INDEX FUTURES TRADING AND STOCK MARKET VOLATILITY: EVIDENCE FROM SEVERAL EASTERN EUROPEAN COUNTRIES

by

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Kyiv School of Economics

Abstract

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The main aim of this research is to analyze the relationship between introducing index futures and volatility of the underlying stock market. The study mostly considers two questions. Firstly, whether there is a change in volatility of the index after index futures have been introduced. Secondly, in case of the presence of the "futures effect", whether it is effect different for the first six trading month. In this study, data for five Eastern European countries (Romania, Russia, Ukraine, Czech Republic and Poland) were used. After controlling for market factors, we find that introduction of index futures increase the volatility of the spot market in Russia, Poland and decrease the volatility in Ukraine. In Romania and Czech Republic, the effect of index future was insignificant.

To my near and dear friend Olga Plis

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GLOSSARY

Futures. A derivative contract obligating the buyer to purchase an asset (or the seller to sell an asset), such as a physical commodity or a financial instrument, at a predetermined future date volume and price.

Index Futures (**IF**)**.** A futures contract on a stock or financial index.

Credit Default Swaps (CDS). A financial swap agreement that the seller of the CDS will compensate the buyer in the event of a loan default or other credit event.

Collateralized Debt Obligation (CDO). An investment-grade security backed by a pool of bonds, loans and other assets

Collateralized Loan Obligation (CLD). A special purpose vehicle (SPV) with securitization payments in the form of different tranches. Financial institutions back this security with receivables from loans.

Chapter 1

INTRODUCTION

There are hot debates appearing around derivatives contracts after the recent word financial crisis. A lot of economists directly connect crisis with the overgrowth of derivatives market. In financial markets there are plenty of different derivatives contracts. The main problematic issue related to such kind of contracts is the procedure of pricing. Mispricing can lead to market inefficiency and thus to potential crisis in the financial market. Some derivative contract, such as Credit Default Swaps (CDS), Collateralized Debt Obligation (CDO) and Collateralized Loan Obligation (CLD), are much more difficult to price than the others and require a lot of assumptions. On the other hand, futures contracts do not require a lot of assumptions in pricing procedure, and their fundamental values can be relatively easily deduced from static arbitrage portfolios. Therefore, mispricing in futures markets are unlikely to be large-scale, frequent and persistent phenomena (Nick Taylor et al, 2000).

Different financial instruments serve different investors' purposes. A derivative contract is a security the price of which depends on the current price of underlying asset, such as exchange rate, stocks, index, interest rate, etc. A derivative contract is usually bought either to hedge risks or to gain the profit from price movements of the underlying asset.

Futures is a contract to buy or sell a certain number of the underlying asset at a pre-determined price at a pre-determined date in the future. Futures are essential for protecting the investor from future price movement of underlying assets, but can also serve as speculative instruments.

Index futures contracts are the cash-settled contracts, which usually serve as speculative rather than hedging instruments. Today, index futures have become one of the most popular speculative securities and market instruments (Chang-Ching Lin, 2012). Almost every year new index futures are launched in new markets (Gulen and Mayhew, 2002). Plenty of countries that are going to develop their stock exchanges plan to introduce the index future contract with the aim of attracting different investors in the market.

While introducing futures contracts might attract new investors to the financial market, there is always a possibility of negative impact of such contracts in the form of potential increase in spot market volatility, which has been detected in some countries at least in early stages after introducing futures contracts (Bolognaet al,. 2002). As index futures contracts together with other derivatives become more widespread, the investigation of the impact of index futures trading on the volatility of the spot market for different countries becomes more and more important.

The main idea of this research is to analyze the relationship between introducing index futures and volatility of the underlying stock market. The study mostly considers two questions. Firstly, whether there is a change in volatility of the index after index futures have been introduced. Secondly, in case of the presence of the "futures effect", whether it is different for first six trading month.

A lot of studies examine the relationship between spot and futures markets. Many of them look at change in the volatility of the stock market after futures introduction mostly for developed countries. There are also similar studies for Asian and African countries. Plenty of studies consider only one country: USA (Darrat and Rahman, 1995; Pericli and Koutmos, 1997; Figlewski 1981), UK (Antonioua and Holmes, 1993), Greece (Panayiotis, 2011), Spain (Illueca and Lafuente, 2003), Poland (Bohly, Salm and Wilfling, 2011), India (Kanti and Kumar, 2011; Mallikarjunappa and Afsal, 2008). Among all Eastern European countries the Polish market is the only one for which the impact of futures introduction on stock market volatility has been investigated. However, Eastern European countries have their specific conditions and market structure. Therefore, there is a necessity of futures impact analysis for these countries.

The focus of this paper is on Eastern European emerging capital markets, such as Russia, Ukraine, Poland, Czech Republic and Romania. These emerging capital markets have some common features because they are in one geographical region and they all appeared after the collapse of The Socialist Block. In addition, we can suppose that these countries differ from other developing countries in Asia and in Latin America because of different economic and social conditions. At the same time, all these countries have their specific features and economic conditions, and thus we need to consider these countries separately. In addition, speaking about index futures introduction in near Bulgaria it more likely to be similar to the Romania and Russia markets than developed countries. In all examined countries, index futures already exist and the conclusions from our analysis can be used to determine potential problems and advantages appearing after index futures introduction in other similar markets.

There is no consensus in both theoretical and empirical literature about the behavior of the spot market after index futures introductions. Some researchers argue that volatility of stock market should increase; others insist that it should decrease.

Futures can be used with two main purposes: hedging and speculation. Thus, the spot price movements can be largely influenced by introduction of index futures market through hedging, speculation activities and arbitrage seeking behavior. In this way, arbitrageurs can increase the spot price volatility (Chen and Han, 2012).

At the same time, futures are often used with the aim of portfolio diversification and play significant role in price discovery process and the process of information transmission. Therefore, it can have a stabilizing effect on spot market.

In the markets of Eastern Europe stock future indexes appeared during the last 18 years. A lot of institutional investors follow closely the progress and improvement of financial markets. Thus, this study is useful to both practitioners and regulators because it makes clear what the effect of index futures introduction on the stock market in the Eastern Europe countries is. If spot markets in these countries are not so sensitive to the speculations in the futures contracts or even index futures stabilize the spot market in terms of reducing volatility of the spot market, there is no necessity for providing restrictions or regulation by stock market authorities in trading futures. In addition, investors and practitioners are interested in such investigation because they can benefit from the market inefficiency through arbitrage opportunities, which can appear after futures introduction. Moreover, speaking about index futures introduction in near Bulgaria it more likely to be similar to the Romania and Russia markets than developed countries.

A standard approach to determining the effect of introducing futures is to use a GARCH model to model the volatility of the stock market and then to use the dummy variable for index futures existence in the market in order to see whether it has any significant influence on the volatility. Dummy variable is in charge of exogenous factor of one–time permanent shift in volatility. In a more complex empirical model such as the one suggested by Mayhew and Gulen (2000) index futures dummy variable can be either additive or multiplicative. Their model takes into consideration asynchronous data and asymmetric volatility responses by additionally using positive residuals from returns regression in conditional variance equation. In this study a similar model is used for estimating volatility, and control variables responsible for the effect of world financial market are also included.

We will use daily data for main index in each county and will consider each country separately. We expect that for most countries the effect of index futures introduction will be positive because these markets are not mature markets and at least at first stages futures should destabilize the spot markets.

The structure of the thesis is the following. The next chapter gives literature review; the third chapter is dedicated to methodology of the study. In the fourth chapter there is data description and in the fifth chapter empirical result are discussed. In the final sixth chapter there are results and the conclusion.

Chapter 2

LITERATURE REVIEW

Numerous studies have been devoted to studying the effect of futures markets on spot markets. Edwards (1988) was among the first researchers who estimated the relationship between futures trading and the volatility of the spot market using pre-futures and post-futures introduction data. He tries to challenge the existing opinion in the theoretical literature provided by Cox(1976), Brorsen and Irwin (1985), Pindyck (1984), Barro (1986), Bhattachrya and Ramje (1986), that new financial assets destabilize the spot market. He analyzes the S&P 500 index and finds that there is no significant destabilizing effect of futures trading on cash market. After this study others researchers began to estimate the effect of index futures introduction using different empirical models ranging from simple linear regression to complicated GARCH models, trying to compare the volatility before and after futures launching dates.

Currently there is a strong debate in the theoretical literature about the effect of index futures introduction. One group of researchers argues that index futures have a negative impact on spot market. Index futures, as a financial instrument, have a high degree of leverage and consequently can also be very attractive to speculative uninformed investors. Such investors can behave irrationally and in such manner create a noise in the market (Black, 2001). This can make informational flow inconsistent and flat, which can lead to the fluctuation in the price of asset in the market, increasing the volatility. Such opinion is supported by Cox (1976), Finglewski (1981), Stein (1987) and Cagan (1981), Harris (1989).

Other researchers argue that futures improve the functioning of spot market and reduce the volatility of the underlying asset. Powers (1970) claims that the futures trading increase the flow of available information, market becomes deeper and therefore futures have a beneficial effect on the market. Danthine (1978) argues that the appearance of a futures market has a positive effect on stock market depth and stabilizes it. Bray (1981) and Kyle (1985) show that futures market reduces the volatility of stock market and enhances the market efficiency. Stroll and Whaley (1988) argue that futures influence market efficiency in positive direction. Schwarz and Laatsch (1991) support this opinion and show that futures have a significant role in price discovery in the way of improving market efficiency and market completion.

After looking at the theoretical debate concerning the impact of future trading, the most logical conclusion is that both views are supported and the question is more empirical rather than a theoretical one. Futures trading can influence spot market in both directions and in which exactly it will mostly depend on special condition existing in particular markets.

In empirical literature many studies attempt to identify whether the index future trading stabilize the spot market or not. Figlewski (1981) who considers the Government National Mortgage Association (GNMA) futures market and how the trading in this market affects the volatility of the spot market does another early study. He finds that the spot market tends to be more volatile after futures introduction.

The majority of the subsequent studies investigate stock markets of specific countries and futures on specific indexes traded in those markets using mostly ARCH/GARCH type of models and dummies for index future introduction and also return on some world market index to control for other factors that can influence the volatility. Such studies are: Darrat and Rahman (1995), Pericli and Koutmos, (1997), Antonioua and Holmes (1993), Panayiotis (2011), Illueca and Lafuente (2003), Bohly, Salm and Wilfling, (2011), KantiandKumar, (2011) Mallikarjunappa and Afsal, (2008) and so on. The majority found the stabilizing effect of futures market.

Gulen and Mayhew (2000) examine not a specific country, but the international equity market. They consider 25 countries. They use several GARCH models. These models are with additive or multiplicative dummies. The empirical model takes into account asynchronous data and asymmetric volatility response using conditional variance equation. From their data they exclude from consideration Russia and Poland because at the time when the research was done there was a very small number of observations in the post-futures period for these countries. Gulen and Mayhew (2000) find that index futures trading increased stock market volatility in the USA and Japan, but in other countries it has almost no significant effect on conditional variance.

Bologna and Cavallo (2002) consider not only the "futures effect" on stock market but also whether this effect is immediate or delayed in time. They investigate the Italian Stock Exchange and find that futures stabilize the Italian Stock market. They also find that in the stabilizing way index futures have a positive effect on market efficiency and therefore on public welfare. From their study, index futures have an immediate stabilizing effect on the underlying spot market.

Therefore, there are a plenty of works considering theoretical and empirical impact of index futures introduction on the volatility of the spot market in different countries, but almost no works considering Eastern European countries. This study will contribute to the empirical literature in the way of considering separately Eastern Europe countries with asymmetric model and also forming the model with joint dynamics of country indexes and market portfolios. Also this study considers new methodology which directly takes into account asynchrony data.

This study is mostly closely related to in terms of methodology and interpretation of results to Kumar and Mukhopadhyay (2007)and Gulen and Mayhew (2000) studies.

C h a p t e r   3

METHODOLOGY

Our methodology is based on the studies by Kumar and Mukhopadhyay (2007) and Gulen and Mayhew (2000).

In order to find the effect of futures introduction we should compare volatility using the data before and after introduction. Previous studies suggest that the GARCH model is the most suitable for the stock market data. In addition, a GARCH model allows precisely specifying the volatility as well as providing controls for other factors affecting volatility.

Our main hypothesis is formulated in the following way:

H_0: volatility of the index after index futures introduction shifts.

H_1: no change in volatility after index futures introduction.

To test this hypothesis we use GJR-GARCH model. In our GARCH model the dependent variable will be the continuously compounded return, equal to the difference between the natural logarithms of two consecutive spot index levels:

$$R_{it}=\ln(P_{it}/P_{it-1}).$$

The explanatory variables will be past returns.

$$R_t = \alpha_0 + \sum^{m}_{i=1}\alpha_i R_{t-i} + \sum^{q}_{i=1}\mu_i e_{it-i} + e_t, \tag{1}$$

where $e_t \sim N(0,h_t)$

The regression of variance can explain how old information influences current volatility. We will follow Gulen and Mayhew (2000) and use GJR-GARCH model with additive dummy that takes into consideration the asymmetric response to news in volatility.

$$h_t^2 = \exp(\delta_0 + \delta_{0,1} D_1) + \sum\nolimits^{p}_{i=1} \beta_i h_{t-i}^2 + \sum\nolimits^{g}_{i=1} \lambda_i e^2_{t-i} + \gamma_1 \max(0, -e_{t-1})^2 \qquad (2)$$

The variance h_t^2 will be explained by a dummy variable "futures contracts" (D= 1 if there is futures trading activity in the market and 0 otherwise). The positive and significant value of $\delta_{0,1}$ would tell us about the increase in spot market volatility after index future introduction through changing the intercept $\exp(\delta_0)$. In addition, significant value of γ_1 will indicate the presence of asymmetric response to news.

To test whether there are other factors that can cause high volatility of the spot market we propose to use MSCI Emerging Markets (MXEF) as a proxy for world markets information in emerging markets. In return equation we include returns on world market portfolio to see whether there is a change in return levels. Also, we include the square of this variable in the variance equation as proxy for variance. It will help to control for other factors and more clearly show the effect of index futures trading introduction on the volatility of the spot market. As a result, the following model is estimated:

$$R_t = \alpha_0 + \varrho_1 MXEF_t + \sum\nolimits^{m}_{i=1} \alpha_i R_{t-i} + \sum\nolimits^{q}_{i=1} \mu_i e_{it-i} + e_t, \qquad (3)$$

where $e_t \sim N(0, h_t)$, and

$$h_t^2 = \exp(\delta_0 + \delta_{o,d} D_1 + \nu_0 MXEF_t^2) + \sum\nolimits^{p}_{i=1} \beta_i h_{t-i}^2 + \sum\nolimits^{g}_{i=1} \lambda_i e^2_{t-i} + \gamma_1 \max(0, -e_{t-1})^2 \qquad (4)$$

The variable MSCI is needed to test whether the change in volatility is due to world market factors rather than index futures introduction. The MSCI Emerging Markets Index is in US dollars, so to make our analysis meaningful, all country indexes were converted into dollars terms using daily exchange rates for each currency.

Our next step is to determine the time difference in volatility changes in the case of presence of the "futures effect". We suppose that in first trading month the index futures trading has greater effect on spot market volatility than in later periods. It is possible as market participants are still learning about the new futures market at early stages and there is a lot of noise in the trading data. Thus, we make our next hypothesis:

H_0: the change in volatility after index futures introduction is different in the first six trading months compared to later periods.

H_1: the change in volatility after index futures introduction is the same at all time.

To test this hypothesis we add the second dummy D2 in conditional variance equation. This dummy is equal to zero before index futures introduction, it is equal to one during the first six months after index futures introduction, and then in the rest of observations it is again equal to zero. Therefore, the main return equation and conditional variance equation will now be:

$$R_t = \alpha_0 + \varrho_1 MXEF_t + \sum^{m}_{i=1}\alpha_i R_{t-i} + \sum^{q}_{i=1}\mu_i e_{it-i} + e_t, \qquad (5)$$

where $e_t \sim N(0,h_t)$, and

$$h_t^2 = \exp(\delta_0 + \delta_{o,1}D_1 + \delta_{o,2}D_2 + \nu_0 MXEF_t^2) + \sum^{p}_{i=1}\beta_i h_{t-i}^2 + \\ + \sum^{g}_{i=1}\lambda_i e^2_{t-i} + \gamma_1 \max(0,-e_{t-1})^2 \qquad (6)$$

With the aim to understand how the constant in conditional variance equation change in first six trading month we should sum the coefficient in front of two dummies. The constant equal:

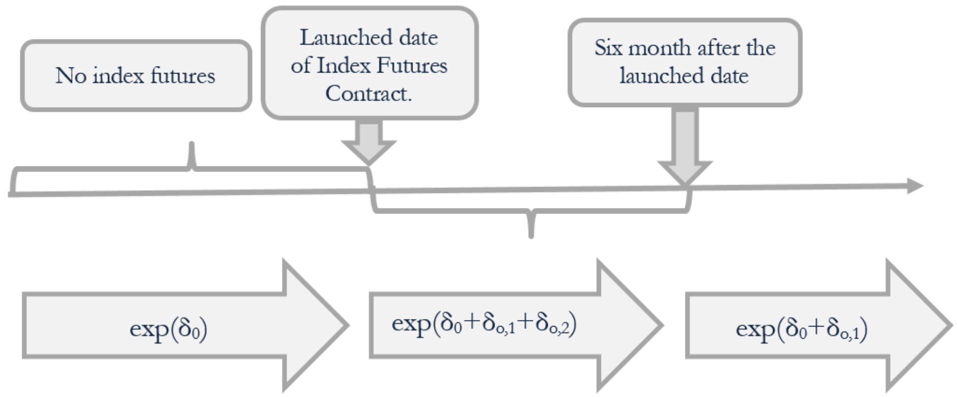

Figure 1. The timeline of the index futures introduction effect.

In addition, as we work with introduction of a new financial instrument, we may suppose that there were some expectations about it for some time (e.g., a month) before the futures was actually introduced. These expectations can influence the volatility of the spot market before the index futures launched date. Moreover, we suspect that the first trading month after introduction of new instrument is not very representative in terms of market participant involvement. To deal with this problem, we propose to re-estimate the last model, on which we rely for our main conclusions, after dropping from the data one month before and one month after index futures introduction, and then test our second hypothesis:

$$R_t = \alpha_0 + \varrho_1 MXEF_t + \sum^{m}_{i=1}\alpha_i R_{t-i} + \sum^{q}_{i=1}\mu_i e_{it-i} + e_t, \qquad (7)$$

where $e_t \sim N(0,h_t)$, and

$$h_t^2 = \exp(\delta_0 + \delta_{o,1}D_1 + \delta_{o,2}D_2 + \nu_0 MXEF_t^2) + \sum^{p}_{i=1}\beta_i h_{t-i}^2 + \\ + \sum^{g}_{i=1}\lambda_i e^2_{t-i} + \gamma_1 \max(0,-e_{t-1})^2 \qquad (8)$$

Chapter 4

DATA DESCRIPTION

The data used in this study consists of the daily closing price series on 5 major country indexes, the world market index MSCI Emerging Markets (MXEF) and the daily data on exchange rate for all countries.

The dates of futures contracts launching in Eastern Europe countries stock exchanges are provided in the following table:

Table 1. Launch date of Index Futures Contract.

Country	**Index**	**Date**
Russia	RTSI	March 1997
Poland	WIG20	16 January 1998
Czech Republic	PX	10 May 2006
Romania	BET	Sept 2007
Ukraine	UX	27 May 2010

From Table 1 we see that index futures were first introduced in Russia, and then in Poland, Czech Republic, Romania and finally in Ukraine.

Table 2. Data periods used for each country

Country	Index	Time interval
Russia	RTSI	01.09.1995 - 31.12.1999
Poland	WIG20	23.10.1995 - 30.03.2000
Czech Republic	PX	10.05.2002 - 10.05.2010
Romania	BET	11.09.2003-12.09.2011
Ukraine	UX	27.05.2008-19.04.2013

We use daily stock market index data obtained from Bloomberg. For these countries, the data for stock market indexes are obtained from the beginning of stock market appearance and first equity trading in these markets. In Table 2 you can see the data periods used for each country. We used the data on spot prices to cover 4 years before introduction and 4 years after index futures introduction (where it was possible). For Ukraine, Poland and Russia we use the windows of 2 years before and 2 years after the events, because in these countries index futures were introduced before 4 years passed since the first trading day in these stock exchanges.

Table 3. Indexes descriptive statistics of annualized index returns

Variable	Obs	Mean	Std. Dev.	Min	Max
rtsi	1075	13.69%	925.65%	-5317.84%	3920.33%
wig20	1103	11.30%	546.28%	-3307.21%	2549.16%
px	2007	18.34%	497.95%	-4479.64%	4713.58%
bet	1988	12.83%	573.47%	-3405.67%	3068.77%
ux	1215	-20.33%	661.28%	-3328.99%	4214.96%

As we discussed earlier, time spans are different for different countries resulting in different numbers of observations for each country. We decide to take approximately equal numbers of observation before and after index futures introduction to make our results more comparable. However, number of observations before index futures introduction are limited in some countries. That is why the numbers of observation are different for each country.

From Table 3 you can see that average annual return on index are the highest in Czech Republic which make this market very attractive and the lowest in Ukraine which can be due to recent financial crises in Ukraine.

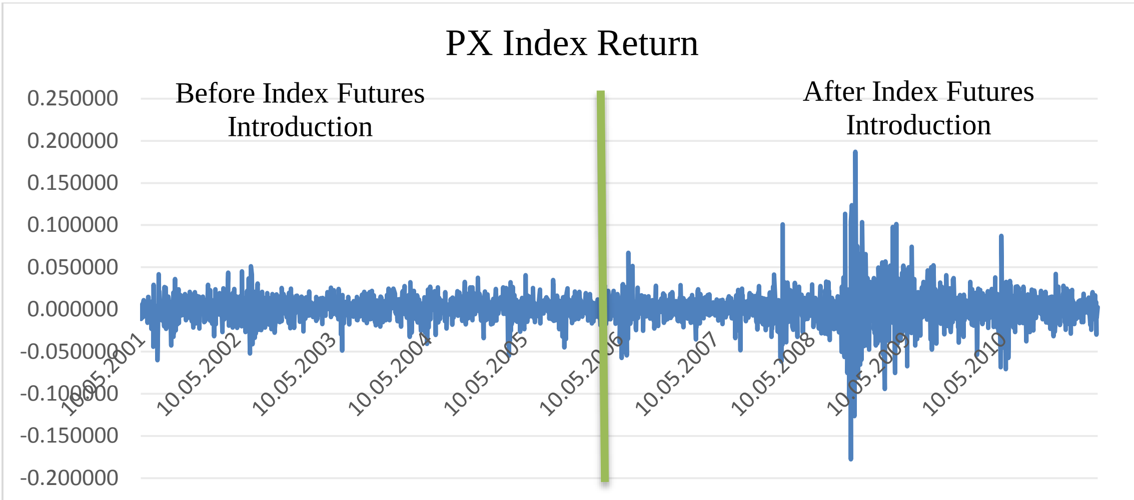

Figure 2. Historical PX Index Return.

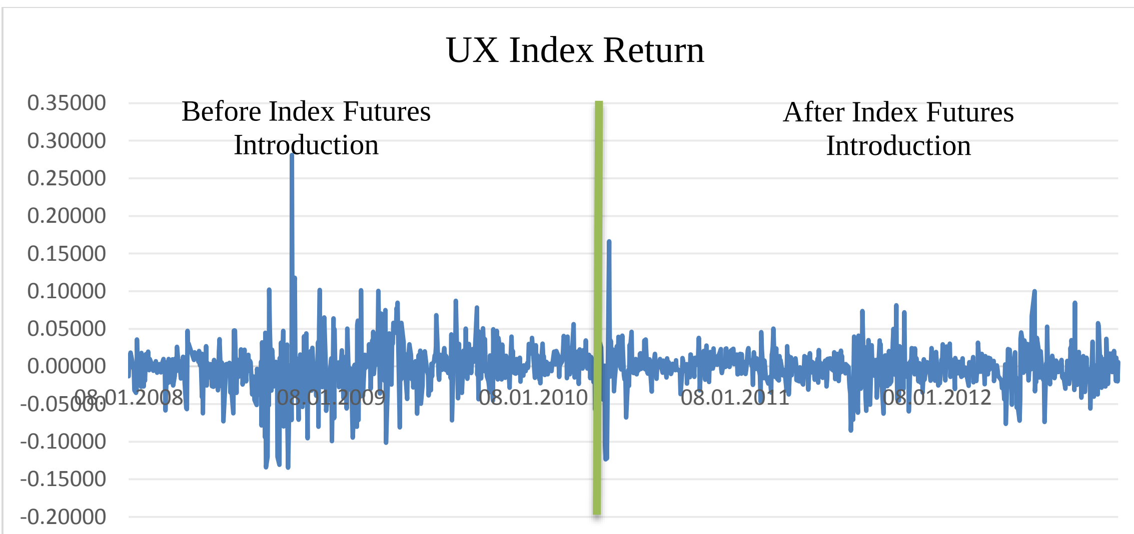

Figure 3. Historical UX Index Return.

From Figure 2 and 3 you can see the data plots on the PX and UX index returns. Visually, it seems that in Czech Republic volatility of index after futures introduction is likely to increase. In contrast to Czech Republic, in Ukraine the volatility of index after futures introduction seems to decrease.

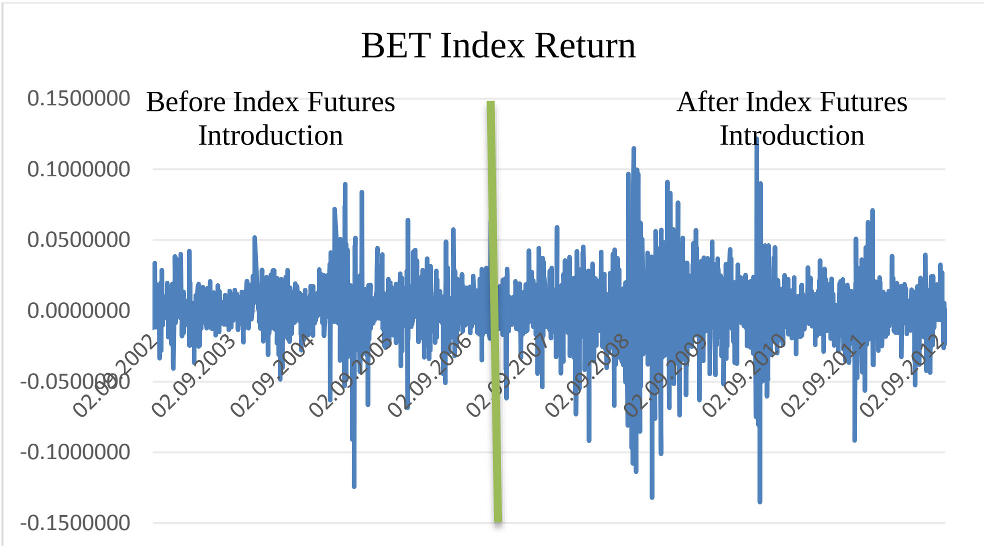

Figure 4. Historical BET Index Return.

From Figure 4 we clearly see that in Romania the index volatility after index futures introduction increased destabilizing the equity market, like in the case of Czech Republic. However, in Romania the average standard deviation of index return is bigger than in Czech Republic. Nevertheless, we cannot draw the results only from graphs without controlling for other factors that also may change the volatility.

Figures for other countries can be found in Appendixes A and B

Chapter 5

EMPIRICAL RESULTS

For empirical part of work, we use Stata program. In order to do GJR-GARCH model firstly we check time series for stationary with Dickey-Fuller unit root test. This test shows that all series are stationary and thus we can build a time-series model. Then, we use autocorrelation and partial autocorrelation functions to build ARIMA models to check the data for ARCH-GARCH effects and find that all time series exhibit ARCH-GARCH effects. Thus, with the aim to find the appropriate GARCH specification for each data series, we estimate all possible models with different reasonable ARCH and GARCH lags. The fit of models to the data is evaluated based on Akaike information criterion (AIC) and Bayesian information criterion (BIC). The results of best-fit regressions are presented in Table 4 – 8

Table 4. Estimation results for Russia from equations (1)-(8)

	(1)-(2)	(3)-(4)	(5)-(6)	(7)-(8)
ϱ_1		1.058***	1.120***	1.133***
		(0.097)	(0.093)	(0.095)
α_0	0.506*	0.158	0.043	0.051
	(0.282)	(0.287)	(0.239)	(0.330)
ARMA				
α_2	0.061*	0.018		
	(0.031)	(0.036)		
α_3			-0.953***	0.966***
			(0.074)	(0.047)
μ_1	0.249***	0.226***		
	(0.034)	(0.035)		
μ_3			0.945***	-0.956***
			(0.081)	(0.055)

Table 4. Estimation results for Russia from equations (1)-(8) - Continued

HET				
$\delta_{0,1}$	0.668***	0.209	0.439**	0.442**
	(0.159)	(0.178)	(0.192)	(0.193)
ν_0		0.017***	0.014***	0.014***
		(0.002)	(0.002)	(0.002)
$\delta_{0,2}$			-0.609**	-0.622*
			(0.309)	(0.344)
δ_0	2.560***	1.501***	1.333***	1.338***
	(0.190)	(0.338)	(0.174)	(0.172)
ARCH				
λ_1	0.261***	0.138***	0.238***	0.255***
	(0.025)	(0.045)	(0.039)	(0.042)
λ_2	0.295***	0.119*		
	(0.032)	(0.065)		
λ_3	0.241***	0.019		
	(0.027)	(0.071)		
γ_1	-0.017***	0.035	0.015	0.007
	(0.004)	(0.049)	(0.043)	(0.045)
β_1	-0.509***	0.347	0.705***	0.696***
	(0.028)	(0.276)	(0.027)	(0.028)
β_2	-0.170***	0.474*		
	(0.033)	(0.263)		
β_3	0.700***	-0.175		
	(0.028)	(0.174)		
N	1076	1076	1076	1023

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

From Table 4, among other things we can see the estimates of $\delta_{0,1}$, which corresponds to futures dummy effect. For Russia. $\delta_{0,1}$=0.668, which means that the increase in the constant term of the variance equation is almost twofold (exp(0.668)=1.95). The constant of conditional variance equation, on average, is equal to exp(2.560)=12.95 before index future introduction, and exp(2.561)*exp(0.668)=25.25, on average, after index future introduction. Taking the squared root we obtain that shift in the volatility after index futures introduction was 5.024. So, for Russia the "dummy effect" is quite significant in economic terms as well as in statistical terms.

Moreover, you can see from Table 4, that when we control for market factors through MSCI Index, the index futures dummy change the sign and becomes statistically insignificant. From return and conditional variance equation we see that global market factors have significant impact on stock market in Russia. From this, we can conclude that in the conditional variance equation (2) the dummy captures not only their own "index future introduction effect" but also mostly the global market movement effect like crisis and changing in investors demand, etc.

Therefore, controlling for the market factors we reject the first hypothesis about the change in volatility after index futures introduction in Russia. Moreover, Russian market shows a significant response to news in equations (1)-(2). Based on equations (4)-(5) we can calculate the total effect of futures introduction in first six trading month on the constant in the conditional variance equation: it is equal to exp(1.333+0.439-0.609)=3.19 or 1.79 in volatility terms.

Evaluating our second hypothesis, we tested whether $\delta_{0,1}+\delta_{0,2}=0$ and got these result:

test $\delta_{0,1}+\delta_{0,2}=0$

chi2(1) = 0.31

Prob> chi2 = 0.5755

This test result suggest that in the first 6 trading months there was no significant effect on index return, the significant effect appeared only after this initial period.

Table 5. Estimation results for Poland from equations (1)-(8)

	(1)-(2)	(3)-(4)	(5)-(6)	(7)-(8)
ϱ_1		0.731***	0.728***	0.718***
		(0.062)	(0.061)	(0.065)
α_0	0.052	-0.022	-0.011	-0.044
	(0.162)	(0.159)	(0.159)	(0.165)
ARMA				
α_1	-0.199*	-0.131	-0.133	-0.086
	(0.118)	(0.240)	(0.238)	(0.240)
μ_1	0.412***	0.260	0.262	0.220
	(0.113)	(0.234)	(0.232)	(0.237)
HET				
$\delta_{0,1}$	0.453***	0.460***	0.531***	0.520***
	(0.157)	(0.095)	(0.100)	(0.101)
ν_0		0.017***	0.017***	0.017***
		(0.002)	(0.002)	(0.002)
$\delta_{0,2}$			-0.320*	-0.246
			(0.182)	(0.198)
δ_0	0.735***	1.597***	1.552***	1.532***
	(0.261)	(0.245)	(0.247)	(0.251)
ARCH				
λ_1	0.076***	0.151***	0.148***	0.140***
	(0.009)	(0.044)	(0.044)	(0.043)
λ_2	0.093***	-0.080**	-0.085**	-0.081**
	(0.010)	(0.036)	(0.035)	(0.033)
γ_1	0.024***	-0.008	-0.006	-0.007
	(0.005)	(0.037)	(0.036)	(0.035)
β_1	-0.831***	0.865***	0.918***	0.959***
	(0.008)	(0.249)	(0.246)	(0.252)
β_2	0.655***	-0.236	-0.282	-0.323
	(0.015)	(0.227)	(0.230)	(0.242)
β_3	0.908***	-0.004	0.009	0.022
	(0.010)	(0.072)	(0.074)	(0.078)
N	1103	1103	1103	1063

Standard errors in parentheses
* $p< 0.10$, ** $p< 0.05$, *** $p< 0.01$

Table 5 shows that the dummy variable that corresponds to the index future introduction does not lose its significance after we control for global market factors like it happens in Russia. This suggests that we should accept our first hypothesis in case of Poland.

In Poland, global market movements also influence the index return as well as volatility of index returns. Therefore, from the equations (2)-(3) the constant of conditional volatility equation changes in 1.22 times. After robustness check all conclusions stay the same, except that second dummy appears insignificant at 10% of significance level. We test the second hypothesis:

test $\delta_{0,1}+\delta_{0,2}=0$

chi2(1) = 1.40

Prob> chi2 = 0.2367

According to our results we should reject the second hypothesis: no significant changes in volatility in the first 6 trading months were found.

Table 6. Estimation results for Ukraine from equations (1)-(8)

	(1)-(2)	(3)-(4)	(5)-(6)	(7)-(8)
ϱ_1		0.835***	0.851***	0.814***
		(0.033)	(0.034)	(0.035)
α_0	-0.230	-0.312	-0.223	-0.172
	(0.229)	(0.194)	(0.179)	(0.158)
ARMA				
α_1	-0.098	1.015	1.811***	1.966***
	(0.076)	(0.893)	(0.099)	(0.014)
α_2	0.894***	-0.124	-0.853***	-0.982***
	(0.076)	(0.817)	(0.090)	(0.013)
μ_1	0.270***	-0.932	-1.721***	-1.877***
	(0.086)	(0.894)	(0.102)	(0.036)
μ_2	-0.839***	0.058	0.699***	0.818***
	(0.105)	(0.745)	(0.106)	(0.068)
μ_3	-0.105**	0.036	0.080**	0.078**
	(0.042)	(0.044)	(0.034)	(0.035)
HET				
$\delta_{0,1}$	-0.858***	-0.796***	-0.588***	-0.567***
	(0.181)	(0.167)	(0.132)	(0.167)
ν_0		0.007***	0.007***	0.007***
		(0.001)	(0.001)	(0.001)
$\delta_{0,2}$			-1.908*	-1.799*
			(1.004)	(1.099)
δ_0	0.359*	0.292	-0.492*	-0.731**
	(0.215)	(0.250)	(0.253)	(0.304)
ARCH				
λ_1	0.325***	0.382***	0.375***	0.366***
	(0.042)	(0.050)	(0.052)	(0.050)
λ_2	-0.074	-0.141***	-0.181***	-0.167***
	(0.059)	(0.054)	(0.061)	(0.061)
λ_3	-0.112***	-0.101***	-0.135***	-0.143***
	(0.038)	(0.033)	(0.032)	(0.031)
γ_1	-0.091***	-0.096***	-0.061***	-0.051***
	(0.024)	(0.027)	(0.015)	(0.014)
β_1	0.889***	0.883***	0.959***	0.960***
	(0.019)	(0.023)	(0.011)	(0.011)
N	1216	1216	1216	1176

Standard errors in parentheses

* $p< 0.10$, ** $p< 0.05$, *** $p< 0.01$

Result for Ukraine differ from the previous two countries. The coefficient in front of the dummy variable is negative and significant in all models. This suggests that in the case of Ukraine index futures have a stabilizing effect on the Ukrainian index market. In Ukraine the MSCI Emerging market index also has a significant effect on both returns and conditional their variances.

In addition, after controlling for global market factors we can conclude that index futures reduce the constant in the conditional volatility equation in 0.67 times. This result allows us to accept the first hypothesis that the index futures introduction shifts the volatility of the equity market, in the case of Ukraine, in the decreasing direction. After testing the second hypothesis, we obtain the following result:

test $\delta_{0,1} + \delta_{0,2} = 0$

chi2(1) = 6.15

Prob > chi2 = 0.0131

The p-value of the test allows us to accept the second hypothesis and make a conclusion that indeed the effect of index futures introduction was differ in the first 6 trading months. The coefficient in front of the second dummy is significant at 10% significance level. From equations (6)-(7) the total effect on constant in the conditional variance equation was $\sqrt{\exp(-0.588 - 1.908)} = 0.287$. So the constant decreases in the first six trading months more than afterwards. The robustness check almost does not change the significance of the coefficients.

There is no significance effect of futures trading on equity market in Czech Republic before we control for global market movement, which we can see from Table 7. However, after adding squared return on the MSCI Emerging market index, the coefficient in front of the dummy variable in equations (3)-(4) becomes significant at 10% significant level. So, based on model (3)-(4) we conclude that we can accept the first hypothesis and state that the index futures introduction decreases the constant in the conditional volatility equation by 0.788. Looking at equations (3)-(4) we can say without any testing that in first six trading months there was no significant effect on the volatility of index. However, after doing the robustness check we see that the second dummy becomes significant at 10% significant level. Taking into account robustness checks, we can deduce that only in the first six trading months after index futures began trading there was a decrease in index volatility, but there was no significant effect on the spot market after sixth month. Therefore, we accept the second hypothesis.

Table 7. Estimation results for Czech Republic from equations (1)-(8)

	(1)-(2)	(3)-(4)	(5)-(6)	(7)-(8)
ϱ_1		0.809***	0.816***	0.804***
		(0.024)	(0.025)	(0.025)
α_0	0.292***	0.192**	0.195**	0.194**
	(0.079)	(0.084)	(0.082)	(0.084)
ARMA				
α_1	0.130***	-0.277	1.892***	-0.124
	(0.043)	(0.309)	(0.067)	(0.353)
α_2	-0.917***	-0.690***	-0.937***	-0.609*
	(0.043)	(0.265)	(0.067)	(0.339)
μ_1	-0.064	0.448	-1.728***	0.296
	(0.051)	(0.311)	(0.070)	(0.355)
μ_2	0.896***	0.746***	0.611***	0.630*
	(0.046)	(0.288)	(0.078)	(0.355)
μ_3	0.030	0.090	0.167***	0.071
	(0.026)	(0.062)	(0.024)	(0.073)
HET				
$\delta_{0,1}$	-0.013	-0.477*	-0.253	-0.256
	(0.202)	(0.261)	(0.242)	(0.231)
ν_0		0.009***	0.009***	0.008***
		(0.001)	(0.001)	(0.001)
$\delta_{0,2}$			-1.139	-1.416*
			(0.760)	(0.841)
δ_0	-0.595***	-1.370***	-1.331***	-1.280***
	(0.192)	(0.290)	(0.286)	(0.276)

Table 7. Estimation results for Czech from equations (1)-(8) - Continued

ARCH				
λ_1	0.140***	0.098***	0.097***	0.086***
	(0.028)	(0.020)	(0.020)	(0.020)
λ_2	-0.004	-0.005	-0.018	-0.003
	(0.030)	(0.031)	(0.031)	(0.030)
λ_3	0.055**	-0.012	-0.007	-0.011
	(0.023)	(0.026)	(0.026)	(0.026)
γ_1	-0.109***	-0.007	-0.001	-0.006
	(0.019)	(0.016)	(0.016)	(0.016)
β_1	0.833***	0.908***	0.911***	0.912***
	(0.020)	(0.013)	(0.013)	(0.013)
N	2008	2008	2008	1966

Standard errors in parentheses
* $p< 0.10$, ** $p< 0.05$, *** $p< 0.01$

Table 8. Estimation results for Romania from equations (1)-(8)

	(1)-(2)	(3)-(4)	(5)-(6)	(7)-(8)
ϱ_1		0.809***	0.809***	0.819***
		(0.029)	(0.029)	(0.030)
α_0	0.286	0.175	0.178	0.210*
	(0.183)	(0.118)	(0.119)	(0.120)
ARMA				
α_1	0.080**	-0.512	-0.524	-0.281
	(0.037)	(1.892)	(1.876)	(0.322)
α_2	0.952***	0.168	0.165	0.220
	(0.022)	(0.443)	(0.438)	(0.224)
α_3	-0.058**	0.029	0.031	
	(0.027)	(0.210)	(0.209)	
μ_1	0.004	0.639	0.651	0.407
	(0.024)	(1.894)	(1.878)	(0.326)
μ_2	-0.955***	-0.017	-0.012	-0.102
	(0.021)	(0.662)	(0.654)	(0.204)
HET				
$\delta_{0,1}$	0.210	0.107	0.072	0.058
	(0.205)	(0.115)	(0.121)	(0.121)
ν_0		0.008***	0.008***	0.008***
		(0.001)	(0.001)	(0.001)
$\delta_{0,2}$			0.280	0.420
			(0.244)	(0.258)
δ_0	-1.092***	-0.708***	-0.735***	-0.700***
	(0.193)	(0.195)	(0.195)	(0.195)
ARCH				
λ_1	0.314***	0.202***	0.202***	0.210***
	(0.031)	(0.030)	(0.030)	(0.031)
λ_2	-0.229***	-0.145***	-0.146***	-0.153***
	(0.030)	(0.030)	(0.030)	(0.031)
γ_1	-0.037***	-0.011	-0.010	-0.012
	(0.012)	(0.012)	(0.012)	(0.012)
β_1	0.923***	0.922***	0.923***	0.922***
	(0.009)	(0.011)	(0.011)	(0.011)
N	1989	1989	1989	1945

Standard errors in parentheses

* $p< 0.10$, ** $p< 0.05$, *** $p< 0.01$

In case of Romania, we should reject the first hypothesis as well as the second hypothesis. From Table 8 we see that the coefficient in front of both first and second dummies are insignificant in all equations from (1) to (8). This result suggests that index futures introduction did not affect the volatility of the spot market of Romania at all despite a seemingly apparent increase in volatility observed on the graph in Appendix C. There is no need in additional test for total effect in the first 6 trading months as two coefficients are insignificant.

Nevertheless, the global market movements have an effect on the Romanian equity market in the return equation, as well as in the conditional variance equation. In addition, the data shows the asymmetric response to news only in equation (1)-(2).

Chapter 6

CONCLUSIONS

This study analyzes the impact of index futures introduction on spot market volatility in 5 Eastern European countries. Four main empirical models were considered: the first one with one futures dummy in the conditional variance equation, the second one with the MSCI Emerging Markets index to see the pure effect of the futures dummy, in the third model we added the second dummy (to the second model) that corresponded to the first 6 months of futures trading. The fourth model was done as a robustness check and omitted one month of the data prior to futures introduction and one month after this event to control for the effect of market turbulence.

Although there exists empirical evidence that introducing Index Futures can change the volatility of the underlying index, the comparison between 5 Eastern European countries showed that the effects are very country specific.

Without controlling for global market factors we can conclude that introduction of index futures has increased the spot market volatility in Russia, Poland and decreased the volatility in Ukraine, but has insignificant effect in Czech Republic and Romania. When we control for global market factors we see that the "futures effect" becomes insignificant in Russia and Romania, but becomes significant at 10% level in Czech Republic and almost stays the same in Ukraine and Poland.

In Ukraine, in the first 6 trading months after index futures introduction the decrease in the volatility of equity market is more intense than afterwards. Moreover, in case of Czech Republic after robustness check at 10% significance level we conclude that the index futures introduction has decreased the spot market volatility only in the first 6 trading month.

In all countries, global market movements have a significant impact on index return equation as well as conditional variance equation. Significant asymmetric variance response showed up in all equations in the Ukrainian market, in contrast to other countries were this response is significant only in the first model.

After analyzing all data, we clearly see that all countries are different. Every equity market has their own specific that is why in some countries index futures introduction deceased the spot market volatility, in other increase and in the rest has no effect.

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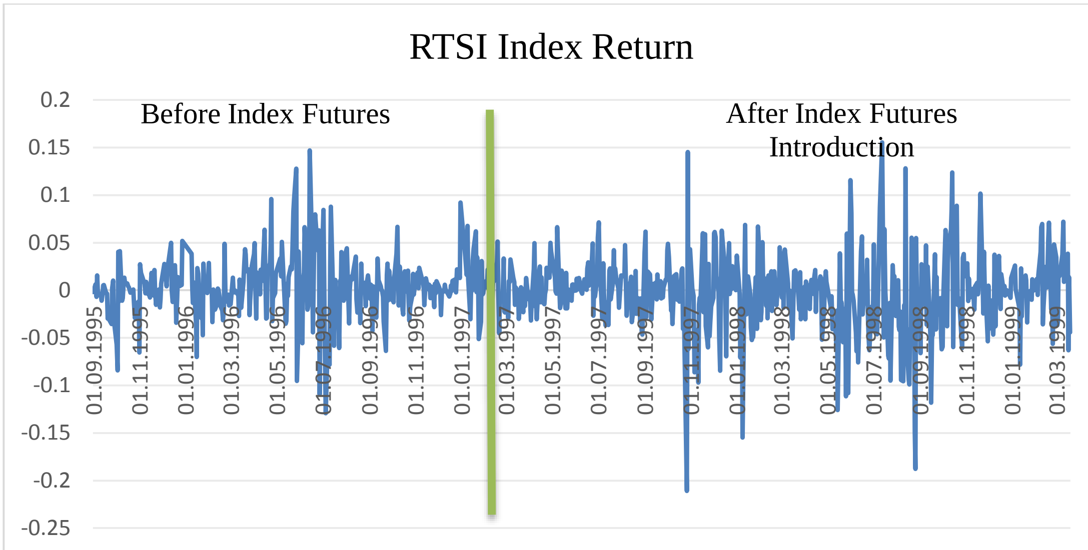
Appendix A. Historical RTSI Index Return.



Appendix B. Historical WIG20 Index Return.