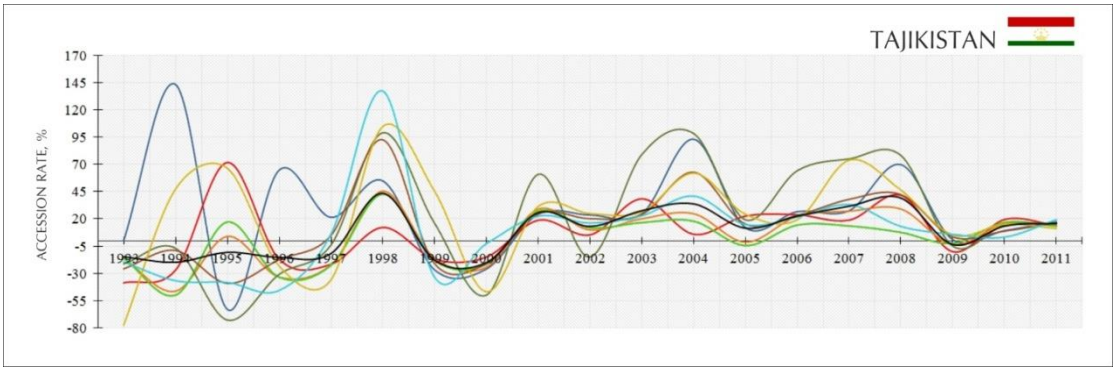


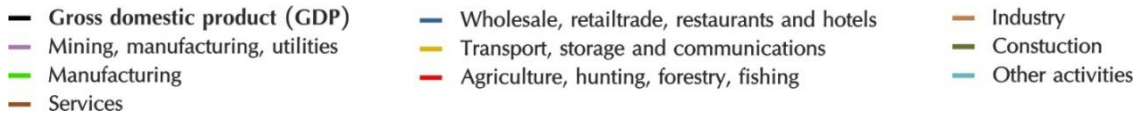

Gross domestic product (GDP)
Mining, manufacturing, utilities
Manufacturing
Services
Wholesale, retailtrade, restaurants and hotels
Transport, storage and communications
Agriculture, hunting, forestry, fishing
Industry
Constuction
Other activities
BOSNIA AND HERZEHOVINA
CROATIA
KAZAKHSTAN
KYRGYZSTAN
ACCESSION RATE, %
1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011

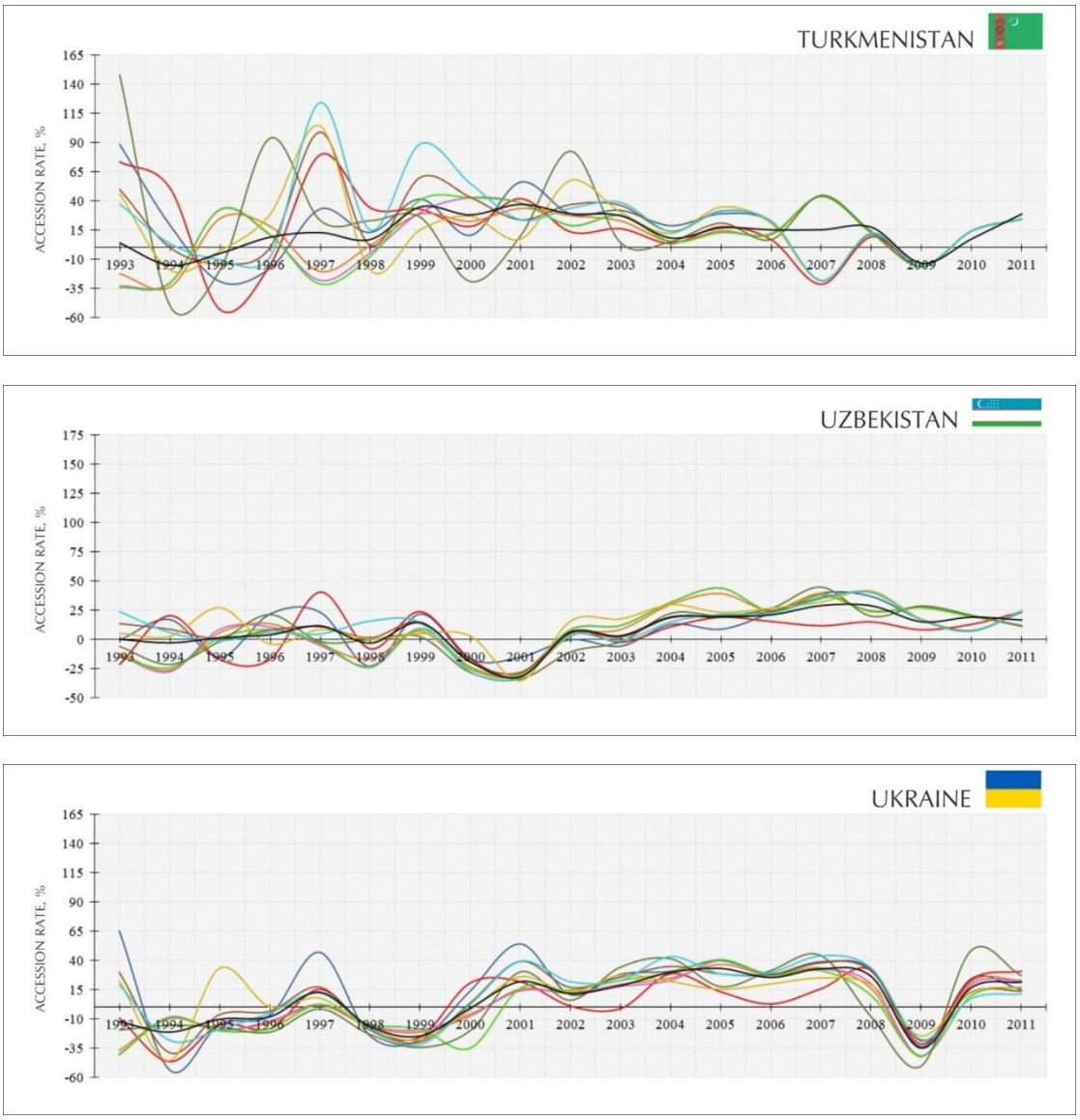

MACEDONIA
ACCESSION RATE, %
200
175
150
125
100
75
50
25
0
-25
-50
1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011


MOLDOVA
ACCESSION RATE, %
175
150
125
100
75
50
25
0
-25
-50
1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011


RUSSIAN FEDERATION
ACCESSION RATE, %
175
150
125
100
75
50
25
0
-25
-50
1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011


TAJIKISTAN
ACCESSION RATE, %
170
145
120
95
70
45
20
-5
-30
-55
-80
1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011

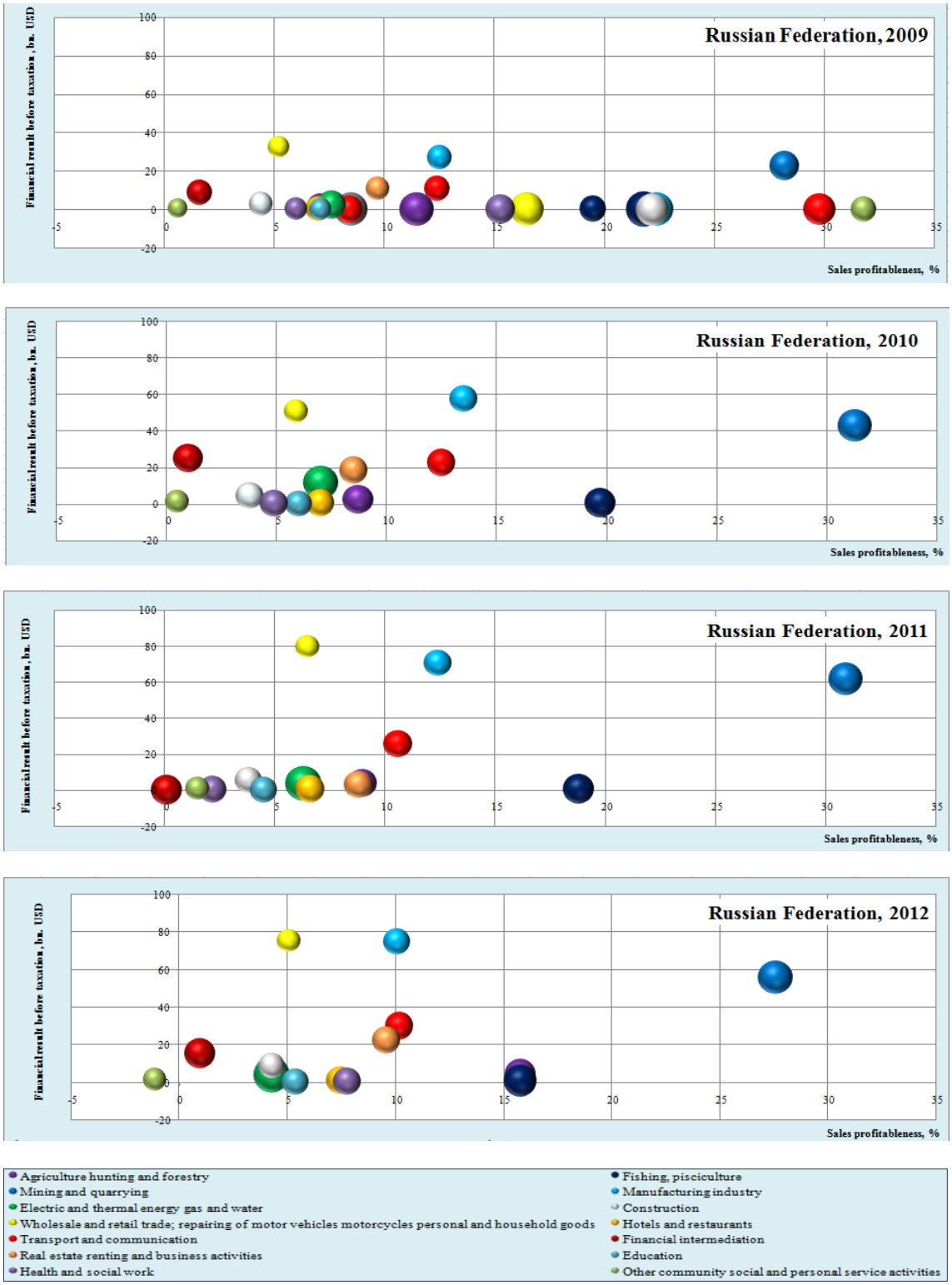

Gross domestic product (GDP)
Mining, manufacturing, utilities
Manufacturing
Services
Wholesale, retailtrade, restaurants and hotels
Transport, storage and communications
Agriculture, hunting, forestry, fishing
Industry
Constuction
Other activities

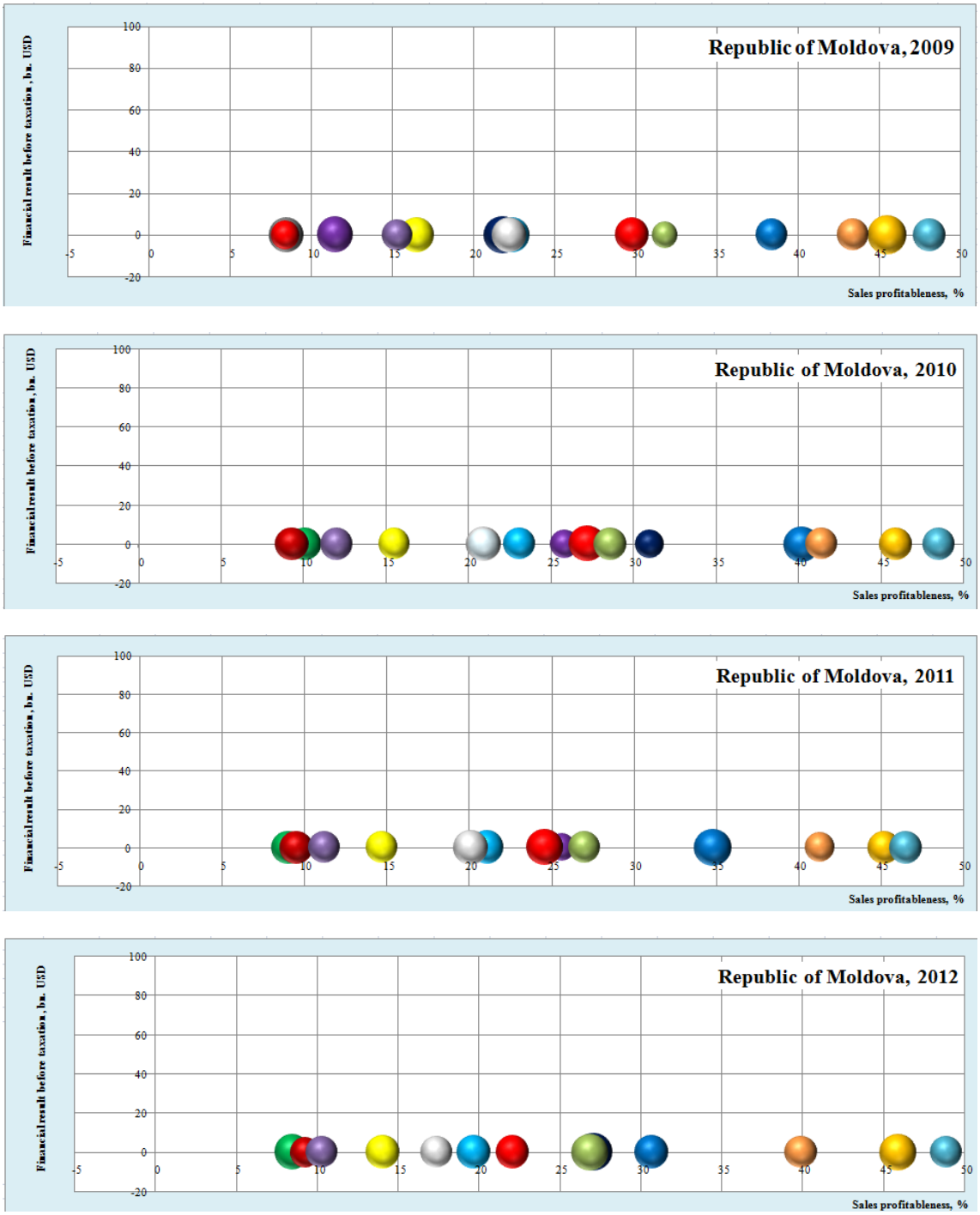


Source: own computations

APPENDIX B

Figures 1 – 2: Dependence between "Sales profitableness", "Financial result before taxation" and "Loss-making enterprises" for the Republic of Moldova and the Russian Federation, 2009-2012





Source: own computations

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ENDOGENOUS MONEY AND SECURITIZATION. AN ANALYSIS ON UNITED STATES (1999-2012)

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Abstract:

In this paper we examine the behavior of loans supply by explicitly accounting for the money endogeneity arising from securitization bank's activity. The empirical results with U.S. data provide strong evidence of money supply endogeneity under a regime in which securitization affects monetary transmission mechanism of monetary policy via the bank lending channel. The critical theoretical differences between the three competing approaches to the determination of the money supply are identified in terms of the importance of the private initiatives of banks in accommodating expansions of loans demand by using securitization. Specifically, in this paper we conclude short-run and long-run evidence in favor of structuralism approach.

Keywords: bank lending channel, endogenous money, securitization, monetary policy stance, long-run cointegrating relationship.

JEL Classification: E12, E51, E52.

1. Introduction

The conventional money supply literature has treated money supply as exogenously given. Within orthodox monetary macroeconomics the determination of the money supply is widely regarded as unproblematic. According to Keynesians, monetary policy affects both monetary base and money supply. Changes in money supply cause interest rates fluctuations which in turn affect investments and income. Recently, Post-Keynesian economists have sought to re-open this issue, arguing for a re-focusing of attention away from money supply toward the role of bank lending in this process. The contribution of this paper with respect to the existing passive money hypothesis literature is twofold. Firstly, we analyze money endogeneity in a short and long term study of the U.S. Area during the two main crises: the dot-com bubble burst (1998-1999) and the sub-prime mortgage crisis (2008-2009), in addition to the effect of financial innovation as securitization on lending channel. Secondly, we extend the evidence of endogenous money hypothesis on other advanced countries. In fact, there is a small amount of empirical evidence available on developed countries (Howells and Hussein 1998; Moore 1998; Nell 2000; Vera 2001; Shanmugam *et al.* 2003) and a recent study on United States could fill this gap. The analysis is focused in particular on the aggregate M1and M2. In the study period the Federal Reserve uses M1 and M2 money supply as its monetary target.

2. Theoretical background

The theories that support the Post-Keynesian view consider different causal relationships. According to accommodationalists (Moore 1989) there is full settlement of reserve demand by Central Banks versus banking systems that totally accommodates loans requests. Consequently, there is a one-way causal relationship from loans to monetary base and from loans to monetary aggregates. Furthermore, debtors establish their own loans demand considering future income expectations. At the same time, deposits created with new loans are used to finance increases in aggregate demand. To sum up, the accommodationist view (Moore 1989; Pollin 1991) involves a two-way causality relationship between money revenue and money supply.

The structuralist hypothesis (Pollin 1991; Palley 1996, 1998) combines the classical characteristics of monetarism (the Central Bank controls reserves supply) with the accommodationist view. This vision implies bidirectional causality from monetary base to loans, from money supply to loans and from money multipliers to loans. Structuralists consider the use of alternative financing forms to partially exceed reserves shortage (Palley 1996). Considering the relationship between income and money supply, structuralism is consistent with accommodationalism, which implies bi-directionality between the two variables.

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The exponents of the liquidity preference theory (Howells 1995) support the *core* of accommodationalist that argues a causal relationship from loans to money supply. However, the economic units involved have independent liquidity preference on how much money they wish to hold, so a supply excess may exist (Howells 1995). In this case, the liquidity preference view implies two-way causality from money supply to loans.

In Post Keynesian economics the first work on passive money is carried out by Pollin (1991) who obtains results supporting structuralism for USA during 1953-1988. Vera (2001) finds outcomes sustaining accommodationalist and structuralist theories for Spain in the period 1987-1998 using Granger causality test applied to money multipliers and loans data. Nell (2000-2001) examines the relationships among money supply, money circulation velocity and loans using VECM models for South Africa during 1966-1997 and confirms all Post-Keynesian approaches (Structuralist, Accommodationalist and liquidity preference theorist). Shanmungan Nair and Li (2003), analyze the relationships among money base, money supply, credit and industrial production index with VECM models and Granger causality test in Malaysia in the period 1985-2000: their results support the accommodationalist and liquidity preference theorists. Lavoie (2005) tests money endogeneity in Canada and in the United States obtaining results that sustain accommodationalist view. Ahmad and Ahmed (2006) apply VAR models for non cointegrated series (short term test) and VECM models (long term test) for cointegrated series on passivity money hypothesis for Pakistan during 1980-2003.

The short term results confirm the structuralist and liquidity preference approaches while the long-run test highlights the active role of Pakistan Central Bank to set money supply. Gunduz (2001), Seyrek, Duman and Sarikaya (2004) analyze the role of Turkish lending channel during 1986-1998 applying VAR models. Their findings support an active role of monetary policy. Cifter and Ozun (2007) examine the passive money hypothesis in Turkey for the period between 1997-2006 using money base, money supply, industrial production index, interest rate, inflation rate, and exchange rate through a VECM models. Their results partially support accommodationalist theorists because there is a one-way causality relationship from credit to money base and from credit to money supply but there does not exist a causal relationship between money supply and industrial production index.

Finally, Lopreite (2014) analyzes the endogenous money supply hypothesis in the Euro Area using data from 1999 to 2010. In doing so, she makes extensive use of Vector Autoregression models (VAR) with Granger causality procedure to analyze non-cointegrated series. According to Granger causality test there is a one-way causality from loans to M3 but not from loans to industrial production index. The results are confirmed by adjusting the loans series for securitization activity in the Euro Area and partially support the accommodationist view.

Table 1 - The endogenous money hypothesis: a comparison of the three approaches

Accommodationalist view (Moore 1989)	**Structuralist view (Palley 1996, 1998;Pollin 1991)**	**Liquidity preference theorists (Howells 1995)**
L->M1, M2, BM	L<-> BM, M1, M2	L<-> M1, M2
IPI<-> M1, M2	IPI<-> M1, M2	

Notes: Variables BM= monetary base (BM); M1, M2 = money supply (M1, M2); L= loans (L); IPI= industrial production index (proxy of GDP using monthly data). The symbol -> implies one-way causality direction. The symbol <-> implies two-way causality direction.

3. Vector Auto-Regressive models and VECM models analysis on United States data

For this analysis we use monthly US observations drawn from Federal Reserve Statistical Data Warehouse. The variables are: loans (L), M1 money supply (M1), M2 money supply (M2), monetary base (BM)[41] and loans adjusted for securitization (LSEC). We also use industrial production index as proxy variable for macroeconomic activity since a monthly measure of GDP is not available.

The sample examined is the United States area. We transform the data by taking logarithms. The sample period goes from 1999:01 to 2012:05. The total amount of observations is equal to 160. A large sample size enhances the power of this estimation. Monthly seasonal factors are estimated using the X-12-ARIMA procedure (to avoid problems related to series seasonality). Figure 1 depicts the monthly movements of the aforementioned variables. They exhibit the typical pattern of not stationary series with increasing trends and rapidly grew (Figure 1)[42]. The non-stationarity of the series is confirmed by the Augmented Dickey-Fuller (ADF) test, the Phillips Perron (PP) test and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test, as shown in Table 2. The ADF test and PP test, in fact, never reject at the 1% level of significance the null hypothesis of unit root's presence; while the KPSS test never accept the null hypothesis of unit root's absence.

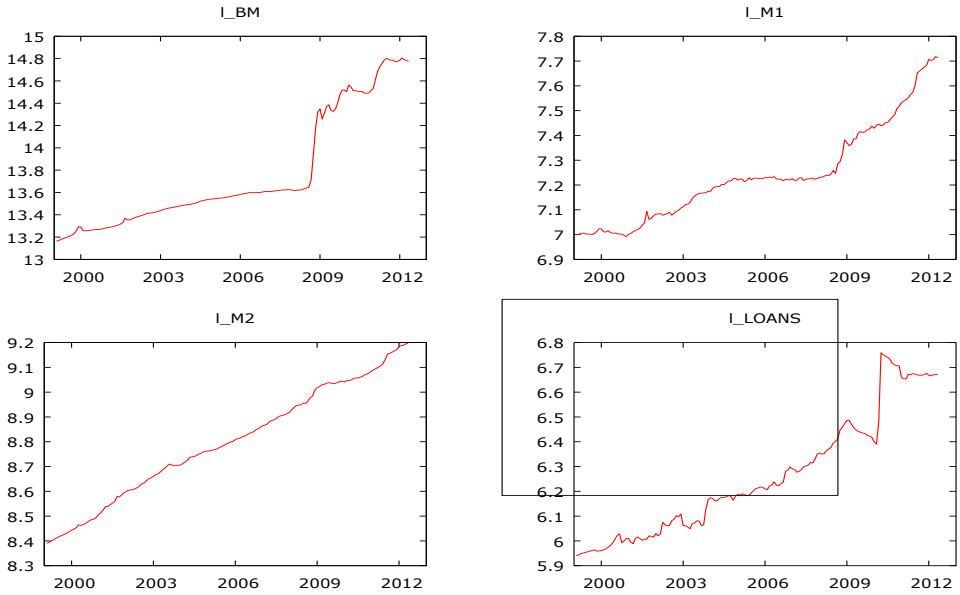

Figure 1- Series in log-levels of base money, monetary aggregates and loans seasonally adjusted

[41] The monetary aggregates of the United States area are defined according to the Federal Reserve definition in the following way: *M0 (monetary base)* consists of total reserves, required clearing balances and adjustments to compensate for float at Federal Reserve Banks, the currency component of the money stock, for all quarterly reporters on the "Report of Transaction Accounts, Other Deposits and Vault Cash" and for all those weekly reporters whose vault cash exceeds their required reserves. *M1 (money supply M1)* consists of currency outside the U.S. Treasury, Federal Reserve Banks, and the vaults of depository institutions; traveler's checks of nonbank issuers; demand deposits at commercial banks (excluding those amounts held by depository institutions, the U.S. government, and foreign banks and official institutions) less cash items in the process of collection and Federal Reserve float and other checkable deposits (OCDs), consisting of negotiable order of withdrawal (NOW) and automatic transfer service (ATS) accounts at depository institutions, credit union share draft accounts, and demand deposits at thrift institutions. *M2 (money supply M2*) consists of M1, savings deposits (including money market deposit accounts), small-denomination time deposits (time deposits in amounts of less than $100,000), less individual retirement account (IRA) and Keogh balances at depository institutions and balances in retail money market mutual funds, less IRA and Keogh balances at money market mutual funds. Back to top.Finally, loans comprise credit granted by the banking system to households and enterprises (nonbank private sector) in the United States area excluding the interbank positions and the government. This series is not adjusted for securitization. All variables are in billions US dollar except money base that is in millions US dollar.

[42] The graphs of series transformed into first-order differences are available upon request.

Table 2- Unit root test of series in log-levels

Variables	Lags	ADF Test (test statistic)[a]	KPSS Test (test statistic)[b]	PP Test (test statistic)[c]
l_L	9	-3.12	1.61	-2.85
l_BM	4	-2.73	2.76	-1.78
l_M1	13	-0.98	1.14	-0.14
l_M2	5	-3.16	1.69	-2.15
l_IPI	4	-2.9	1.04	-1.64
l_LSEC	2	-0.87	2.26	-0.66

Notes: [a] The critical value at 5% level of significance is equal to -3.43 and the critical value at 1% level of significance is equal to -4.01. [b] The critical value at 5% level of significance is equal to 0.14 and the critical value at 1% level of significance is equal to 0.21. [c] The critical value at 5% level of significance is equal to -3.43 and the critical value at 1% level of significance is equal to -4.01.

We also apply the ADF test, PP test and KPSS test to the variables in log-levels transformed into first-order differences. The results are reported in Table 3:

Table 3- Unit roots test of series in log first-order differences

Variables	Lags	ADF Test (statistic test)[a]	KPSS Test (test statistic)[b]	PP Test (test statistic)[c]	Results
dl_L	8	-10.02	0.26	-9.59	**I(0)**
dl_BM	3	-6.01	0.25	-5.94	**I(0)**
dl_M1	12	-13.01	0.28	-12.53	**I(0)**
dl_M2	4	-11.45	0.22	-10.01	**I(0)**
dl_IPI	3	-11.22	0.9	-10.45	**I(0)**
dl_LSEC	1	-12.78	0.24	-11.58	**I(0)**

Notes: [a]The critical value at 5% level of significance is equal to -2.91, the critical value at 1% level of significance is equal to -3.55.[b] The critical value at 5% level of significance is equal to 0.46, the critical value at 1% level of significance is equal to 0.73.[c] The critical value at 5% level of significance is equal to -2.91, the critical value at 1% level of significance is equal to -3.55.

The PP, ADF and KPSS test jointly confirm stationarity of the series at the 1% level of significance, so we can confirm that they do not contain more than one unit root and are integrated of order 1. In order to confirm the presence of a unit root and to take into account the events connected with the U.S subprime crises (IMF 2013), which could be seen as a structural break, separate ADF tests we carry out on the pre-crisis period (1999–2008) and the post-crisis period (2009–2012) for the series considered. The hypothesis of the presence of a unit root is never rejected at the 5% significance level. The obtained results do not support the presence of a structural break. If the money supply in the long-run is endogenous deviations from the cointegrating relationship should be caused by loans. To examine this effect we follow a two-step approach. Firstly, we identify whether exists a long-run relationship among the I(1) variables, after we estimate the VECM model and we test if exist a long-run causality between loans-money supply.

As the variables are I(1) in levels and they become I(0) in their first order differences, it is possible to apply the Johansen cointegration test (1995). This more general test is preferred to the Engle-Granger test (1991). In this case, we assume that all the variables of the system are endogenous and it is not necessary to establish a direction of causality amongst them *a priori*.

We carry out the test by including the option "unrestricted costant" and the lags, which minimise the information criteria of Akaike (AIC), Schwartz Bayesian (BIC) and Hannan-Quinn (HQC). We add an exogenous temporal dummy to capture the effects of the policy stance and business cycle effects. In order to test for the presence of outliers, the temporal dummy variable (dum1) assumes the value of one in the months 2008M8-M9-M10, and zero in all the other months. The variable is proved significant by applying the Wald test.

Table 4 reports the results of cointegration tests with monthly series. The null hypothesis of no cointegrating vector against more than one is rejected by the trace test and the maximal eigenvalue test at the 5% significance level in loans-M1 relationship.

A nonzero cointegrating vector represents the influence from a long-term force. The cointegrating vector specifies a long term relation among the levels of loans and M1. Any deviation from this relation will cause changes in loans and the impact of this deviation will last for a long period of time because it is the levels of the variables that cause changes in loans. Since a nonzero cointegrating vector has enduring effect, it represents the influence in the long run. The results are shown in Table 4.

Table 4 -The maximal Eigenvalue Test and the Trace Test of Johansen

Variables	Lags	H_0	λ_{trace} Stat.	λ_{max} Stat.
l_L and l_BM	**3**	**r =0**	8.68 [0.40]	8.53 [0.33]
l_L and l_M1	**2**	**r=0** **r=1**	15.79 [0.043]** 1.62 [0.20]	14.176 [0.04]** 1.62 [0.20]
l_L and l_M2	**2**	**r=0**	11.62 [0.18]	11.59 [0.13]
l_L and l_IPI	**2**	**r=0**	2.40 [0.98]	2.11 [0.98]
l_M1 and l_IPI	**2**	**r=0**	12.48 [0.13]	10.43 [0.18]
l_M2 and l_IPI	**2**	**r=0**	3.027 [0.95]	2.81 [0.9]
l_BM and l_IPI	**3**	**r=0**	10.8 [0.23]	10.47 [0.18]

*Note***:** The values in parentheses are the respective *p-values*. (*), (**), (***) indicate statistical significance at 10%, 5% and 1% percent level.

By using Johansen procedure results zero cointegrating vector among loans-BM, loans-M2, loans-IPI and IPI-M1, M2, BM. So, according to Vera (2001) and Shanmugam, Nair and Li (2003) rather than levels, I consider first-order differences variables in order to estimate stationary VAR models. To check the endogeneity of the money supply we apply VAR models for no cointegrated series (Eq.1). We select the optimal lags order for each bivariate VAR model considering the three information criteria[43] which turn out of order 2 for the relationships loans (L)-monetary base (BM), industrial production index (IPI)- monetary base (BM) and of order 1 for the relationships industrial production index (IPI)-money aggregate (M1), industrial production index (IPI)-money aggregate (M2), loans (L)-money supply (M2), and loans (L)-industrial production index (IPI).

$$Y_t = C+A(L)\, Y_{t-1}+B(L)\, X_t+ \quad (1)$$

We divide the variables included in the model into two groups.[44] The first group of variables, X_t contains the U.S short term nominal interest rate[45]. We also include this variable to control for changes in demand and in inflation. We also include a temporal exogenous dummy variable to capture

[43] Akaike Information Criterion (AIC), Hannan-Quinn Information Criterion and Schwartz Information Criterion (SIC).
[44] Each of all the VAR models contain a constant.
[45] This variable is the monthly federal funds rate. According to Federal Reserve definition it is the interest rate at which depository institutions lend balances at the Federal Reserve to other depository institutions overnight.

the effects of the subprime crises. The temporal dummy variable (dum1) assumes the value of one in the months 2008 M8-M9-M10, and zero in all the other months. The variables exogenous influence the other variables of the model Y_t but there is no feedback from the other variables to this variable. Further it is allowed for a contemporaneous impact of the exogenous variable on the endogenous variables. The endogenous variables of the benchmark model Y_t consist of loans (L), money base (BM), money supply (M2) and industrial production index (IPI).

Finally C is a vector of constants and Ɛ is an independent and identical distributed vector of errors. More evidence in favor of money endogeneity according to the structuralist view is the rejection of the null hypothesis that loans supply are not useful to predict money supply (M2), and money base (BM) and the rejection of the null hypothesis that money supply (M2) and money base (BM) are not relevant to predict loans supply. The results are reported in Table 5 for each bivariate VAR model.

Using Granger causality tests to analyze the endogenous money hypothesis results that loans help to predict money supply (M2) and money base (BM) and industrial production index in each estimations. The results also indicate that the money supply (M2), money base (BM) and industrial production index (IPI) are significant in the estimations for predicting loans supply when money structural endogeneity is confirmed.

Table 5- Granger causality test

Variables	Optimal lags (p.value)	6 Lags (p.value)	8 Lags (p.value)	12 Lags (p.value)
dM2 **GC** dL	0.023**	0.059**	0.008***	0.001***
dL **GC** dM2	0.044**	0.027**	0.009***	0.005***
dL **GC** dBM	0.07*	0.06*	0.05**	0.026**
dBM **GC** dL	0.04**	0.015**	0.05**	0.024**
dL **GC** dIPI	0.03**	0.06*	0.07*	0.08*
dIPI **GC** dL	0.07*	0.09*	0.09*	0.04**
dIPI **GC** dM1	0.06*	0.0026***	0.0067***	0.0013**
dM1 **GC** dIPI	0.09*	0.07*	0.08*	0.08*
dIPI **GC** dM2	0.022**	0.05**	0.08*	0.085*
dM2 **GC** dIPI	0.012**	0.067*	0.09*	0.077*
dIPI **GC** dBM	0.017**	0***	0***	0 ***
dBM **GC** dIPI	0.005***	0.036**	0.067*	0.05**

***Notes*:** Ho: No *Granger-causality* (GC). The values reported are the respective *p-values* (*), (**), (***) indicate statistical significance at 10%, 5% and 1% percent level.

To sum up, in United States the VAR evidence shows that loans influence the monetary policy, suggesting that the U.S banks do not find it difficult to raise financing during periods of tight monetary policy. These results suggest that causality goes from the banking credit loans to monetary policy stance and from the banking credit loans to macroeconomic activity and vice versa.

Since lending has effect on money supply M2, money base and income it changes the demand for reserves and monetary policy: there is then an incentive to liability management. This also means that the money supply is affected by lending and this supports the structuralist view. Specifically, we find that the amount of liquidity on banks' balance sheets significantly influences the degree to which they change loans after a monetary shock: the higher level of liquidity causes the stronger loans supply response. These findings confirm the endogenous money hypothesis in the United States during the period 1999-2012. Different lag lengths, varying from optimal lag order to 12 provide qualitatively similar results. This confirms the robustness of the tests[46]. We apply for the analysis of cointegrated series VECM models by using Wald test to analyze short-term relationships (Shanmugan, Nair and Li 2003; Cifter and Ozun 2007). We use VECM to analyze the potential long-term and short-term causality between money supply M1 and loans. Johansen (1995) describes cointegrated variables

[46] The results are also robustness to autocorrelation and heteroskedasticity. The results are available upon request.

(loans, M1) as being in equilibrium when the stationary linear combination of their levels is at its unconditional mean that is usually assumed to be zero. The system is out of equilibrium when this combination of levels (loans and M1) is not zero. However, since the combination is stationary, there is always a tendency for the system to return to equilibrium. The non-zero stationary cointegration vector is defined "equilibrium error" (EC). We make the analysis of long-run relationship considering EC parameter (Shanmugan, Nair and Li 2003; Cifter and Ozun 2007). The error correction models imply a situation in which a long-term relationship exists among the variables (loans, M1) in the economy and in which the equilibrium error induces change in the dependent variable. We estimate a vector error correction model of order 1 with rank one for the relationships loans-M1 (Eq.2). Since VECM order is one and the rank is one it is not necessary to impose other constraints for a correct interpretation (Luetkepohl and Reimers 1992a).

$$\begin{bmatrix} \Delta l_{L_t} \\ \Delta l_{M1_t} \end{bmatrix} = \mathrm{d_t} + \begin{bmatrix} \alpha_1\beta_1 & \alpha_2\beta_2 \end{bmatrix} \begin{bmatrix} l_{L_{t-1}} \\ l_{M1_{t-1}} \end{bmatrix} + \begin{bmatrix} v_1 \\ v_2 \end{bmatrix} \quad (2)$$

Table 6- Causality test for the money endogeneity hypothesis based on vector Error Correction Model

	Short term Effect	Long term Effect		
	Wald Test	EC_{t-1}	Short term	Long Term
Dependent Variable: dlM1	7.69*** (0.0005)	-0.026*** (0.0002)	**lL=>lM1**	**lL=>lM1**
Dependent Variable: dlL	3.28* (0.07)	0.028* (0.089)	**lM1=>lL**	**lM1=>lL**

Notes: The values in parentheses are the respective *p-values.* (*), (**), (***) indicate statistical significance at 10%, 5% and 1% percent level.

Table 6 reveals that M1 influences loans in the long-run because the EC term is statistically significant and this relationship also exists in the short-term. We find also that loans affect M1 in the long-run and cause variations of money supply M1 in the short-run. This seems to suggest that money supply is endogenously determined and implies that the Post-Keynesian view may hold true in the case of United States M1 money supply supporting the structuralist view. The model also passes the usual diagnostic tests of no autocorrelation and no arch effects in the residuals[47]. Finally, the tests of structural stability (CUSUM test and CUSUMQ test) of the parameters of the VECM model provide no evidence of instability and the series moves within the confidence intervals[48].

4. The effect of securitization activity

In order to identify the relevance of securitization to explain money endogeneity we consider an alternative model specification. We use loans series adjusted for securitization to analyze whether banks can insulate from monetary policy negative shocks through securitization.

In this case, respect to the findings of Lopreite (2014) on Euro area the activity of securitization affects the investor's decision rules, and thus the policy stance is still affected by the banking system. We carry out the estimations by using VAR models of order 2 and 1 for stationary series and testing the endogenous money hypothesis with Granger Causality Test. The results are reported in Table 7.

Table 7- Granger Causality test: The effect of securitization

Variables	Optimal Lags	4 Lags (p.value)	8 Lags (p.value)	12 Lags (p.value)
dLSEC **GC** dIPI	0.007***	0***	0***	0.0078***
dIPI **GC** dLSEC	0.0058**	0.0009***	0****	0.02**
dLSEC **GC** dM2	0.0075***	0.008***	0.0086***	0.0009***

[47] Test of autocorrelation and ARCH effects are available upon request.
[48] The graphs of the CUSUM and CUSUMQ test are available upon request.

Variables	Optimal Lags	4 Lags (p.value)	8 Lags (p.value)	12 Lags (p.value)
dM2 **GC** dLSEC	0.027**	0.03**	0.012**	0.021**
dLSEC **GC** dBM	0.006***	0.005***	0.008***	0***
dBM **GC** dLSEC	0.05**	0.0006***	0.003***	0.0015**

***Notes*:** The values reported are the respective *p-values* (*), (**), (***) indicate statistical significance at 10%, 5% and 1% percent level.

As shown in Table 7 the results of the previous sections are highly confirmed. The estimates all show that there is a two-way Granger Causality from loans supplies to monetary base (BM), money aggregate (M2) and industrial production index (IPI).

These findings support the structuralist view. It is possible to interpret them as the relevance of the bank lending channel to explain the monetary transmission mechanism. This result not surprising, when the period analyzed is further confined to 1999-2012, the positive effect of banks' securitization on monetary policy becomes more evident. These results suggest that the use of securitization as financial resources is important and insulate U.S banks from negative shocks of the monetary policy's transmission mechanism. Finally, relevant results are obtained applying the VECM model for cointegrating relationships (Table 8).

Table 8- Causality test based on Vector Error Correction Model to test endogeneity of money

	Short Term Effect	Long term Effect	Short Term	Long Term
	Wald Test	EC_{t-1}		
Dependent Variable: dlM1	14.50* (0.06)	-0.08*** (0.0012)	lL_SEC=>lM1	lL_SEC=>lM1
Dependent Variable: dlL_SEC	2.53 (0.11)	0.06 (0.9)	lM1≠>lL_SEC	lM1≠>lL_SEC

Notes: (*), (**), (***) indicate statistical significance at 10%, 5% and 1% percent level.

In this case results a long-run and short-run relationship from loans adjusted for securitization to M1 but not vice versa. This result reveals that money endogeneity increases if banks securitize loans. This analysis underlines the important role played by banks' securitization in the liquidity position of the banking system. The monetary policy tightening does not cause an initial liquidity shortage because of securitization. In fact although the total stock reserves' stock remains unchanged securitization allows the banking system to fund more loans in United States.

Conclusion

A crucial condition for the existence of an active U.S banking system is that banks through securitization should be able to influence the monetary policy. This paper contributes to the discussion on the issue of passive money hypothesis by presenting empirical evidence from VAR and VECM estimations based on a dataset that comprises aggregate information on US loans banks and Federal Reserve monetary policy during the years 1999-2012. In this work we consider money supply, monetary base, credit capacity and industrial production index to test the passive money hypothesis. Given the discussion in the literature of endogenous money hypothesis we start the analysis by carrying out the regression on the basis of VAR models. We find the dependence of money supply M2, base money BM and industrial production index IPI to loans series and vice versa. By estimating VECM model we find that there is a bidirectional relationship from loans to M1 in the short run and long term. These results show that in the United States money supply is endogenous in nature and support the structuralist vision and the theory of liquidity preference.

The analysis replicated considering loans adjusted for securitization highly confirms the results of the previous section. In this case results that both in the short run and long run securitized loans affect money supply M1 but not vice versa. We also find that Granger causality running from

credit loans to M2, monetary base and industrial production index and vice versa. This is not surprising: the strong use of securitization motivates banks in United States during 1999-2012 to increase loans supply with a preemptive motive to cushion the impact of policy shocks. This evidence suggests that in the presence of a monetary policy shock, banks that have access to securitization will increase loans supply in order to compensate for the decrease on the financing resources. In this case, the greatest liquidity seems to determine their reaction to monetary policy. The mechanism is based on the assumption that banks in general face difficulties in their ability to raise additional funds after a monetary tightening and have to decrease their loans supply.

The key assumption that must hold in order to interpret these results as evidence for the existence of money passive hypothesis is that these effects have to be attributable to a strong reaction of U.S banks loans supply to monetary policy. This could be comparatively strong outcome if we take into account the securitization effect to confirm structuralist passive money hypothesis by using VAR models and VECM models unlike most of the previous literature has done so far. However, there could still remain the question whether securitization shows cyclic patterns that the models implemented in this paper are not able to capture. It is crucial importance to use more sophisticated tools, such as Regime Switching variants to discriminate among the theories that support the Post-Keynesian view. This point is left for future research.

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ECONOMIC POLICY UNCERTAINTY AND STOCK MARKET RETURNS IN SELECTED EUROZONE COUNTRIES

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Abstract:

The uncertainties in economic policies may affect macroeconomic variables by affecting the decision making process of the economic agents. This paper examines the impact of economic policy uncertainty in selected Eurozone member countries on stock market returns during the period January 2001-December 2014 by using Dumitrescu and Hurlin (2012) panel causality test. The causality results indicated that there was no causality from economic policy uncertainty at both country level and common level to stock markets, but there was causality from stock market to EPU indexes. On the other hand there was bidirectional causality between stock market and dollar/euro exchange rate.

Keywords: economic policy uncertainty, stock market returns, panel causality test.

JEL Classification: C23, G12, G18

1. Introduction

Stock market index is generally seen as a leading indicator of the whole economy. Increases in stock market index are accepted as signs of future economic growth, while decreases in stock market index are accepted signs of economic downturns. Moreover changes in stock prices also can lead the changes in the wealth of households and Tobin's q (see Tobin (1969), Dynan and Maki (2001)). Therefore, stock markets have impact on the consumption and investment decisions of the households and firms directly and indirectly. Changes in stock prices are attributed to the risk factors, business cycles (see Fama and French (1989), Schwert (1989)). Economic units watch the course of the economy by considering major macroeconomic variables such as industrial production, unemployment rate, inflation rate, interest rates, foreign exchange rate etc. and adjust their expectations and investment decisions with regard to developments in the whole economy.

In this study, we contribute to the literature by examining the causality between Economic Policy Uncertainty (EPU) and stock market returns for four members of the Eurozone. This will be one of the pioneering studies which will examine the relationship between stock market index, EPU of individual countries, and common EPU index of all the countries in a monetary union. We also employ common currency as a control variable in our study. For this purpose we use the EPU index constructed by Baker *et al*. (2012).

The uncertainties in economic policy can be defined as the uncertainty in the decisions economic policymakers which have impact on the decisions of economic units such as consumption, investment, saving, lending etc. Therefore the whole economy may be affected negatively from the uncertainty in policies. The United States (US) EPU index constructed by Baker et al. (2013) is based on three components which are the newspaper coverage of EPU, the number and size of federal tax code provisions set to expire, and forecaster disagreement, while the European EPU index is based on news coverage about EPU and economic forecaster disagreement. We also take the US dollar per euro foreign exchange rate as a control variable.

The purpose of the study is to investigate the causality between stock market index, EPU of individual countries, common EPU of all the countries and dollar/euro exchange rate in four Eurozone member countries including Germany, Italy, France and Spain during the period January 2003-December 2014. The rest of the study is organized as follows. Section 2 reviews the literature on the relationship between stock market performance and EPU; Section 3 presents data, empirical application and major findings and Section 4 concludes the study.

2. Literature review

There have been numerous studies on the potential effects of EPU on miscellaneous economic variables such as personal consumption, business investment, labor supply, saving, capital flows, economic growth, asset prices (See Bernanke (1983), Rodrik (1991), Ozoguz (2009)). Yet there have been relatively few studies on the impact of EPU on stock markets. These empirical studies generally have found that EPU had negative impact on stock market returns.

Pástor and Veronesi (2012) examined the impact of policy uncertainty on stock prices by using general equilibrium model and found that policy uncertainty had negative impact on stock prices. On the other hand Sum (2012) examined the impact of EPU in Europe on stock market in 33 countries including the European Union countries, Croatia, Norway, Russia, Switzerland, Turkey and Ukraine during the period February 1993-April 2012 by using regression analysis. He reached that EPU had negative significant impact on stock markets in all the countries except 8 countries (Croatia, Bulgaria, Estonia, Latvia, Lithuania, Malta, Slovakia and Slovenia).

Kang and Ratti (2013) investigated the relationship among oil shock, EPU, real stock returns in the US during the period January 1985-December 2011 by using structural VAR model. They found that EPU had negative effect on real stock returns and explained 19% of the long run variation in real stock returns. On the other hand Sum (2013) examined the impact of EPU index in the US on stock market returns of Association of Southeast Asian Nations (ASEAN) countries including Indonesia, Malaysia, Philippines, Singapore and Thailand during the period February 1985-February 2012 by using causality tests and he found that EPU of the US had negative impact on stock markets of the ASEAN countries.

Chang *et al.* (2013) examined the causality between EPU and stock price for seven OECD countries including Canada, France, Germany, Italy, Spain, UK and the US during the period January 2001-April 2013 by using bootstrap panel causality. They found that there was unidirectional causality from stock prices to EPU for Italy and Spain, and from EPU to stock prices for the UK and the US, and no causality for Canada, France and Germany.

Donadelli (2014) examined the impact of the US macroeconomic conditions and EPU on 10 Asian stock market returns (China, India, Indonesia, Korea, Malaysia, Pakistan, Philippines, Sri Lanka, Taiwan, Thailand) during the period January 1988 - December 2011 by using Granger causality test and regression and he reached mixed findings:

- The US EPU was not Granger cause of excess returns in China, India, Indonesia, Korea, Malaysia, Pakistan and Taiwan stock markets.
- All the Asian stock markets except Indonesia were Granger cause of the US EPU.
- There was bidirectional causality between US EPU and excess return in stock markets of Philippines, Sri Lanka and Thailand.
- Consequently the US EPU generally could not explain the changes in excess returns of Asian stock markets.

Arouri *et al.* (2014) investigated the impact of EPU in the US, Europe and China which are main net oil importers on stock markets of Bahrain, Oman, Kuwait, Qatar, Saudi Arabia and the United Arab Emirates which are net oil exporters during the period May 2005- January 2014 by using panel regression with monthly data. They reached that there was a negative relationship between EPU and stock returns, in other words increases in EPU decreased the stock return. On the other hand Kang and Ratti (2014) examined the mutual dependence among the EPU of China, world oil market and stock returns in China during the period January 1995-December 2011by using structural VAR model. They found that a positive shock in EPU has a lagged negative impact on real stock returns and world oil prices, while shocks in world oil market increased EPU and decreased stock returns in China. In another study Lam and Zhang (2014) investigated the impact of policy uncertainty on stock returns globally in 49 countries during the 1995-2006 by using regression analysis and found that policy uncertainty had significant impact on stock returns.

3. Data, empirical application and major findings

We investigated the causality among stock market index, EPU index of selected Eurozone countries and European EPU and dollar/euro exchange rate in selected Eurozone countries during the period January 2003-December 2012 by Dumitrescu and Hurlin (2012) panel causality test.

We firstly tested whether there is cross-sectional dependency and slope homogeneity among the units, then we conduct second generation unit root test considering the results of cross-sectional dependency test in Table 4. Finally we used Dumitrescu and Hurlin (2012) panel causality test to analyze the causality among the variables in the study.

3.1. Data

We used the monthly time series data of individual and common EPU indices for the selected Eurozone countries and stock market indexes of selected Eurozone countries in Table 1 during the period January 2003–December 2014. The availability of data determines our sample and study period. Individual and common EPU indices of Germany, Italy, France and Spain were obtained from the www.PolicyUncertainty.com. Common and individual monthly EPU indices of the Eurozone countries are based on 2 papers from each of the largest 4 European economies (Germany, France, Italy, and Spain). The papers include El Pais and El Mundo from Spain, Corriere della Sera and La Repubblica from Italy, Le Monde and Le Figaro from France, Handelsblatt and FAZ from Germany (Economic Policy Uncertainty, 2015). On the other hand we took monthly average of daily US dollar per euro exchange rates from European Central Bank as control variable (European Central Bank, 2015).

Table 1 - Stock market indexes used in the study

Countries	Stock market index
France	CAC All Shares Index
Germany	HDAX Index
Italy	FTSE Italia All Shares Index
Germany	Madrid Stock Exchange General Index (IGBM)

Source: **www.**investing.com**,** 2014

The variables, their symbols and their sources were presented in Table 2. Eviews 8.0 and Gauss 6.0 statistical packages were used in the econometric analysis.

Table 2 - Variables used in the econometric analysis and their symbols

Symbol	Variable	Data Source
SMI	Stock market index	http://www.investing.com/indices
EPU	Economic policy uncertainty	www.PolicyUncertainty.com
EEPU	European economic policy uncertainty	www.PolicyUncertainty.com
FX	Dollar/euro foreign exchange rate	European Central Bank

3.2. Slope homogeneity and cross-sectional dependence tests

All the coefficients are common in a homogenous panel data model, while all parameters vary from unit to unit in a heterogenous panel data model (Hurlin, 2010). Swamy (1970) is the leading study to determine whether the slope coefficients of the cointegrating equations related to the cross-sectional units of the panel. Then Pesaran and Yamagata (2008) improved Swamy test and the hypotheses of their test are as follows:

H_0: Slope coefficients are homogeneous.

H_1: Slope coefficients are not homogeneous.

We used Pesaran and Yamagata (2008) homogeneity test to determine whether the slope coefficients are homogenous or not. The results of homogeneity test were presented in Table 3. The test results demonstrated that slope coefficients of the cointegrating equation were homogeneous.

Table 3 - Pesaran and Yamagata (2008) homogeneity test results

	Test statistic	p value
$\tilde{\Delta}$	0.151	0.440
$\tilde{\Delta}_{adj}$	0.158	0.430

We tested whether there is cross-sectional dependence in panel data for selection of panel unit root test. We can determine the existence of cross-sectional dependency by Breusch-Pagan (1980) CD_{LM1} test in case of time dimension (T)> cross-sectional dimension (N), Pesaran (2004) CD_{LM2} test in case of T=N, by Pesaran (2004) CD_{LM} test in case of T<N. We used Breusch Pagan (1980) CD_{LM1} to test the cross-sectional dependency because there are 4 countries (N=4) and 144 months (T=144).

The hypotheses of the test are as follows:

H_0: There is no cross-sectional dependency

H_1: There is cross-sectional dependency

The results of CD_{LM1} test were presented in Table 4. The results demonstrated that there was cross-sectional dependency in the series. So we will employ second generation panel unit root tests.

Table 4 – Results of the cross-sectional dependence test

Test	SMI	EPU
CD_{LM1}	261.220***	103.951***

Note: *** indicates rejection of the null hypothesis at 0.01 level.

3.3. Panel unit root test

We used the bootstrap tests of Smith *et al.* (2004) considering the cross-sectional dependence among the countries of the panel. These are specified by respectively $\bar{t}$, $\overline{LM}$, $\overline{max}$ and $\overline{min}$. The null hypothesis for each test is there is unit root for the panel of countries. Therefore, the rejection of null hypothesis shows that at least one country of the panel does not have a unit root. The results of Smith *et al.* (2004) bootstrap panel unit root tests were presented in Table 5. The results demonstrated that SMI was I(1), while EPU, EEPU and FX were I(0).

Table 5 - Results of Smith et al. (2004) bootstrap panel unit root tests

Variable	$\bar{t}$ statistic	$\bar{t}$ p-value	$\overline{LM}$ statistic	$\overline{LM}$ p-value	$\overline{max}$ statistic	$\overline{max}$ p-value	$\overline{min}$ statistic	$\overline{min}$ p-value
SMI	-1.480	0.555	2.511	0.534	-1.065	0.521	1.187	*0.573*
DSMI	-9.067	0.00	52.497	0.00	-9.049	0.00	52.376	0.00
EPU	-13.250	0.00	78.196	0.00	-12.753	0.00	75.379	*0.00*
	ADF t-stat		5% level cv		PP t-stat		5% level cr	
EEPU	-3.0431		-2.8818		-3.6278		-2.8816	
FX	-3.0796		-2.8818		-2.9551		-2.8816	

Note: The bootstrap p-values are based on 5000 simulations; d specifies the first difference of the variable.

3.4. Panel causality test

Dumitrescu and Hurlin (2012) panel causality test is a version of Granger (1969) non-causality test and used for heterogeneous panels with fixed coefficients. Moreover it considers both heterogeneity of the regression model and heterogeneity of the causal relationships. The results of Dumitrescu-Hurlin (2012) panel test were presented in Table 6. The results demonstrated that there was no causality from European EPU(EEPU)/EPU of individual countries to stock market index, but there was causality from stock market to EPU indexes. On the other hand there was bidirectional causality between stock market and dollar/euro exchange rate. Also there is bidirectional causality between EEPU and dollar/euro foreign exchange rate.

Table 6 - Results of Dumitrescu and Hurlin panel causality test

Hypothesis	W-*Stat.*	Zbar-Stat.	*Prob.*
EEPU does not homogeneously cause DSMI	0.677	-1.312	0.189
DSMI does not homogeneously cause EEPU	4.970	2.854***	0.004
EPU does not homogeneously cause DSMI	0.872	-1.123	0.261
DSMI does not homogeneously cause EPU	5.147	3.026***	0.002
FX does not homogeneously cause DSMI	17.604	15.117***	0.000
DSMI does not homogeneously cause FX	7.448	5.260***	1.E-07
FX does not homogeneously cause EEPU	6.16992	4.01985***	6.E-05
EEPU does not homogeneously cause FX	5.99136	3.84648***	0.0001
EPU does not homogeneously cause EEPU	2.84970	0.79621	0.4259
EEPU does not homogeneously cause EPU	7.53068	5.34102***	9.E-08
EPU does not homogeneously cause FX	2.96363	0.90683	0.3645
FX does not homogeneously cause EPU	3.92283	1.83813*	0.0660

Note: ***,* indicate the statistical significance at 1percent and 10 percent levels respectively.

Conclusion

We investigated the casual relationship between stock market index, EPU and dollar/euro exchange rate in selected Eurozone countries including France, Germany, Italy and Spain during the period January 2003-December 2014. In this regard we firstly applied Pesaran and Yamagata (2008) homogeneity test and found that the slope coefficients are homogeneous. Then we tested the existence of cross-sectional dependency by Breusch-Pagan (1980) and found that there was cross-sectional dependence among the variables. Finally we conduct panel unit root test and Dumitrescu and Hurlin (2012) panel causality test. The casuality test results indicated that there was no causality from European EPU(EEPU)/EPU of individual countries to stock market index, but there was causality from stock market to EPU indexes. On the other hand there was bidirectional causality between stock market and dollar/euro exchange rate.

Our findings are partially consistent with Chang *et al.*. (2013), Donadelli (2014). But we should remember that there have already been few studies on the causality between stock market and EPU in the literature. The causality from stock market to EPU can be arisen from the high level of stock market development of the Eurozone countries.

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