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From the Editor

The South East European Journal of Economics and Business (SEEJ) traditionally publishes selected papers presented at the International Conference of the School of Economics and Business (ICES), University of Sarajevo. This special issue brings us three selected papers from this Conference. All three studies are empirical works, and all of them are focused on the regions which are of special interest for the Journal, the regions of Central, Eastern and South-East Europe.

The first paper is by Okičić, J., and is titled "An empirical analysis of stocks returns and volatility: the case of stock markets from Central and Eastern Europe." The paper investigates the relationship between returns and conditional volatility, focusing on stock markets from Central and Eastern Europe. The author aims to contribute to the limited empirical research focused on the volatility of stock returns in less developed stock markets, which is the case for the regions it studies. More specifically, the study includes an investigation of econometric modelling of the conditional mean and volatility of stock returns from Central and Eastern Europe. The obtained results indicate confirmatory evidence that ARIMA and GARCH processes provide parsimonious approximations of mean and volatility dynamics in the case of the selected stock markets. The author also reports that there is overwhelming evidence corroborating the existence of a leverage effect, meaning that negative shocks increase volatility more than positive shocks. The results presented in this paper provide useful information in decision making for those who are planning to invest in stock markets from the regions in focus.

The second paper is by Bezdrob, M. and Šunje, A., and is titled "Management innovation – designing and testing a theoretical model." The authors consider management innovation as the introduction of management processes, structures and practices that are new to companies. The exisiting literature is used to underpin a new theoretical model of management innovation, with particular reference to immature and underdeveloped markets; this is how markets are often identified in the South East European region. The constructed theoretical model is then tested based on qualitative data gathered through semi-structured interviews, including an empirical econometric analyisis of quantitative data collected through a targeted survey of companies in the Federation of Bosnia and Herzegovina (FBiH). The general finding of this study is that the context in which companies operate, as well as companies' management background (proficiency), are directly and positively related to management innovation. The authors conclude that the existing management innovation theory is applicable to market conditions in FBiH with only slight adaptation. Furthermore, this research provides useful insights on the factors that affect the companies' readiness to introduce innovative management structures, processes and practices.

The third paper is by Zaimović, A. and Arnaut-Berilo, A., and is titled "Risk diversification between stock markets in Germany and Bosnia and Herzegovina." The paper provides up-to-date research focused on the co-movements of stock markets in Germany and Bosnia and Herzegovina (BiH). The period in focus is 2006-2011, hence covering the timing before, during and after the last economic and financial downturn. The authors test whether there are any risk diversification possibilities by spreading out investments between the two equity markets in focus. The empirical part of the paper relies on the method of convex (quadratic and linear) programming aiming to determine the mean-variance efficiency of portfolios based on the Markowitz portfolio optimization method. The authors find that the recent crisis affected BiH's stock market much more strongly in comparison to the German market. Moreover, the authors report that the German market during the crisis period performed much better. Zaimović and Arnaut-Berilo argue that the lack of diversification during the downturn is less due to high integration between the analyzed markets than the underperformance of the BiH equity market.

In the end, I would like to thank the journal's Editoral Board and referees, who helped us to select and improve the papers, and who supported the continuity of publishing high-quality research from ICES conference.

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AN EMPIRICAL ANALYSIS OF STOCK RETURNS AND VOLATILITY: THE CASE OF STOCK MARKETS FROM CENTRAL AND EASTERN EUROPE

Jasmina Okičić *

Abstract

The main goal of this paper is to investigate the behaviour of stock returns in the case of stock markets from Central and Eastern Europe (CEE), focusing on the relationship between returns and conditional volatility. Since there is relatively little empirical research on the volatility of stock returns in underdeveloped stock markets, with even fewer studies on markets in the transitional economies of the CEE region, this paper is designed to shed some light on the econometric modelling of the conditional mean and volatility of stock returns from this region. The results presented in this paper provide confirmatory evidence that ARIMA and GARCH processes provide parsimonious approximations of mean and volatility dynamics in the case of the selected stock markets. There is overwhelming evidence corroborating the existence of a leverage effect, meaning that negative shocks increase volatility more than positive shocks do. Since financial decisions are generally based upon the trade-off between risk and return, the results presented in this paper will provide valuable information in decision making for those who are planning to invest in stock markets from the CEE region.

Keywords: *stock returns, volatility, CEE region*

JEL classification: *G11, C58*

1. INTRODUCTION

There are several reasons to model and forecast return and volatility. First, one may need to analyze the risk of holding an asset. Second, forecast confidence intervals may be time-varying, so that more accurate intervals can be obtained by modelling the variance of the errors. Third, more efficient estimators can be obtained if heteroskedasticity in the errors is handled properly (IHS Global Inc, 2013, p. 224). As documented by Bollerslev, Engle and Nelson (1994), financial time series are generally characterized by the presence of fat-tails and volatility clustering. Therefore, the assumption of constant volatility is unsuitable and can drive high levels of inaccuracy. Linear time series models are therefore unable to explain a number of important features common to much financial data, including (Brooks, 2008, p. 380): (1) *Leptokurtosis* – that is, the tendency for financial asset returns to have distributions that exhibit fat tails and excess peakedness at the mean. (2) *Volatility clustering/pooling* – the tendency for volatility in financial markets to appear in bunches. Thus large returns (of either sign) are expected to follow large returns, and small returns (of either sign) to follow small returns. A plausible explanation for this phenomenon, which seems to be an almost

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universal feature of asset return series in finance, is that the information arrivals which drive price changes themselves occur in bunches rather than being evenly spaced over time. (3) *Leverage effects* – the tendency for volatility to rise more following a large price fall than following a price rise of the same magnitude.

The main goal of this paper is to explain the behaviour of financial time series, i.e. stock returns in the case of stock markets from the Central and Eastern Europe (CEE), focusing on the relationship between returns and conditional volatility. Empirical studies have shown that this relationship is important for several reasons. First, the nature of stock return behaviour is fundamental to the formulation of the concept of risk in various financial theories and models. Second, stock return volatility is central to finance, whether in asset pricing, portfolio selection, or risk management. There is relatively less empirical research on the volatility of stock returns in underdeveloped stock markets, with even fewer studies on the markets in the transition economies of the CEE region. Therefore, in this paper we will focus on the econometric modelling of the conditional mean and volatility of stock returns from the CEE region.

The research should result in responses to the following questions: What are the general specificities of the financial time series from the underdeveloped stock markets from the CEE region? Do ARIMA and GARCH processes provide parsimonious approximations to mean and volatility dynamics in the case of stock markets from the CEE region? Do financial time series from the CEE region have a significant leverage effect? Bearing in mind the above, the central research hypothesis shall be as follows: *ARIMA and GARCH processes provide parsimonious approximations to mean and volatility dynamics in the case of stock markets from the CEE region.* The main limitations of this study are to be found in the shorter available financial time series in the selected stock markets.

Since financial decisions are generally based upon the trade-off between risk and return, results presented in this paper could be a good starting point in decision making for those who are planning to invest in stock markets from the CEE region.

The paper is organized as follows. After the introduction, part one gives a short overview of some recent literature relevant to the main objective of the paper. Part two presents a fundamental theoretical background and the research methodology. Part three brings a description of our data and research design. Part four is the main section of the paper and contains an analysis of the original empirical results. The last part contains some final remarks and conclusions.

2. LITERATURE REVIEW

ARCH models were introduced by Engle (1982) and generalized as GARCH (Generalized ARCH) by Bollerslev (1986). These models are widely used in various branches of econometrics, especially in financial time series analysis. Since most of the empirical research on return and volatility comes from the developed stock markets, in this section we will only present some recent results of the econometric modelling of the conditional mean and volatility of stock returns from underdeveloped (emerging and frontier) stock markets.

Murinde and Poshakwale (2001) investigated volatility in the emerging stock markets in the CEE region, i.e. Croatia, the Czech Republic, Hungary, Poland, Russia and Slovakia. Although GARCH seemed to be the most appropriate process in characterizing volatility in these markets, the explanation provided by symmetric and asymmetric GARCH models was not significant enough for predicting future volatility.

Alberg, Shalit and Yosef (2008) gave a comprehensive empirical analysis of the mean return and conditional variance of the Tel Aviv Stock Exchange (TASE) indices by using various GARCH models. They found that the asymmetric GARCH model with fat-tailed densities improves overall estimation for measuring conditional variance. The EGARCH model using a skewed Student-t distribution was the most successful for forecasting TASE indices.

Gokcan (2000) compared the linear (GARCH(1,1)) and non-linear (EGARCH) versions of the GARCH model by using the monthly stock market returns of seven emerging countries from February 1988 to December 1996. He found that for emerging stock markets the GARCH(1,1) model performed better than the EGARCH model, even if the stock market return series displayed skewed distributions.

Sandoval (2006) applied asymmetric GARCH models on exchange rate volatilities in emerging markets. The set of emerging market exchange rates did not show generalized asymmetric evidence. Bhaskar (2012) documented that the EGARCH model successfully models the Sensitive Index or Sensex related to Bombay Stock Exchange (BSE) data, whereas GJR-GARCH was able to explain conditional variance in the returns from Nifty associated with the National Stock Exchange (NSE). Worthington and Higgs (2004) examined the transmission of equity returns and volatility among Asian equity markets and investigates the differences that exist in this regard between the developed and emerging markets. Three developed markets (Hong Kong, Japan and Singapore) and six emerging markets (Indonesia, Korea, Malaysia, the Philippines, Taiwan and Thailand) were included in the

analysis. The results generally indicated the presence of large and predominantly positive mean and volatility spillovers.

Kovačić (2007) investigated the behaviour of stock returns in an emerging stock market, namely, the Macedonian Stock Exchange, focusing on the relationship between returns and conditional volatility. The results indicated that the Macedonian stock return time series display stylized facts such as volatility clustering, high kurtosis, and a low starting and slow-decaying autocorrelation function of squared returns, and that the asymmetric models show little evidence on the existence of leverage effect.

Égert and Koubaa (2004) investigated conditional variance patterns in daily return series of stock market indices in the G-7 (Canada, France, Germany, Italy, Japan, the UK and the US) and 6 selected economies of Central and Eastern Europe (the Czech Republic, Hungary, Poland, Russia, Slovakia and Slovenia). For this purpose, various linear and asymmetric GARCH models were employed. The estimation results revealed that the selected stock returns for the G-7 could be reasonably well modelled using linear specifications, whereas the overwhelming majority of the stock indices from the CEE region could be much better characterized using asymmetric models. In their research Kasch-Haroutounian and Price (2001) econometrically modelled returns from four emerging equity markets of CEE (Czech Republic, Hungary, Poland and Slovakia). The estimates of asymmetric models of conditional volatility showed rather weak evidence of asymmetries in the selected markets. Patev and Kanaryan (2003) investigate the nature of the Central European stock market volatility before, during and after major emerging market crises. Their results led to the conclusion that following a financial crisis, the negative return shocks had higher volatility than positive return shocks. Also, they found that an asymmetric GARCH model with non-normal distributed residuals captured most of the Central European stock market's volatility characteristics.

Shields (1997) investigated whether an analogous asymmetric characteristic is reflected in two emerging Eastern European Markets. No evidence of asymmetry was found. Shin (2005) examined the relationship between expected stock returns and conditional volatility in 14 emerging international stock markets. Using both a parametric and a flexible semi-parametric GARCH in mean model, he found that a positive relationship prevailed for the majority of the emerging markets. Also, the results lent little support to the asymmetric volatility argument that stock return volatility should be negatively correlated with stock returns.

3. THEORETICAL BACKGROUND AND METHODOLOGY

3.1 Theoretical background

As discussed by Engle (2001) the basic version of the least squares model assumes that the expected value of all error terms, when squared, is the same at any given point. This assumption is called homoskedasticity, and it is this assumption that is the focus of GARCH models. Data in which the variances of the error terms are not equal, in which the error terms may reasonably be expected to be larger for some points or ranges of data than for others, are said to suffer from heteroskedasticity. Therefore, and as pointed out by Engle (2001), the standard warning is that in the presence of heteroskedasticity, the regression coefficients for an ordinary least squares regression are still unbiased, but the standard errors and confidence intervals estimated by conventional procedures will be too narrow, giving a false sense of precision. Instead of considering this a problem to be corrected, ARCH and GARCH models treat heteroskedasticity as a variance to be modelled. As a result, not only are the deficiencies of least squares corrected, but a prediction is computed for the variance of each error term.

GARCH models are specifically designed to model and forecast conditional variances. They consist of two equations, i.e. the conditional variance equation and the conditional mean equation. In this research, for the second equation we will use the autoregressive moving average (ARIMA) model. There is a huge variety of ARIMA models. The general non-seasonal model is known as ARIMA(p,d,q) where p denotes the order of the autoregressive (AR) part, d stands for the degree of first differencing involved and q denotes the order of the moving average part (MA). The representation for the conditional mean of the ARIMA model is given by (IHS Global Inc, 2013, p. 94):

$$r_t = \varphi_0 + \varphi_1 r_{t-1} + \ldots + \varphi_p r_{t-p} + \varepsilon_t + \eta_1 \varepsilon_{t-1} + \ldots + \eta_q \varepsilon_{t-q}\,, \quad (1)$$

where r_t denotes the dependent variable at time t, φ_0 is the constant term, φ_j is the j-th autoregressive parameter, η_j is the j-th moving average parameter and ε_{t-k} is the error term at time t-k. Residuals of the estimated mean equation have to be tested for ARCH effects. It is standard procedure to use an ARCH LM test (*H_0: there is no ARCH effect in residuals*) which is a Lagrange multiplier (LM) test for autoregressive conditional heteroskedasticity in the residuals. A rejection of the null implies the existence of significant ARCH effects. The variance of the dependent variable is modelled as a function of the past values of the dependent variable and independent or exogenous variables.

The GARCH models allow variance not only to be dependent on past shocks but also to be dependent on the most recent variance of itself. The representation for the conditional variance of GARCH(q,p) is given as follows:

$$\sigma_t^2 = \omega + \sum_{j=1}^{q} \beta_j \sigma_{t-j}^2 + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-i}^2 \quad , \qquad (2)$$

where, ω, α_i and β_j are parameters.

The conditional variance equation specified in (2) is a function of three terms: (1) a constant term: ω, (2) news about volatility from the previous period, measured as the lag of the squared residual from the mean equation: ε_{t-i}^2 (the ARCH term) and (3) the last period's forecast variance: σ_{t-j}^2 (the GARCH term). If one restricts the parameters of the GARCH model to sum to one and drops the constant term:

$$\sigma_t^2 = \sum_{j=1}^{q} \beta_j \sigma_{t-j}^2 + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-i}^2 \qquad (3)$$

such that

$$\sum_{j=1}^{q} \beta_j + \sum_{i=1}^{p} \alpha_i = 1 \qquad (4)$$

then we have an integrated GARCH model (IGARCH).

Although the standard GARCH process captures several important phenomena regarding financial time series, it fails to model the leverage effect. In a seminal paper, Black (1976) provided a compelling explanation for this effect in terms of the firm's financial leverage: a negative return implies a drop in the value of the firm's equity, increasing its leverage which, in turn, leads to higher equity-return volatility. The standard GARCH model assumes that the effects of different shocks on volatility depend only on size, regardless of sign. The model depends on summation of square shocks (ε_{t-i}), but it is well known that *volatility is higher after negative shocks* (bad news) than after positive shocks (good news). According to the ability to capture a stylized fact of asymmetry, GARCH family models can be divided into symmetric and asymmetric models[1].

Models (2) and (3) are typical symmetric GARCH models. An asymmetric model allows the possibility that the unexpected arrival of "bad news" has a larger impact on future volatility than an unexpected arrival of "good news" of similar magnitude.

To address this problem, many nonlinear extensions of GARCH have been proposed, such as the exponential GARCH (EGARCH), the threshold GARCH (TARCH), power ARCH (PARCH), etc. The representation for the conditional variance of the EGARCH model is given as follows (IHS Global Inc., 2013, p. 221):

$$\log\left(\sigma_t^2\right) = \omega + \sum_{j=1}^{q} \beta_j \log\left(\sigma_{t-j}^2\right) + \sum_{i=1}^{p} \alpha_i \left|\frac{\varepsilon_{t-i}}{\sigma_{t-i}}\right| + \sum_{k=1}^{r} \gamma_k \frac{\varepsilon_{t-k}}{\sigma_{t-k}} \qquad (5)$$

where γ_k denotes the leverage effect.

The EGARCH model differs from the standard GARCH models in two main respects (Engle and Ng, 1993, p. 1753): (1) the EGARCH model allows good news and bad news to have a different impact on volatility, while the standard GARCH model does not, and (2) the EGARCH model allows big news to have a greater impact on volatility than the standard GARCH model.

The generalized specification for the conditional variance for the TARCH model is given by (IHS Global Inc, 2013, p. 220):

$$\sigma_t^2 = \omega + \sum_{j=1}^{q} \beta_j \sigma_{t-j}^2 + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-i}^2 + \sum_{k=1}^{r} \gamma_k \varepsilon_{t-k}^2 I_{t-k}^- \quad , \qquad (6)$$

where $I_{t-k}^- = 1$ if $\varepsilon_t < 0$ and 0 otherwise. In this model, good news ($\varepsilon_{t-i}^2 > 0$) and bad news ($\varepsilon_{t-i} < 0$) differently affect conditional variance.

Basically, good news has an impact of α_i and bad news an impact of $\alpha_i + \gamma_i$. If $\gamma_i > 0$, then bad news increases volatility, and we say that there is a leverage effect for the *i*-th order. The representation for the conditional variance of the PARCH model is given as follows (IHS Global Inc., 2013, p. 222):

$$\sigma_t^\delta = \omega + \sum_{j=1}^{q} \beta_j \sigma_{t-j}^\delta + \sum_{i=1}^{p} \alpha_i \left(\left|\varepsilon_{t-i}\right| - \gamma_i \varepsilon_{t-i}\right)^\delta \quad , \qquad (7)$$

where δ denotes the power parameter, and $\delta > 0$, $\left|\gamma_i\right| \leq 1$ for $i = 1,..., r$, $\gamma_i = 0$ for all $i>r$, and $r \leq p$. Following any modelling procedure, it is a good idea to assess the validity of the model.

Residuals and diagnostic statistics allow us to identify patterns that are either poorly fit by the model, have a strong influence upon the estimated parameters, or which have a high leverage.

This diagnostic check consists of: (1) testing serial correlation in residuals (H_0*: there is no serial correlation in the residuals*); (2) examining the existence of ARCH effects in residuals (H_0*: there is no ARCH effect in the residuals*) and finally (3) examining the normality of the residuals (H_0*: the residuals are normally distributed*).

3.2. Methodology and data

As a representative of the CEE region, we used the following stock traded indices from the CEE region: SASX-10 and BIRS (Bosnia and Herzegovina), SOFIX (Bulgaria), CROBEX (Croatia), PX (Czech Republic), BUX (Hungary), MBI10 (FYR Macedonia), MONEX20 (Montenegro), WIG20 (Poland), BET (Romania), BELEX15 (Serbia), SAX (Slovakia) and SBITOP (Slovenia).

According to MSCI[2] Inc. (2013), the capital markets of Bulgaria, Croatia, Serbia, Slovenia and Romania are classified as *frontier* markets. The Czech Republic, Hungary and Poland are included in *emerging* markets. According to this source, Bosnia and Herzegovina is included among the so called *standalone* markets. FYR Macedonia, Slovakia and Montenegro are not classified by the MSCI.

Furthermore, FTSE[3] Int. (2014) classifies the capital markets of Bulgaria, Croatia, Romania, Serbia, Slovak Republic and Slovenia as frontier markets. According to FTSE quality[4] of markets criteria, the capital markets of Czech Republic, Hungary and Poland are classified as emerging markets. Bosnia and Herzegovina, FYR Macedonia, Slovakia and Montenegro are not classified by the FTSE Int.

It is now well-known that emerging and frontier capital markets have vastly different characteristics than developed capital markets. According to Geert and Campbell (1997) there are at least four distinguishing features of emerging and frontier market returns: average returns are higher, correlations with developed market returns are low, returns are more predictable and volatility is higher.

When it comes to our research design, first, we will have to transform price series into return series. So, if we denote successive index value observations made at time t and t+1 as I_t and I_{t+1}, respectively, then continuous compounding transforms a price series $\{I_t\}$ into a return series $\{r_t\}$ as:

$$r_t = \ln \frac{I_t}{I_{t-1}}. \quad (8)$$

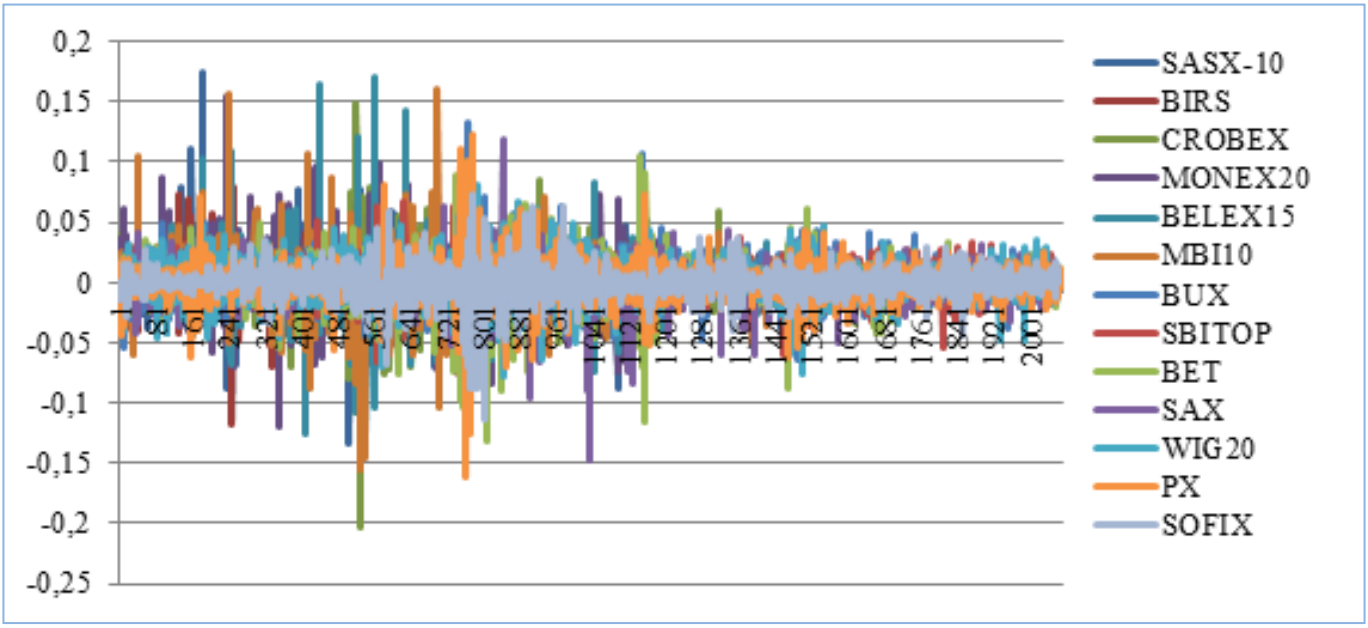
After this, research shall be conducted in the following four stages: (1) identifying and estimating an econometric ARIMA model for a mean equation; (2) using the residuals of the mean equation to test for ARCH effects; (3) specifying and estimating a volatility model (if ARCH effects are statistically significant) and (4) performing residual diagnostics.

4. EMPIRICAL RESULTS AND DISCUSSION

According to the previously explained research design, in this section we will present relevant results. First we will give a comparative illustration of daily index returns (Figure 1). Real financial time series for all stocks observed in this paper were retrieved from Yahoo! Finance Worldwide (2014). The period is from October 2005[5] to December 2013.

Preliminary investigation identified the following mean equation models as appropriate models to start with: ARIMA(1,1,1) for BELEX15, ARIMA(0,0,1) for BET, ARIMA(1,1,1) for BIRS, ARIMA(2,2,1) for BUX,

Figure 1 A comparative illustration of daily index returns



Source: Author's illustration

ARIMA(1,0,0) for CROBEX,ARIMA(2,2,1) for MBI10, ARIMA(1,0,0) for MONEX20, ARIMA(2,0,0) for PX, ARIMA(1,0,0) for SASX-10, ARIMA(1,0,0) for SAX, ARIMA(1,0,0) for SBITOP, ARIMA(2,0,0) for SOFIX, and ARIMA(0,0,1) for WIG20.

This investigation and lag length selection was based on the Akaike information criteria (*AIC*), significance of the model parameters and post-estimation tests such as Ljung-Box test for model residuals and squared residuals.

The Ljung-Box statistics LB(36) and $LB^2(36)$ for the returns and squared returns series respectively, are highly significant. Therefore, we reject the hypothesis that there is no autocorrelation in the level of returns and squared returns. The LB(36) test result could be interpreted as an indicator of market efficiency. According to Brigham (1992), a body of efficient market hypotheses (EMH) holds: (1) that stocks are always in equilibrium and (2) that it is impossible for an investor to consistently beat the market. According to the EMH, fair price is represented by current market price. EMH also represents a way of evaluating market (in) efficiency, meaning that an investor in an efficient market should not expect earnings above the market return while using technical analysis or fundamental analysis. EMH is a very attractive approach in that it gives a kind of guarantee that trading will be done at the price that is considered to be fair. Depending on the information set involved there are three forms of the EMH: (1) weak-form efficiency, (2) semi strong-form efficiency, (3) strong-form efficiency. Weak-form efficiency assumes that all historical information is incorporated into the market stock price. Semi strong-form efficiency assumes that, beside all historical information, stock market price also reflects expectations about a company. Strong-form efficiency is based on the assumption that market stock prices reflect not only historical and expected, but also insider information. What this means is that in an efficient market excess return will equal zero even with insider information.

According to the obtained results of the LB(36) test, selected stock markets from the CEE region are weak-form inefficient, since there is a strong chance that investors could use historical data to beat the market, i.e. earn above average gains.

Furthermore, the $LB^2(36)$ test result suggests significant autocorrelation in the squared returns series. In other words, the GARCH effect, i.e. time-varying second moment has been detected in returns series. Thus the use of GARCH-type models for the conditional variance is justified. Since we found statistically significant ARCH effects we performed a joint estimation of the mean and volatility equations.

In the preliminary analysis, for each index, we estimated symmetric and asymmetric GARCH models, i.e.: GARCH, IGARCH, EGARCH, GJR and PGARCH.

Preliminary investigation identified the following volatility equation models as appropriate models to start with: PARCH(1,1) for BELEX15, TARCH(1,1) for BET, EGARCH(1,1) for BIRS, PARCH(1,1) for BUX, PARCH(1,1) for CROBEX, GARCH(1,1) for MBI10, EGARCH(1,1) for MONEX20, TARCH(1,1) for PX, EGARCH(1,1) for SASX-10, PARCH(1,1) for SAX, TARCH(1,1) for SBITOP, TARCH(1,1) for SOFIX and EGARCH(1,1) for WIG20. This investigation was based on the *AIC*, the significance of the model parameters and the diagnostic check which consisted of: testing serial correlation in residuals, examining the existence of ARCH effects in residuals and finally examining the normality of the residuals. Table 1 presents the estimation results for the mean and variance equations.

Furthermore, we estimated the parameters and test their significance in the case of the mean and volatility equation as well. In the variance equation the first three coefficients: ω, α and β are highly significant at the conventional significance level. There is a high persistence of shocks in the volatility. This persistence is measured in the GARCH case by the sum α of β and is in each case close to 1. The coefficient γ is significant at the 5% level in all models, which means that a leverage effect does exist (negative shocks increase the volatility more than positive shocks).

However, in contrast to the results found for most other markets, the leverage effect term has an unexpected negative sign the in cases of BIRS, MONEX20, SASX-10 and WIG20. For stock returns, the parameter is usually estimated to be positive; in this case, it reflects the leverage effect, signifying that negative returns increase future volatility by a larger amount than positive returns of the same magnitude.

The present findings seem to be consistent with the research conducted by Kovačić (2007). Furthermore, a Ljung-Box test was used to check for any remaining autocorrelations in standardized and squared standardized residuals from the estimated variance equation. Since these two statistics were not significant, we conclude that the variance equation is specified correctly. Remaining ARCH effects were not detected in the standardized residuals. Table 2 presents the results of the ARCH test.

Finally, when it comes to examining the normality of the residuals, we rejected the null hypothesis of normally distributed errors. This isn't something that is desirable when it comes to the diagnostic check of the model, but the model has no serial correlation, and no ARCH effect. This is an important issue for future research.

Table 1 Estimation results for the mean and variance equations

Indices	*Parameters*								
	Mean equation				*Variance equation*				
	φ_0	φ_1	φ_2	η_1	ω	α	β	γ	δ
BELEX15	*1,40E-05***	*2,20E-01***	-	*-9,80E-01***	*0,009***	*0,158***	*0,848***	*0,069***	*0,253***
BET	*4,20E-04*	-	-	*8,60E-02***	*0,000***	*0,194***	*0,763***	*0,074**	-
BIRS	*2,80E-06*	*9,60E-02***	-	*-9,80E-01***	*-0,235***	*0,167***	*0,987***	*-0,014**	-
BUX	*-2,10E-07*	*-6,30E-01***	*-3,40E-01***	*-1,00E+06***	*0*	*0,121***	*0,875***	*0,408***	*1,363***
CROBEX	*4,00E-05*	*1,30E-01***	-	-	*0*	*0,136***	*0,884***	*0,168***	*1,589***
MBI10	*-2,80E-07*	*-4,30E-01***	*-2,20E-01***	*-1,00E+00***	*0,000***	*0,284***	*0,651***	-	-
MONEX20	*-1,20E-04*	*1,70E-01***	-	-	*-0,312***	*0,228***	*0,981***	*-0,026***	-
PX	*9,20E-05*	*3,80E-02*	*-4,60E-02*	-	*0,000***	*0,088***	*0,836***	*0,099***	-
SASX-10	*-3,80E-04*	*1,50E-01***	-	-	*-0,240***	*0,192***	*0,987***	*-0,025***	-
SAX	*-2,60E-04*	*-1,20E-01***	-	-	*0,000**	*0,017***	*0,969***	*0,126***	*2,364***
SBITOP	*3,90E-05*	*1,90E-01***	-	-	*0,000***	*0,199***	*0,697***	*0,097***	-
SOFIX	*1,70E-04*	*1,10E-01***	*5,70E-02**	-	*0,000***	*0,243***	*0,696***	*0,096***	-
WIG20	*4,00E-05*	-	-	*2,40E-02*	*-0,217***	*0,133***	*0,987***	*-0,068***	-

Notes: ** denotes statistical significance at 1% level; * denotes statistical significance at 5% level. Estimations are carried out by EViews econometric software

Table 2 Heteroskedasticity Test: ARCH

Index	*F-statistic*	*R-squared*	*Prob. F*	*Prob. Chi-Square*
BELEX15	*2,472*	*2,471*	*0,116*	*0,116*
BET	*3,594*	*3,591*	*0,058*	*0,058*
BIRS	*3,366*	*3,363*	*0,067*	*0,067*
BUX	*0,036*	*0,036*	*0,849*	*0,849*
CROBEX	*0,652*	*0,653*	*0,419*	*0,419*
MBI10	*1,537*	*1,537*	*0,215*	*0,215*
MONEX20	*2,575*	*2,574*	*0,109*	*0,109*
PX	*0,467*	*0,467*	*0,494*	*0,494*
SASX-10	*0,044*	*0,044*	*0,833*	*0,833*
SAX	*0,023*	*0,023*	*0,879*	*0,879*
SBITOP	*0,201*	*0,201*	*0,654*	*0,654*
SOFIX	*0,020*	*0,020*	*0,887*	*0,887*
WIG20	*2,375*	*2,374*	*0,124*	*0,123*

Contrary to the findings of Shin (2005), Shields (1997), Murinde and Poshakwale (2001) and Kasch-Haroutounian and Price (2001) the estimation results revealed that the selected returns of the stock indices from Central and Eastern Europe could be much better characterized using asymmetric models. The present findings seem to be consistent with the research conducted by Alberg, Shalit and Yosef (2008), Égert and Koubaa (2004), Patev and Kanaryan (2003) and Bhaskar (2012).

In other words, the selected stock markets of transition economies exhibit asymmetry because negative shocks hit these markets much harder than positive news. As Égert and Koubaa (2004) have already pointed out, this corroborates the usual observation that emerging stock markets may collapse much more suddenly and recover more slowly than developed stock markets.

5. CONCLUSION

On the basis of the theoretical inferences and empirical evidence presented in this paper, it seems fair to suggest that ARIMA and GARCH processes provide parsimonious approximations of mean and volatility dynamics in the case of stock markets from the CEE region. The findings of this study suggest the existence of a leverage effect, meaning that in the case of stock markets from the CEE region negative shocks increase

the volatility more than positive shocks.

Furthermore, we found evidence of stock market information inefficiency, since there is a strong chance that investors could use historical data to earn above average gains. Although further work is required to gain a more complete understanding of the relationship between stock returns and volatility in the CEE region, the main practical consequence of the results presented in this paper is that they could be a good starting point in decision making for those who are planning to invest in stock markets from the CEE region.

Since the nature of the return-volatility relationship is fundamental to the formulation of the concept of risk in various financial models, further research should shed some more light on the contemporary theoretical, methodological and applicative approaches for using these models when shaping investment strategy.

REFERENCES

Ajayi, R. A., Mehdian, S. & Perry, M. J. 2004.The Day-of-the-Week Effect in Stock Returns: Further Evidence from Eastern European Emerging Markets. *Emerging Markets Finance and Trade* 40(4): 53-62.

Alberg, D., Shalit, H. & Yosef, R. 2008.Estimating Stock Market Volatility Using Asymmetric GARCH Models. *Applied Financial Economics* 18(15): 1201–1208

Bhaskar, S. 2012. Determining Historical Volatility in Emerging Markets Using Advanced GARCH Models. *Social Science Research Network*, advance online publication September 3. http://dx.doi.org/10.2139/ssrn.2140647

Black, F. (1976). Studies of stock price volatility changes. Proceedings of the 1976 Meeting of the Business and Economic Statistics Section, American Statistical Association, Washington, D.C.

Bollerslev, T. 1986. Generalized Autoregressive Conditional Heteroskedasticity. *Journal of Econometrics* 31(3): 307-327

Bollerslev, T., Engle, R. F. & Nelson, D. 1994. ARCH models. In: R. F. Engle & D.L. McFadden (Ed.) 1994. *Handbook of Econometrics*. Elsevier Science, Vol. IV

Brigham, E.F. 1992. *Fundamentals of Financial Management,* 6th Ed., Fort Worth: The Dryden Press

Brooks, C. 2008. *Introductory Econometrics for Finance*. Cambridge: Cambridge University Press.

Égert, B. & Koubaa, Y. 2004. Modelling Stock Returns in the G-7 and in Selected CEE Economies: A Non-Linear GARCH Approach. William Davidson Institute Working Paper No. 663. *Social Science Research Network*, advance online publication September 3. http://dx.doi.org/10.2139/ssrn.512862

Engle, R. 2001. GARCH 101: The Use of ARCH/GARCH Models in Applied Econometrics. *Journal of Economic Perspectives* 15(4): 157–168.

Engle, R. F. & Ng, V. K. 1993. Measuring and Testing the Impact of News on Volatility. *The Journal of Finance* 48(5): 1749-1778.

Engle, R. F. 1982. Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation. *Econometrica* 50(4): 987-1007.

FTSE International Limited. 2014. *FTSE Quality of Markets Criteria (EUROPE Frontier) as at March 2014.* London: FTSE International Limited

Geert, B. & Campbell, H. R. 1997.Emerging Equity Market Volatility, *Journal of Financial Economics* 43(1): 29-77.

Gokcan, S. 2000. Forecasting Volatility of Emerging Stock Markets: Linear Versus Non-linear GARCH Models. *Journal of Forecasting* 19: 499–504.

IHS Global Inc. 2013. *EViews 8 User's Guide II*. Irvine: IHS Global Inc.

Kasch-Haroutounian, M. & Price, S. 2001. Volatility in the transition markets of Central Europe. *Applied Financial Economics* 11: 93-105.

Kovačić, Z. 2007. Forecasting volatility: Evidence From the Macedonian Stock Exchange. *MPRA Paper No. 5319*, advance online publication October 24. http://mpra.ub.uni-muenchen.de/5319/

MSCI Inc. 2013.*The 2013 MSCI Global Market Accessibility Review*. New York: MSCI Inc.

Murinde, V. & Poshakwale, S. 2001. Volatility in the Emerging Stock Markets in Central and Eastern Europe: Evidence on Croatia, Czech Republic, Hungary, Poland, Russia and Slovakia. *European Research Studies* IV(3-4): 73-101.

Patev, P. G. & Kanaryan, N. K. 2003. Modelling and Forecasting the Volatility of the Central European Stock Market. *Social Science Research Network*, advance online publication http://dx.doi.org/10.2139/ssrn.518463

Sandoval, J. 2006. Do Asymmetric GARCH Models Fit Better Exchange Rate Volatilities on Emerging Markets? *ODEON – Observatorio de Economía y Operaciones Numéricas*. 3: 97-116.

Shields, K. K. 1997. Threshold modelling of stock return volatility on Eastern European markets. *Economics of Planning* 30(2-3):107-125.

Shin, J. 2005. Stock returns and volatility in emerging stock market. *International Journal of Business and Economics* 4(1): 31-43.

Worthington, A. & Higgs, H. 2004. Transmission of Equity Returns and Volatility In Asian Developed And Emerging Markets: A Multivariate GARCH Analysis. *International Journal of Finance and Economics* 9(1): 71-80

Yahoo! Finance Worldwide. 2014. *Market Performance*. Retrieved 31 January 2014, from http://finance.yahoo.com/market-overview/

(Endnotes)

[1] This common property refers to the fact that volatility of returns has various effects on positive and negative shocks.

[2] The MSCI market classification framework consists of following three criteria: economic development, size and liquidity as well as market accessibility. The MSCI Inc. (2013) provides an evaluation of the four market accessibility criteria, which are: (1) openness to foreign ownership; (2) ease of capital inflows/outflows; (3) efficiency of the operational framework and (4) stability of the institutional framework.

[3] FTSE Group (FTSE) is a global leader in indexing and analytic solutions. FTSE calculates thousands of unique indices that measure and benchmark markets and asset classes in more than 80 countries around the world. FTSE is wholly owned by London Stock Exchange Group.

[4] According to the FTSE Int. (2014) criteria for evaluating quality of market are: (1) the quality of regulation; (2) the dealing landscape; (3) custody and settlement procedures, and (4) the presence of a derivatives market would all be taken into account.

[5] In order to keep the data consistency we used October 2005 as a starting point while the base date for BELEX-15 was 1st October, 2005.

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MANAGEMENT INNOVATION – DESIGNING AND TESTING A THEORETICAL MODEL

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Abstract

Management innovation – the introduction of management processes, structures and practices that are new to companies, is crucial to business success. Based on the existing literature on management innovation and a rigorous theoretical approach to model design and development, a theoretical model of management innovation that is applicable to immature and underdeveloped markets was designed. Using this model, the study shows that the context in which companies operate, as well as companies' management background (proficiency), are directly and positively related to management innovation. The main implication of the research is that the existing management innovation theory is applicable to market conditions in the Federation of Bosnia and Herzegovina with only slight adaptation. Furthermore, this research provides important insights about the factors that affect the companies' readiness to introduce innovative management structures, processes and practices.

Keywords: *Management innovation, Immature markets, Managerial proficiency, Models*

JEL classification: *M100 – Business Administration: General*

1. INTRODUCTION

One of the most recent research topics in the field of management and business administration is management innovation – the introduction of management processes, structures and practices that are new to the companies. Even though management innovation is crucial to business success, most organizations focus their innovation efforts on perfecting operational and product innovations. The same odd situation can be found within academia, where scientific and professional works on technological innovation outnumber those on management innovation more than 100-fold (Hamel 2007). Such a situation initiated Hamel, Birkinshaw and Mol to open a new and broad research area (Birkinshaw *et al.* 2005).

There were some studies on management innovation (Abrahamson 1996; Damanpour 1987, 1991; Gruber & Niles 1972, 1974; Kimberly 1981) before Hamel and others initiated their theory, but after these initial studies a number of works on this topic emerged (e.g. Hindle 2008; Birkinshaw & Mol 2006; Vaccaro *et al.* 2009, 2012), among which those that are especially

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important are works by Fariborz Damanpour (e.g. Damanpour & Aravind 2012; Damanpour 2014). Most of these previous studies primarily explored the nature and causes of management innovation, as well as who the main actors are in management innovation processes.

Studies that analyze the management innovation process at the organizational level are quite rare and recent (e.g. Mol & Birkinshaw 2009b; Walker *et al.* 2011; Černe *et al.* 2013). Authors of these studies strove to reveal the causes and/or effects of the management innovation process at an organizational level, and they identified a lack of such research work as a major gap in the existing literature

This study built on these previous research and sought to further reduce the identified gap in the literature. We were primarily interested in a general picture of the management innovation phenomenon. More precisely, we were interested in the global situation that influences and encompasses management innovations implementation at the company level. That leads to the first research question of this study:

Q1: What are the main situational factors that determine companies' operational setting, and that have an important and significant influence on management innovation implementation processes?

During our research work on the topic, we realized that all noteworthy management innovations were invented and subsequently described by the professionals, companies and scholars from the most developed countries of modern world. That fact leads to the second research question of this study:

Q2: Is the existing theory and practice of management innovation adaptable and applicable to the conditions of the immature and underdeveloped market of the Federation of Bosnia and Herzegovina?

Furthermore, it was only until recently that one could find literature about management innovation that is related to transitional and developing economies (García-Zamora *et al.* 2013; Wu *et al.* 2008), especially studies from the region of South-East Europe, with the exception of a few studies from Slovenia (Černe *et al.* 2013; Ursič & Mulej, 2005). Consequently, each study on this topic significantly contributes to the body of literature on management innovation.

In this study we wanted to design an overall theoretical model of management innovation founded on the existing literature. That model had to be simple and empirically verifiable. In addition, we wanted to adapt that model in such way that it could be applied to any market conditions and particularly to those of the Federation of Bosnia and Herzegovina (F B&H). Finally, we wanted to have a model that is fully open for modifications and applicable for future research.

2. LITERATURE REVIEW

Early works related to management innovation could be found in the 1970s and later on (e.g. Abrahamson 1991, 1996; Gruber & Niles 1972, 1974; Teece 1980) but it was not until very recently that one could find more works on that topic (e.g. Hervás-Oliver & Peris-Ortiz 2014; Hindle 2008; Walker *et al.* 2011; Hollen *et al.* 2013). Furthermore, all of these research activities provide few insights about how to improve management innovation capacity or about the true origins of management innovation (Birkinshaw *et al.* 2005, 2008).

In addition, the most important management innovations came from truly innovative business organizations (Hamel 2006) but the same absence of interest in the process of management innovation could be found among the practitioners of management. Even though some authors argued that a lack of management innovation is the most serious problem for competitiveness (Stata 1989, 2002) a systematic approach to the process of management innovation could not be noted within companies in general (Birkinshaw *et al.* 2005).

2.1. Management Innovation – The Theory Foundation

Based on Abrahamson's "Management fashion" theory (Abrahamson 1991, 1996; Abrahamson & Fairchild 1999) Birkinshaw, Hamel and Mol have developed their management innovation theory. Pursuant to the title of Hamel's HBR article (Hamel 2006) they focused their interest on three questions – the "why", "what" and "how" of management innovation.

In his book, *The Future of Management* (2007), Hamel challenges the mere concept of today's management and explains the reasons why management should be reinvented. First, modern management resides on premises that were laid down at the beginning of the 20th century and are based on centralized control and high efficiency. Hamel argues that such management practices are not adequate for 21st century companies and, consequently, a completely new management paradigm should be invented (Hamel 2007, 2009). Another argument that he poses is that management innovations can create a powerful and long-standing competitive advantage that cannot be surpassed by any other kind of innovation (Hamel

2006). Similarly, Birkinshaw argues that the basic purpose of management has been corrupted over the years. He suggests that managers should seek smarter choices about how the work gets done in order to improve management in the future (Birkinshaw 2010).

Regarding the "what" question, above all a comprehensive and clear definition of the term "management innovation" should be established. This research treats management innovation as: "*the implementation of management practices that are new to the firm and intended to enhance firm performance (2009b: 1269)*" (Mol & Birkinshaw 2009b).

There are four critical elements in this definition that profoundly explain the concept of management innovation and that should be emphasized. First, the term "management practices" implies all possible managerial activities that managers undertake in their work (Hamel 2006). Second, it clearly states the level of novelty of those activities – they do not have to be new to the world but only to the adopting organization (e.g. McCabe 2002; Yang *et al.* 2007). Third, management innovation assumes the implementation of those activities inside the real world organization and not the development of a scientific idea (Birkinshaw *et al.* 2008). Finally, the fourth element, the intention to further the organization's goals, expresses the primary reason why organizations undertake management innovation at all and accept all the risk that such a process brings about (Birkinshaw *et al.* 2005).

The processes of management innovation or how management innovations occur on the operational level represent the third pillar of management innovation theory. Earlier literature on management innovation explains the reasons why and how some management innovations are accepted and diffused (Abrahamson 1991, 1996). On the other hand, it does not provide any details on how those innovations happen on the operational level. For that purpose, Birkinshaw, Hamel and Mol (2008) have developed a framework that describes the management innovation process. According to this framework, there are four interlinked phases of the process (*motivation*, *invention*, *implementation* and *theorization and labeling*) and two key players (*internal change agents* and *external change agents*). The authors of this framework further explain that innovation emerges through a complex sequence of identified phases in which two groups of agents mutually interact through ten core innovation activities.

2.2. Management Innovation – The Model

Most of the management innovation literature is focused on high level understanding of the management innovation phenomenon (Kimberly 1981; Abrahamson 1996; Birkinshaw *et al.* 2005, 2008; Hamel 2006, 2012). There is also plenty of research work on specific aspects of management innovation implementation (Kossek 1987; Nickell *et al.* 2001; McCabe 2002; Hargrave & Van de Ven 2006) and some research work about the effects of management innovations on the adopting organizations (Biagi *et al.* 2008; Bryson *et al.* 2009). At the same time, management innovation research work on the company level is quite rare. Because of that fact, we have focused our research effort on building a theoretical model of management innovation, which links management innovation and the situational factors of the organization.

Similar reasons have led Mol and Birkinshaw to conduct research on the relationship between the context in which organizations operate and the organizations' search for knowledge sources and management innovation (Mol & Birkinshaw 2009b). They have conducted empirical research based on the UK Community Innovation Survey (CIS3 and CIS4) in order to find out what explains management innovation best (Mol & Birkinshaw 2009a). Likewise, Hecker and Ganter (2013) have used the German Community Innovation Survey (CIS IV) to empirically validate the relationship between competition, as an indicator of industry dynamics, and a company's inclination to innovate.

According to these research activities, the context, defined as a set of organizational attributes (Mol & Birkinshaw 2009b), represents an important determinant of management innovation. Thus we propose our first hypothesis as:

H1: Organizational context has a direct and positive impact on management innovation.

Some studies have discussed the interaction between management innovation and the different constituents of an organization (Nguyen & Mothe 2008; Vaccaro *et al.* 2009; Kunz & Linder 2011). Nguyen and Mothe (2008) looked into the impact of organizational innovation (defined as the changes in management practices, production approaches and external relations) on a company's aptitude to innovate, and found a direct and positive relationship between the two. Here, innovation is considered in accordance with Damanpour's (1992) definition of innovation. On the other hand, Kimberly and Evanisco (1981), who later in his works confirms Damanpour (1987, 1991), have found that functional differentiation is positively associated with the acceptance of administrative innovations.

Assuming that a positive relation between the two types of innovation works two-ways, and as structural

changes usually accompany technical (and technological) innovations, we submit the second hypothesis as:

H2: Production and structural innovation has a direct and positive impact on management innovation.

Here the term "production innovation" relates to the product (service) innovation as well as the production (service) process innovation.

The authors of the previously mentioned studies on management innovation have found a positive link between management innovations and characteristics of the top management team (Vaccaro *et al.* 2009, 2012) as well as the personal traits of employees (Kunz & Linder 2011). Similarly, some studies have found that employee education level is positively related to management innovation (Mol and Birkinshaw 2009b), as well as the ability of the employees to exchange existing knowledge (Černe *et al.* 2013). Furthermore, management innovation theory points to internal change agents (Birkinshaw *et al.* 2008; Mol and Birkinshaw 2014) as a group of key players who carry out the management innovation process. Thus, in accordance with all of these findings we propose the following hypothesis:

H3: The organization's management proficiency has a direct and positive impact on management innovation.

Under the term "management proficiency" we imply management team diversity (Vaccaro *et al.* 2009), the management (organizational) learning system (formal and experience-based learning system) as well as management expert foundation. It relates to overall management expertise, existing and potential, that the company possesses. Bearing in mind this elaboration, the following hypothesis is offered:

H4: The organization's management proficiency has a direct and positive impact on production and structural innovation.

These four hypotheses determine our management innovation theoretical (conceptual) model, which is graphically presented in Figure 1.

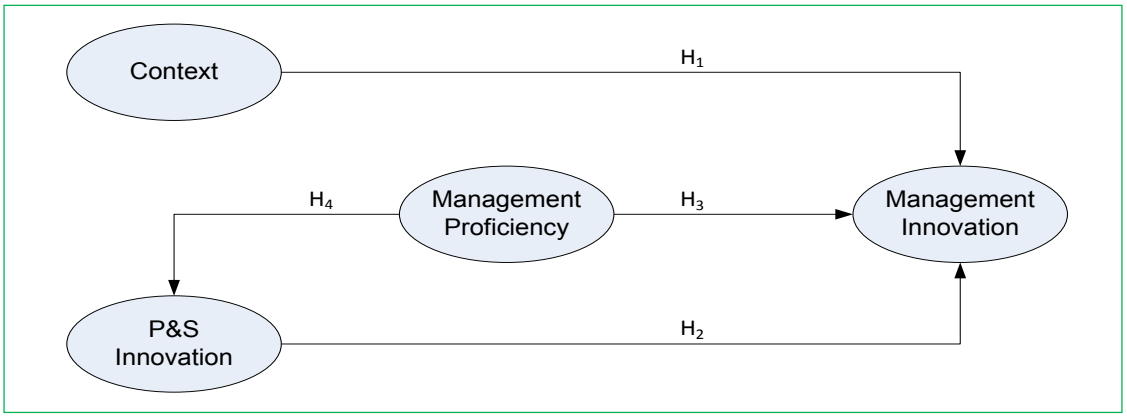
2.3. Management Innovation – Market Status in Bosnia and Herzegovina

Bosnia and Herzegovina, a country located in Southeastern Europe (SEE), is a small open economy whose GDP represents 0.035% of world GDP and whose population represents 0.048% of the world's population (Čaušević 2012). During the devastating war from 1992 to 1995, industrial production and GDP plummeted by almost 80%, but from 1996 to 2007 Bosnia and Herzegovina recorded substantial economic growth (average GDP growth rate was 11,2%), which at the time represented the 17th fastest growing economy in the world. During the global economic crisis this growth was significantly slowed down to around 1% (Čaušević 2012).

With its GDP per capita of 4,675 US$ (the Central Bank of Bosnia and Herzegovina 2014), Bosnia and Herzegovina belongs to the group of developing countries. According to the *Doing Business 2015* report, Bosnia and Herzegovina is ranked 107th, which is the lowest rank in the SEE region and far below the regional average (World Bank 2014). Considering its main economic indicators as well as the general business climate, Bosnia and Herzegovina lags far behind most developed countries.

Last but not least, inefficient administration, government instability and the tax burden are probably the biggest obstacles to faster economic development and a better business climate. Taken all together,

Figure 1. Conceptual model of management innovation



these facts yield market conditions in (Federation) Bosnia and Herzegovina that are significantly different from those of the most developed countries.

All the foregoing references to the theoretical foundations of management innovation originate from the most developed countries of the world. However, the applicability of these theoretical and practical propositions to the countries of the developing world is of great importance. It is often assumed that something accepted in the most developed countries is globally applicable as a "best practice" irrespective of local circumstances (Blunt 2002). However, recent studies show that the best management practices do not necessarily work under different conditions (Khanna 2014). Furthermore, there is a tendency to object when theory and practice differ, and, consequently, there are few research works on the subject of the modification of management innovation (Mamman 2009).

For all of these reasons, one of the most important goals of this research is to adapt the existing knowledge base in order to design and test a theoretical model of management innovation that is applicable to immature and underdeveloped markets, such as the market of the F B&H.

3. DATA AND METHODOLOGY

In the spirit of good research (McGrath 1981) we used a sequential mixed-method research in order to obtain a high level of results credibility. The first part of the research makes up an exploratory qualitative study aimed at providing a deeper understanding of management innovation processes in the circumstances of the immature and underdeveloped market of the F B&H. The second part of the research makes up a quantitative study aiming to confirm the findings and test the proposed hypotheses.

3.1. The Qualitative Study

The qualitative part of our research consists of 14 semi-structured interviews that were conducted with 14 participants selected from within three broad groups: academia, top-management and the business consultant community. We used the maximum-variation sampling scheme in order to obtain multiple perspectives from the participants (Onwuegbuzie & Leech 2007), where professional background was the main participant selection determinant.

Regarding the sample size, we followed a general rule stating that the sample should be big enough to enable data saturation but not too big to prevent a deep analysis of the collected data. There are many practical recommendations regarding the sample size (Onwuegbuzie & Leech 2007; Guest *et al.* 2006) but the most usual recommendation is 12 – 20 interviews. We found that the data saturation occurs after 10th interviewee, but to be on the safe side we have decided to have at least four participants per group. Thus, we conducted 14 interviews.

The interviews consisted of 14 to 16 questions, with each question introducing a particular topic that the interviewees were asked to comment on. In order to reduce any bias in answers or a propensity to answer in favor of the research subject less than half of the interview questions/topics were directly related to management innovations.

The procedure we used to analyze the collected data is known as *subsequent content analysis* (Srnka & Koeszegi 2007), which represents an integrated qualitative-quantitative research method. We used integral thoughts as data units that are numerically coded in accordance with the category scheme, which consists of 12 main categories, with up to two subcategories, resulting in a total of 16 categories. These 12 main categories are compacted into four super-categories.

Due to the abundance of the collected data, the unitization was done jointly by two of us, so we finally obtain 969 thought units. The coding of the obtained thought units was done independently by two coders. For each interview question/topic ("*Q*") one to three generic answers ("*GA*") were offered. Thereafter, coders had to assign a category and, if applicable, a corresponding subcategory to each thought unit. This category assignment was based on the coder's conception of the relation between the generic answers and thought units.

Using the Cohen's kappa for checking the coding consistency between the two coders (Wood 2007) we have yielded an inter-rater reliability coefficient over the super-category "*Attitude*" of $\kappa = 0.88$. It is generally considered that *kappa* values over 0.8 are a very good result (Srnka & Koeszegi 2007). Thus, we have concluded that we have an almost 100% agreement between the coders and that we could use any coding (from any of the two coders).

The results of the data analysis are shown in Table 1. Since the chosen procedure provides a quantification of qualitative data, it was easy to conduct a frequency analysis of the derived quantitative data. Thus, we agreed that if more than two thirds of the respondents had the same opinion about a particular topic then we could consider that opinion a general stand toward the generic answer. Accordingly, we set the separation threshold at 70%.

Table 1. Topics Directly Related to Management Innovation

Question (Q) / Generic Answer (GA)	Opinion ratio		
	Affirmative	**Negative**	**Neutral**
Q: What is the effect of the actual economic conditions on management innovation?			
GA: Direct and negative effect.	64.3%	35.7%	0.0%
Q: What is the effect of the organization's management structure on management innovation?			
GA: Direct and positive effect.	92.9%	0.0%	7.1%
Q: What are the effects of the environmental particularities on implementation of management theories and practices in the Bosnia and Herzegovina?			
GA: There are no specific effects.	64.3%	28.6%	7.1%
Q: What are the effects of the organization's situational factors on management innovation?			
GA: Age – direct and negative effect.	91.7%	0.0%	8.3%
GA: Size – direct and negative effect.	80.0%	0.0%	20.0%
GA: State ownership – direct and negative effect.	85.7%	0.0%	14.3%
Q: What is the effect of employees' education on management innovation?			
GA: Direct and positive effect.	92.3%	0.0%	7.7%
Q: What is the effect of industry dynamics on management innovation?			
GA: Direct and positive effect.	85.7%	0.0%	14.3%
Q: What is the effect of market scope on management innovation?			
GA: Direct and positive effect.	92.3%	0.0%	7.7%

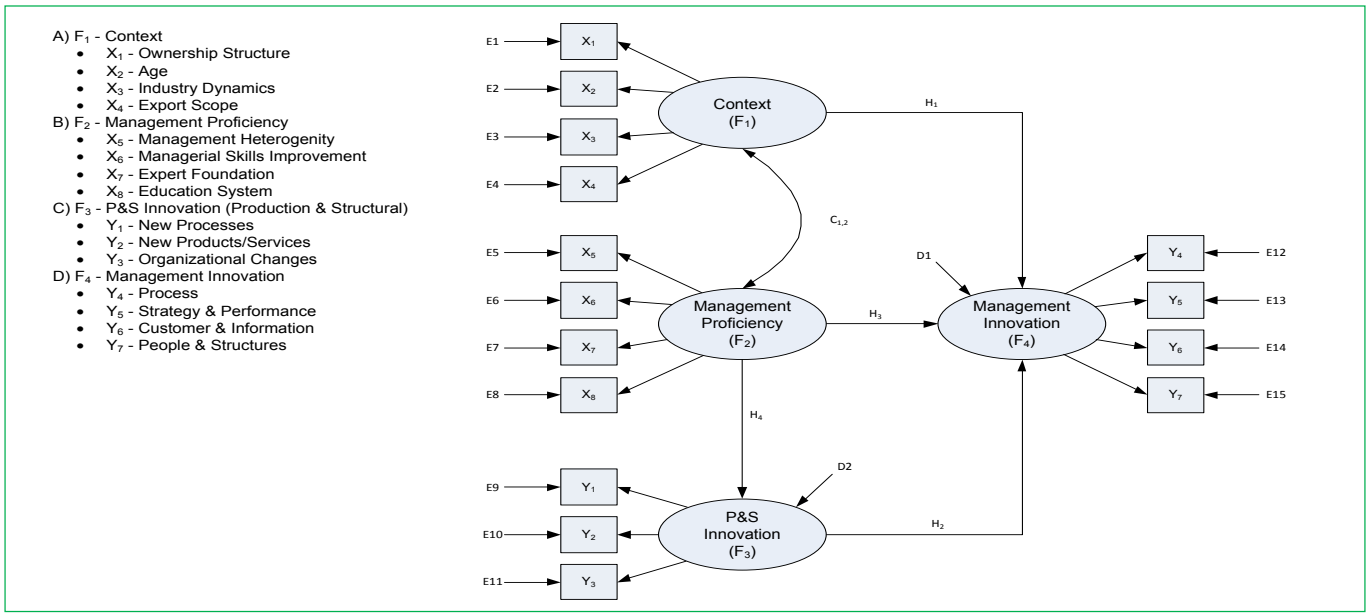
It can be seen in Table 1 that all generic answers are confirmed except for two topics. Particularly interesting is the third listed topic in Table 1. It shows that there is a notable divergence in opinions related to the applicability of management theories and practices within the emerging market of Bosnia and Herzegovina, which is a very important issue for this research.

Combining the theoretical background represented through the proposed hypotheses with the results of this qualitative research we have designed a theoretical (empirical) model of management innovation that is adapted to comply with the immature and underdeveloped market conditions of F B&H. The model is shown in Figure 2.

3.2. The Quantitative Study

To test the hypothesized model we conducted a survey among the companies that are registered in the

Figure 2. Empirical model of management innovation



F B&H. The questionnaire was sent to 310 companies that were randomly chosen from the whole population of the companies that comply with the following profile:
- employing at least 20 people
- established in 2001 or earlier
- not belonging to the financial, health care, social welfare, educational or public sectors.

We received 186 responses (60%), out of which 160 were valid (51.61%). The responding companies had an average size of 180.2 (S.D. 358) employees and an average age of 16.5 (S.D. 4) years. The estimated population of the companies that comply with the described profile is 1400, so the expected statistical error is around 7% with a confidence level of 95%.

3.2.1. Measures

All variables in the model were measured using data from the conducted survey and from the official balance reports of the corresponding companies. The measurement spans the five-year period from 2006 to 2010.

3.2.1.1. Context (F_1)

This construct is related to the context in which the companies operate. We used a four-indicator measure for this construct:
- "*Ownership Structure*" (X_1) – ranks (state ownership – rank 1; 100% foreign capital – rank 8) companies based on the ownership type and foreign capital share.
- "*Age*" (X_2) – ranks (youngest – rank 1; oldest – rank 8) companies based on their life span from the year of incorporation to the year 2011.
- "*Industry Dynamics*" (X_3) – ranks (least dynamic – rank 1; most dynamic – rank 4) companies based on the dynamics of the industry sector to which they belong.
- "*Export Scope*" (X_4) – ranks companies based on a ratio of exporting revenue to total revenue (< 5% – rank 1; 5-30% – rank 2; >30% – rank 3).

3.2.1.2. Management Proficiency (F_2)

This construct is related to the managerial potential that the company has both within its management team and non-managerial staff. We used a four-indicator measure for this construct:
- "*Management Heterogeneity*" (X_5) – ranks (1-6) companies based on the number of top-managers and their experience in different functional areas, controlling for the size of the company (determined by the number of employees). The lowest ranked companies (rank 1) are those with the smallest number of top-managers with the same profession, and companies with an optimal number of top-managers with different professions have the highest rank (6).
- "*Managerial Skills Improvement*" (X_6) – ranks companies based on whether they employed external management consultants (rank 3), organized specialist training for their managers (rank 2) or both (rank 4).
- "*Expert Foundation*" (X_7) – ranks (1-7) companies based on the ratio of employees with a graduate level degree to the total number of employees.
- "*Education System*" (X_8) – ranks (1-9) companies based on their training plans and educational budget. The lowest ranked companies (rank 1) are those with the smallest budget for education and with sporadic trainings for small groups of employees, and companies with the biggest educational budget and with regular trainings for all employees have the highest rank (9).

3.2.1.3. Production & Structural Innovation (F_3)

To measure this construct we used a very simple three-indicator measure which refers to the level of innovative activities within the companies' production systems and structures. Those three indicators are:
- "*New Processes*" (Y_1) – ranks companies based on whether they introduced new production processes (rank 3), modified old production processes (rank 2) or both (rank 4).
- "*New Products/Services*" (Y_2) – ranks companies based on whether they introduced new products (rank 3), modified old products (rank 2) or both (rank 4).
- "*Organizational Changes*" (Y_3) – ranks companies based on whether they introduced a new managerial structure (rank 3), made changes to the existing managerial structure (rank 2) or both (rank 4).

3.2.1.4. Management Innovation (F_4)

In accordance with the list of the most relevant and noteworthy innovations in all areas of management (Mol & Birkinshaw 2007), we produced a set of indicators that measure this construct. Those indicators are as follows:
- "*Process*" (Y_4) – ranks (1-5) companies based on the implementation of the following management practices and structures: *Quality Management System*, *TQM*, *6σ* , *Supply Chain Management* and *Lean Manufacturing*.
- "*Strategy & Performance*" (Y_5) – ranks (1-3) companies

based on the implementation of the following management practices and structures: *BSC*, *EVA*, *Strategy Planning* and *Benchmarking*.

- "*Customer & Information*" (Y_6) – ranks (1-3) companies based on the implementation of the following management practices and structures: *Brand Management*, *CRM*, *Operations Research* and *ERP*.
- "*People & Structures*" (Y_7) – ranks (1-3) companies based on the implementation of the following management practices and structures: *HRM*, *360-degree Feedback*, *PMO* and *Matrix Organization*.

The generated four-indicator measure provides a measurement scale that shows an aggregate level of innovative activities from the management domain.

3.2.2. Results

All variables from the model are measured on an ordinal scale. Table 2 contains the means and standard deviations of and covariance between all model variables, where alternative parameterization is used for the underlying variables of the model's ordinal variables (Jöreskog 2004).

To test the hypothesized model we employed structural equation modeling (SEM) because it enables a concurrent testing of several dependence relationships within a single theoretical model (Hair *et al.* 2009). Following the two-step approach (Anderson & Gerbing 1988) we used LISREL 8.80 for both measurement and structural model testing.

3.2.2.1. Assumptions

The assumptions were evaluated through SPSS and LISREL. The dataset contains responses from 160 companies. There were no missing data and no univariate outliers. Considering that the hypothesized model has only four constructs, each with at least three indicators, this sample size is just adequate for the model estimation (Hair *et al.* 2009).

Since we dealt with ordinal data both univariate and multivariate normality were violated. All variables showed a moderate non-normality (skew < 2, kurtosis < 7) except variable Y_4 (skew > 2). Thus, in accordance with the recommendation for dealing with non-normal and ordinal data (Finney & DiStefano 2006), the Satorra-Bentler scaling method for χ^2 and standard errors is used for model estimation.

Table 2. Means, Standard Deviations and Covariance between Model Variables

	Variable	Mean	S.D.	1	2	3	4	5	6	7
1	Ownership Structure	2.19	0.88	0.77						
2	Age	1.13	1.07	-0.44	1.14					
3	Industry Dynamics	1.17	0.56	0.13	-0.10	0.32				
4	Export Scope	0.12	1.13	-0.18	0.20	-0.27	1.27			
5	Mgmt. Heterogeneity	2.74	1.96	-0.18	0.10	0.04	-0.17	3.85		
6	Managerial Skills Impr.	0.63	1.29	0.08	0.03	-0.02	0.05	0.44	1.67	
7	Expert Foundation	1.76	2.27	0.09	-0.04	0.15	0.02	0.38	0.80	5.14
8	Education System	2.21	2.77	-0.06	-0.45	-0.09	-0.04	0.94	1.73	1.77
9	New Processes	1.59	1.34	0.06	-0.20	-0.04	-0.13	0.10	0.49	0.33
10	New Products/Services	1.92	1.54	0.00	-0.06	0.00	-0.01	0.43	0.49	0.52
11	Organizational Changes	1.23	1.82	0.13	-0.22	-0.09	-0.11	0.49	0.83	0.69
12	Process	-3.19	3.00	1.02	0.01	-0.22	0.13	-0.23	0.62	0.53
13	Strategy & Performance	-0.90	1.07	0.41	-0.28	0.08	-0.12	0.20	0.47	0.30
14	Customer & Information	-1.08	1.22	0.29	-0.33	0.14	0.05	0.14	0.39	0.77
15	People & Structures	-0.87	1.00	0.25	-0.30	0.04	-0.01	-0.02	0.44	0.67

Table 2. Means, Standard Deviations and Covariance between Model Variables (Cont'd)

	Variable	8	9	10	11	12	13	14	15
8	Education System	7.66							
9	New Processes	1.26	1.80						
10	New Products/Services	0.85	1.49	2.37					
11	Organizational Changes	1.50	1.32	1.05	3.32				
12	Process	1.71	0.39	0.16	1.47	9.01			
13	Strategy & Performance	0.82	0.40	0.52	0.59	1.70	1.14		
14	Customer & Information	1.29	0.62	0.64	0.46	1.56	0.78	1.48	
15	People & Structures	0.88	0.48	0.35	0.55	1.64	0.78	0.80	1.00

3.2.2.2. Measurement Model

Measurement model fitting is examined through several absolute, incremental and parsimony goodness-of-fit indices (Table 3). All these fit indices suggest an acceptable fit for the measurement model.

Construct validity is assessed through convergent validity, discriminant validity and nomological validity. All factor loading estimates are in the expected direction and all are statistically significant as required for convergent validity.

Table 3 displays the standardized factor loadings for the measurement model. It could be seen from Table 3 that factors F_1 and F_2 have loadings that fall well below the cutoff value – 0.5 and preferably 0.7 (Hair *et al.* 2009), what makes them candidates for removal from the model. Consequently, the estimates of the average variance extracted (AVE) for above listed factors are below the preferable value of 0.5, but above the cutoff value of 0.25. In addition, the construct reliability (CR) estimates are all almost 0.6 (cutoff value) or higher (Hair *et al.* 2009). Combining these results with the fact that the overall model fits well we proceed with our modeling being aware of this limitation but giving more weight to the theoretical arguments over statistical tests.

All AVE estimates for the model's constructs are greater than the squared inter-construct correlations (Table 4), which indicates that there are no problems with discriminant validity. Moreover, there are no

Table 3. Standardized Factor Loadings, Average Variance Extracted, Reliability Estimates

	F_1	F_2	F_3	F_4
("*Ownership Structure*") – X_1	0.85 ***			
("*Age*") – X_2	-0.55 ***			
("*Industry Dynamics*") – X_3	0.34 *			
("*Export Scope*") – X_4	-0.25 *			
("*Management Heterogeneity*") – X_5		0.22 *		
("*Managerial Skills Improvement*") – X_6		0.68 ***		
("*Expert Foundation*") – X_7		0.40 ***		
("*Education System*") – X_8		0.72 ***		
("*New Processes*") – Y_1			0.95 ***	
("*New Products/Services*") – Y_2			0.75 ***	
("*Organizational Changes*") – Y_3			0.57 ***	
("*Process*") – Y_4				0.61 ***
("*Strategy & Performance*") – Y_5				0.84 ***
("*Customer & Information*") – Y_6				0.74 ***
("*People & Structures*") – Y_7				0.87 ***
Average Variance Extracted (AVE)	30.1%	29.7%	59.7%	59.6%
Construct Reliability (CR)	0.58	0.59	0.81	0.79
Goodness-of-Fit Indices (GoF)	χ^2 = 78.739 (df = 84, p = 0.642) RMSEA = 0.0; 90% CI of RMSEA = 0.0 – 0.0378 SRMR = 0.0746; CFI = 1; PNFI = 0.746			

*** – significant at 0.001; * – significant at 0.05

Table 4. Average Variance Extracted (AVE) and Squared Inter-construct Correlations $(C_{i,j}^2)$

	Construct	F_1	F_2	F_3	F_4
F_1	$C_{1,j}^2$	1.000			
	$min\{AVE(F_1), AVE(F_j)\}$	%			
F_2	$C_{2,j}^2$	0.002	1.000		
	$min\{AVE(F_2), AVE(F_j)\}$	0.297	%		
F_3	$C_{3,j}^2$	0.007	0.214	1.000	
	$min\{AVE(F_3), AVE(F_j)\}$	0.301	0.297	%	
F_4	$C_{4,j}^2$	0.241	0.292	0.170	1.000
	$min\{AVE(F_4), AVE(F_j)\}$	0.301	0.297	0.596	%

cross-loadings among either indicators or error terms, so these results tell us that discriminant validity is provided as well. Nomological validity is supported by the fact that all of the correlations between the constructs are positive just as was predicted, and all but two inter-construct correlations are statistically significant.

3.2.2.3. Structural Model

The second stage in this two-step approach is structural model testing, which consists of structural model specification and assessment of structural model validity. Model specification, which implies proposing hypotheses and establishing structural relationships, was described above. It is visually presented by the structural diagram in Figure 2. Structural model validity assumes an assessment of the overall model fit and the examination of model diagnostics (Hair *et al.* 2009).

Structural model fitting is examined through the same goodness-of-fit indices as for the measurement model (Table 5). All these fit indices suggest that the structural model provides a very good overall fit as well.

The final step in structural model validation is the examination of structural path estimates (Table 5). It could be seen that all but one of the structural path estimates are statistically significant and in the predicted direction. The path between factors F_3 and F_4 is in the expected direction, but its t-value is below the critical level for a Type I error of 0.05, hence it is not supported. On the other hand, *given that three of four estimates are in compliance with the proposed hypotheses, these results provide strong support for our theoretical model*.

The chi-square difference between the structural and the measurement model is $\Delta \chi^2 = 0.56$ with one degree of freedom ($p > 0.05$). The insignificant chi-square difference indicates that the model fit could not be improved by estimating another structural path.

For both the measurement and structural model there was only one standardized residual greater than |4.0| and modification indices point only to the addition of covariance between the error terms of indicators. Thus, we have concluded that there is no need for further model modification.

4. DISCUSSION

This study provides a deeper understanding of management innovation processes under the conditions of the market environment in the Federation of Bosnia and Herzegovina.

During the model design phase we found out that virtually all theoretical propositions apply to the economic and market circumstances of the F B&H. However, our research also showed a notable divergence in opinions related to the applicability of management theories and practices to the same market. Such a somewhat contradictory stand is typical for the turbulent environment of the F B&H. We strongly believe that this case clearly illustrates the reality of life in the F B&H, which only contributes to model validity. Strong support for most of the proposed hypotheses goes in favor of that assertion.

The results obtained by testing the measurement model, as well as the structural model (Figure 2), indicate an excellent fit between the theoretical model and the real world represented by the data sample. All observed goodness-of-fit indices (Table 3) confirm that the model imposed covariance matrix (Σ) is similar to the data sample covariance matrix (S). Such results from SEM analysis point to overall empirical model validity (the measurement validity of all

Table 5. Structural Path Estimates

Structural Relationship	Unstandardized Parameter Estimate	Standard Error	t-value	Standardized Parameter Estimate
H1: F1àF4	0.54	0.21	2.65	0.45**
H2: F3àF4	0.13	0.09	1.48	0.18
H3: F2àF4	0.45	0.14	3.26	0.44**
H4: F2àF3	0.68	0.17	3.98	0.46***
Cov(F1,F2)	0.04	0.09	0.40	%
Goodness-of-Fit Indices (GoF)	$\chi 2 = 79.295$ (df = 85, p = 0.654) RMSEA = 0.0; 90% CI of RMSEA = 0.0 – 0.0371 SRMR = 0.0754; CFI = 1; PNFI = 0.755			

*** – significant at 0.001; ** – significant at 0.01

proposed constructs).

The most important part of SEM analysis, the model's structural path analysis (Table 5), has revealed that three out of the four proposed hypotheses are confirmed (paths estimates are statistically significant at least with p <0.01), which results from an inter-constructs direct effects analysis. Consequently, the following can be asserted:

1. The context in which companies operate has a direct and positive effect on management innovation, which supports our first hypothesis. This finding is in accordance with previous studies (Mol & Birkinshaw 2009a, 2009b). Furthermore, we enriched the model with a few other contextual attributes – ownership, age and industry dynamics.
2. The overall management proficiency, and not only top-management team traits (Camelo-Ordaz *et al.* 2006), as well as high levels of knowledge and knowledge gathering, not only about management but in general, are conducive to management innovation. This finding is in line with previous research (Kunz & Linder 2011; Vaccaro *et al.* 2009) and it supports our third hypothesis.
3. The level of structural and production innovation is predicted with the overall management proficiency, which supports the last hypothesis of this study.
4. Even though we found that a positive relation exists between management innovation and production and structural innovation, that relation was statistically insignificant. Thus, our analysis did not support the second research hypothesis.

The coefficient of determination (R^2) for the *Management Innovation* factor has a value of 0.53, meaning that the model explains 53% of the variance of this factor. Such a fairly large effect points to significant model explanatory value.

The strong support for the proposed hypotheses suggests that the context in which the company operates and especially the company's managerial proficiency determine its aptitude for management innovation. At the same time, we found that there is no significant relation between management innovation and the technological innovativeness of companies, which is a rather interesting and unexpected finding.

Even though the main intent of this study is only to propose and test the theoretical model of innovation management, which would then be used as a basis for future research on the management innovation phenomenon, some further suggestions could be drawn based on the results of the study.

Building on the argumentation that management innovation is crucial to business success, the proposed management innovation model could help both academics and practitioners of management to comprehend some very important aspects of the management innovation implementation process, in order to increase the odds of long-term business thrive.

More specifically, a successful validation of the proposed theoretical model provides important insights about how and which factors affect the companies' readiness to introduce innovative management structures, processes and practices. Investing time, effort and money in managerial capacity building on every management level within the organization, and fostering professional diversity among managers will significantly increase not only management innovation capability but the overall organizations' innovation potential.

Naturally, given the fact that management innovation is the most neglected type of innovation, the necessary condition for such an outcome is a radical behavioral change, meaning that academics, as well as top managers, should embrace management innovation as one of the most potent sources of long-lasting organizational competitive advantage.

5. FUTURE RESEARCH

In addition to the findings and insights resulting from model testing, we have also initiated research activities about management innovation within immature and underdeveloped markets. We designed a theoretical model of management innovation that can be applied in any economic context. What is more important, our model can be used as a basis for further development and improvement of the understanding of the management innovation concept. While most of studies about management innovation focus on why and how management innovations happen (Birkinshaw *et al.* 2005; Hamel 2006), we have focused our efforts on describing just what constitutes the management innovation phenomenon within the world of business.

In addition, this research and its results contribute to the body of knowledge related to management innovation by designing an applicable model with corresponding constructs and individual indicator items, i.e. by designing measurement scales and types that could be used for future research.

However, there are a few different limitations that apply to this research. First, we focused only on management innovations that are new to the company, so the study focuses on only one aspect of management innovation. Second, in order to keep the model simple we have used only a limited set of observed variables and, as a consequence, a smaller portion of the

constructs' variance was explained. Future research could seek to improve the measures we used in our model to enhance construct validity.

Finally, we ran our analysis on single sample whose size is just adequate for a model of this size and complexity. Thus, we could not do any validation of the model. Other studies may further improve the model and test its validity by applying it to different data.

6. CONCLUSION

In this study we wanted to explore the applicability of management innovation theory on the company level in the conditions of immature and underdeveloped markets. Therefore, relying strongly on the existing knowledge base we focused our efforts on the design of a theoretical model of management innovation and its subsequent adaptation to the market conditions of the F B&H.

The study showed that all existing theoretical propositions apply to the economic and market circumstances of the F B&H. In addition, our analysis has shown that all but one of the proposed hypotheses are supported, and that the theoretical model designed for management innovation is valid and applicable to the market conditions of the F B&H.

The coming period will definitely pose new and unprecedented business challenges to all contemporary companies. In order to properly address those challenges, companies will have to invent or to acquire new management models, which can be built only through a series of successful management innovations. Thus, the phenomenon of management innovation will become more and more important both for the practitioners of management and management scholars.

REFERENCES

Abrahamson, E. 1991. Management Fad and Fashions: The Diffusion and Rejection of Innovations. *Academy of Management Review*, 16(3): 586-612.

Abrahamson, E. 1996. Management Fashion. *Academy of Management Review*, 21(1): 254-285.

Abrahamson, E., Fairchild, G. 1999. Management Fashion: Lifecycles, Triggers and Collective Learning Processes. *Administrative Science Quarterly*, 44(4): 708-740.

Anderson, J.C., Gerbing, D.W. 1988. Structural Equation Modeling in Practice: A Review and Recommended Two-Step Approach, *Psychological Bulletin*, 103(3): 411-423.

Biagi, F., Parisi, M.L., Vergano, L. 2008. Organizational Innovations and Labor Productivity in a Panel of Italian Manufacturing Firms. Working paper prepared for the XXIII National Congress of Labor Economics, Brescia, 11-12 September 2008.

Birkinshaw, J. 2010. *Reinventing Management*. New York: Jossey-Bass.

Birkinshaw, J., Hamel, G., Mol, M.J. 2005. Management Innovation. *Advanced Institute of Management Research*, Available at: http://www.managingpeoplebook.com/userimages/aim_management_innovation.pdf. Accessed 21 August 2014.

Birkinshaw, J., Hamel, G., Mol, M.J. 2008. Management Innovation. *Academy of Management Review*, 33(4): 825–845.

Birkinshaw, J., Mol, M.J. 2006. How Management Innovation Happens. *MIT Sloan Management Review*, 47(4): 81-88.

Blunt, P. 2002. Public Administrative Reform and Management Innovation for Developing Countries. Available at: http://unpan1.un.org/intradoc/groups/public/documents/un/unpan006226.pdf. Accessed 21 August 2014.

Bryson, A., Dale-Olsen, H., Barth, E. 2009. How Does Innovation Affect Worker Well-being? Centre for Economic Performance, CEP Discussion Paper No. 953. Available at: http://cep.lse.ac.uk/pubs/download/dp0953.pdf. Accessed 21 August 2014.

Camelo-Ordaz, C., de la Luz, F-A.M., Salustiano, M-F. 2006. Influence of Top Management Team Vision and Work Team Characteristics on Innovation, *European Journal of Innovation Management*, 9(2): 179-201.

Central Bank of Bosnia and Herzegovina. 2014. *Annual Report 2013*. Sarajevo: Central Bank of Bosnia and Herzegovina.

Čaušević, F. 2012. Economic Perspectives on Bosnia and Herzegovina in the Period of Global Crisis, South East European Studies at Oxford, Opinion Piece. Available at: http://www.sant.ox.ac.uk/seesox/opinionpieces/Causevic-Economicperspectives.pdf. Accessed 21 August 2014.

Černe, M., Jaklič, M., Škerlavaj, M. 2013. Management Innovation in Focus: The Role of Knowledge Exchange, Organizational Size, and IT System Development and Utilization. *European Management Review*, 10: 153–166.

Damanpour, F., 1987. The Adoption of Technological, Administrative, and Ancillary Innovations: Impact of Organizational Factors. *Journal of Management*, 13(4): 675-688.

Damanpour, F. 1991. Organizational Innovation: A Meta-Analysis of Effects of Determinants and Moderators. *Academy of Management Journal*, 34(3), 555-590.

Damanpour, F. 1992. Organizational Size and Innovation. *Organization studies*, 13(3): 375-402.

Damanpour, F., Aravind, D. 2012. Managerial Innovation: Conceptions, Processes, and Antecedents, *Management & Organization Review*, 8(2): 423-454.

Damanpour, F. 2014. Footnotes to Research on Management Innovation. *Organization Studies*, 35(9): 1265–1285.

Finney, S.J., DiStefano, C. 2006. Non-normal and Categorical Data in Structural Equation Modeling. In Hancock, G.R., Mueller, R.O. (Eds.), *Structural Equation Modeling: A Second Course*. Charlotte: Information Age Publishing.

García-Zamora, E., González-Benito, Ó., & Muñoz-Gallego, P.A. 2013. Organizational and environmental factors as moderators of the relationship between multidimensional innovation and performance. *Innovation: Management, policy & practice*, 15(2): 224-244.

Gruber, W.H., Niles, J.S. 1972. Put Innovation in the Organization Structure. *California Management Review*, 14(4): 29-35.

Gruber, W.H., Niles, J.S. 1974. How to Innovate in Management. *Organizational Dynamics*, 3(2): 30-47.

Guest, G., Bunce, A., Johnson, L. 2006. How Many Interviews Are Enough? An Experiment with Data Saturation and Variability, *Field Methods*, 18(1): 59-82.

Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E. 2009. *Multivariate Data Analysis*. 7th Edition, Upper Saddle River: Prentice Hall.

Hamel, G. 2006. The Why, What, and How of Management Innovation. *Harvard Business Review*, 84(2): 72-84.

Hamel, G. 2007. *The Future of Management*. Boston: Harvard Business School Press.

Hamel, G. 2012. *What Matters Now: How to Win in a World of Relentless Change, Ferocious Competition, and Unstoppable Innovation*. New York: Jossey-Bass.

Hargrave, T.J., Van de Ven, A.H. 2006. A Collective Action Model of Institutional Innovation. *Academy of Management Review*, 31(4): 864-888.

Hecker, A., Ganter, A. 2013. The Influence of Product Market Competition on Technological and Management Innovation: Firm-Level Evidence from a Large-Scale Survey. *European Management Review*, 10(1): 17-33.

Hervás-Oliver, J-L., Peris-Ortiz, M. 2014. *Management Innovation. Antecedents, Complementarities and Performance Consequences*. Cham: Springer.

Hindle, T. 2008. *Guide to Management Ideas and Gurus*. London: Profile Books Ltd.

Hollen, R.M.A., Van Den Bosch, F.A.J., Volberda, H.W. 2013. The Role of Management Innovation in Enabling Technological Process Innovation: An Inter-Organizational Perspective. *European Management Review*, 10(1): 35–50.

Jöreskog, K.G. 2004. Structural Equation Modeling with Ordinal Variables Using LISREL, Scientific Software International, Available at: http://www.ssicentral.com/lisrel/techdocs/ordinal.pdf. Accessed 21 August 2014.

Khana, T. 2014. Contextual Intelligence. *Harvard Business Review*, 92(9): 58-68.

Kimberly, J.R. 1981. Managerial Innovation. In P.C. Nystrom & W.H. Starbucks (Eds.), *Handbook of organizational design, Volume 1: Adapting Organizations to their Environments*. Oxford: Oxford University Press. pp. 84-104.

Kimberly, J.R., Evanisko, M.J., 1981. Organizational Innovation: The Influence of Individual, Organizational and Contextual Factors on Hospital Adoption of Technologies and Administrative Innovations. *Academy of Management Journal*, 24(4): 689-713.

Kossek, E.E. 1987. Human Resources Management Innovation. *Human Resource Management*, 26(1): 71-92.

Kunz, J., Linder, S. 2011. Managerial Innovation: Role of Employees' Needs and Attitudes. *Copenhagen Business School*. Available at: http://www.cbs.dk/content/download/115702/1564769/file/Managerial%2520Innovation%2520-%2520Role%2520Of%2520Employees%2527%2520Needs% 2520And%2520Attitudes.pdf. Accessed 19 December 2011.

Mamman, B.A. 2009. From Management Innovation to Management Practice. *International Journal of Organizational Innovation*, 2(2): 22-60.

McCabe, D. 2002. 'Waiting for dead men's shoes': Towards a cultural understanding of management innovation. *Human Relations*, 55(5): 505-536.

McGrath, J.E. 1981. Dilemmatics - The Study of Research Choices and Dilemmas. *The American Behavioral Scientist*, 25(2): 179-210.

Mol, M.J., Birkinshaw, J. 2007. *Giant Steps in Management: Innovations That Change the Way You Work*. Harlow: Financial Times/ Prentice Hall.

Mol, M.J., Birkinshaw, J. 2009a. Management Innovation in the UK. *DIUS Research Report 09-07*. Available at: http://www.bis.gov.uk/assets/biscore/corporate/ migratedD/publications/D/DIUS_RR_09_07. Accessed 19 December 2011.

Mol, M.J., Birkinshaw, J. 2009b. The Sources of Management Innovation: When Firms Introduce New Management Practices. *Journal of Business Research*, 62(12): 1269-1280.

Mol, M.J., Birkinshaw, J. 2014. The Role of External Involvement in the Creation of Management Innovations. *Organization Studies*, 35(9): 1287–1312.

Nguyen, T.T.U., Mothe, C. 2008. Assessing the Impact of Marketing and Organizational Innovations on Firm Performance. *Public Research Centre Henry Tudor*. Available at: http://webserver.tudor.lu/cms/lu2020/publishing.nsf/0/A1D3EBE7C542CC99C12575140048AB72/$file/16h30_NGUYEN_MOTHE.pdf. Accessed 21 August 2014.

Nickell, S., Nicolitsas, D., Patterson, M. 2001. Does Doing Badly Encourage Management Innovation. *Oxford Bulletin of Economics and Statistics*, 63(1): 5-28.

Onwuegbuzie, A.J., Leech, N.L. 2007. A Call for Qualitative Power Analyses. *Quality & Quantity*, 41(1): 105-121.

Srnka, K.J., Koeszegi, S.T. 2007. From Words to Numbers: How to Transform Qualitative Data into Meaningful Quantitative Results. *Schmalenbach Business Review: ZFBF*, 59: 29-57.

Stata, R. 1989. Organizational Learning-The Key to Management Innovation. *MIT Sloan Management Review*, 30(3): 63-74.

Stata, R. 2002. Management Innovation. *Leadership Excellence*, 9(6): 8-9.

Teece, D.J. 1980. The Diffusion of an Administrative Innovation. *Management Science*, 26(5): 464-470.

Ursič, D., Mulej, M. 2005. Theory and Practice of Management Concepts: Slovenia's Experiences. *Journal of Management Development*, 24(10): 856-878.

Vaccaro, I.G., Jansen, J.J.P., Van Den Bosch, F.A.J., Volberda, H.W. 2009. Management Innovation: Uncovering the Influence of Top Management Teams. *Copenhagen Business School Management Innovation Conference*. Available at:http://www.cbs.dk/en/layout/set/print/content/download/115700/1564763/file/Management%20Innovation%20-%20Uncovering%20The%20Influence%20Of%20Top%20Management%20Teams.pdf. Accessed 19 December 2011.

Vaccaro, I.G., Jansen, J.J.P., Van Den Bosch, F.A.J., Volberda, H.W. 2012. Management Innovation and Leadership: The Moderating Role of Organizational Size. *Journal of Management Studies*, 49(1): 28-51.

Walker, R.M., Damanpour, F., & Devece, C.A. 2011. Management Innovation and Organizational Performance: The Mediating Effect of Performance Management. *Journal of Public Administration Research and Theory*, 21(2): 367-386.

Wood, J.M. 2007. Understanding and computing Cohen's Kappa: a tutorial. *WebPsychEmpiricist*. Available at: www.wpe.info/vault/wood07/Wood07.pdf. Accessed 21 August 2014.

World Bank. 2014. *Doing Business 2015: Going Beyond Efficiency*. Washington, DC: World Bank Group.

Yang, H.M., Choi, B.S., Suh, M.S. 2007. Supply chain management six sigma: a management innovation methodology at the Samsung Group. *Supply Chain Management*, 12(2): 88-95.

Wu, W., Chen, Q., Yu, B., He, H. 2008. Effects of Management Innovation on Telecommunication Industry System. *WSEAS Transactions on Systems*, 7(5): 455-465.

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RISK DIVERSIFICATION BETWEEN THE GERMAN AND BOSNIAN STOCK MARKETS

Azra Zaimović, Almira Arnaut Berilo *

Abstract

The integration of global equity markets has been a well-studied topic in the last few decades, particularly after stock market crashes. Most studies have focused on developed markets such as the US, Western Europe and Japan. The findings were that the degree of international co-movements among stock prices has substantially increased in the post-crash regime. In this paper we research the co-movements of German and Bosnian stock markets during and after the recent economic and financial crisis.

International market integration means that assets of equal risk provide the same expected returns across integrated markets. This means fewer opportunities for risk diversification if the markets are integrated. It is also believed that stock market indices of integrated markets move together over the long run with the possibility of short-run divergence. There is considerable academic research on the benefits of international diversification. Investors who buy stocks in domestic as well in foreign markets seek to reduce risk through international diversification. The risk reduction takes place if the various markets are not perfectly correlated. The increasing correlation among markets during and after the crises has restricted the scope for international diversification.

International stock market linkages are the subject of extensive research due to rapid capital flows between countries because of financial deregulation, lower transaction and information costs, and the potential benefits from international diversification. Most stock markets in the world tend to move together, in the same direction, implying positive correlation. In and after crises they tend to move together even more strongly. Thus, this paper aims to research if there are any diversification opportunities by spreading out investments across developed and underdeveloped capital markets.

This research attempts to examine the scope of international diversification between German and Bosnian equity markets during the 6-year period from 2006 to 2011. We test the hypothesis of whether there are any risk diversification possibilities by spreading out the investments between German and Bosnian equity markets. In order to determine the mean-variance efficiency of portfolios we use the method of convex (quadratic and linear) programming. The hypothesis is tested with the Markowitz portfolio optimization method using our own software.

The results of this research might enhance the efficiency of portfolio management for both types of capital market under analysis, and prove especially useful for institutional investors such as investment funds.

Keywords: *Risk Diversification, German and Bosnian Capital Markets, Markowitz method*

JEL Classification: *G11, G32*

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1. INTRODUCTION

Investors prefer holding portfolios of securities rather than a single security due to a risk-reduction effect called risk diversification. In addition to providing arbitrage opportunities, diversification is often called "the free lunch in finance."

International stock market linkages are the subject of extensive research for the following reasons: (1) the rapid flow of capital among countries due to financial deregulation,[1] (2) information availability, (3) the reduction of transaction costs, and (4) the potential gains from international diversification of investment portfolios (In, Kim and Yoon, 2002). Most stock markets in the world tend to move together, in the same direction, implying positive correlation. However, the increasing correlations among developed and emerging markets have restricted the scope of international diversification (Srivastava, 2007).

Thus, this paper aims to research if there are any diversification opportunities between two European, and in many aspects different equity markets: those of Germany and Bosnia & Herzegovina. This research examines the scope of international diversification over a six-year period before, during and after the recent crisis, from 2006 to 2011. We test the hypothesis of whether there are any risk diversification possibilities by spreading out investments between German and Bosnian equity markets. The hypothesis is tested by statistical methods and with the Markowitz portfolio optimization process (Markowitz, 1952, 1991). The research results might allow more efficient securities portfolio management on European capital markets.

This paper is organized into five sections, including an introduction. Section 2 outlines the theoretical background and methodology, Section 3 deals with data, Section 4 presents the results, and in Section 5 we conclude the study.

2. THEORETICAL AND METHODOLOGICAL FRAMEWORK

The integration of global equity markets has been a well-studied topic in the last two and a half decades, particularly since the October 1987 stock market crash. Most studies are conducted for developed markets like the US, Western Europe and Japan. The findings were that the degree of international co-movements among stock prices has substantially increased in the post-crash regime (Arshanapalli and Doukas, 1993). After the Asian crisis, the literature started focusing on emerging Asian markets as well. The recent financial and economic crisis has renewed the topic of capital market co-movements.

International market integration has several definitions. One states that assets of equal risk provide the same expected returns across integrated markets. This means that there are fewer opportunities for risk diversification if the markets are integrated. The second definition states that in integrated markets national stock market indices move together over the long run with the possibility of short run divergence.

Vizek and Dadić (2005) researched multilateral integration between the emerging markets of Central and Eastern Europe (CEE) and the German equity market for the period from January 1997 till June 2005. The authors find that the equity markets of Croatia and other CEE emerging equity markets, namely those of Poland, the Czech Republic, Slovenia and Hungary, are multilaterally integrated. In addition, their results indicate multilateral integration between the CEE equity markets and the German equity market. When analyzing Croatian and German equity markets alone, they find no evidence of bilateral integration.

Zaimović and Delalić (2010) investigate the risk diversification possibilities of the four West Balkan capital markets: the Sarajevo, Banja Luka, Zagreb and Belgrade Stock Exchanges. By analyzing the six main stock market indices in a 34-month period, from 2006 till 2008, they found a low to medium positive statistically significant correlation between indices returns pairs. The equally weighted portfolio of three index fund stocks would have a very good standard deviation – mean trade-off, lying almost on the efficient frontier. This study encourages the creation of index replicating funds in the analyzed markets.

Within the theoretical context of market integration, international stock market linkages and interdependence form a cornerstone of modern portfolio theory, especially in relation to asset diversification. This theory suggests that investors diversify their assets across national borders as long as stock returns in other markets are less than perfectly correlated with those of the domestic market (Masih and Masih, 1997).

Financial integration between equity markets can be assessed by a different methodology. Fratzschner (2001) used uncovered interest parity, Korajczyk (1995) used multifactor Arbitrage Pricing Theory, Bekaert and Harvey (1995) and Dumas and Solnik (1995) used the Capital Asset Pricing Model. Co-integration analysis is used to test the stability of long run relationship across financial markets (Dickinson, 2000, Vizek and Tadić, 2005).

Risk diversification has two basic sources: one concept was developed by Markowitz (1952) and another

1 The global financial and economic crisis has revealed the need for new regulation of financial markets and banks.

developed by Sharpe (1964). Markowitz introduced the notion of a (mean-variance) efficient portfolio that (1) provides minimum variance for a given expected return or (2) provides maximum expected return for a given variance. Diversifying risk by selecting weakly correlated securities implies that the decision is made based on information about standard deviation and correlation between securities' returns. This diversification is called Markowitz or efficient diversification, because Markowitz was the first who developed the procedure for calculating efficient portfolios.

Sharpe finds that one can reduce the risk of a portfolio just by adding randomly selected securities in a portfolio, in such a way that all the securities have the same but small weights. Through this procedure, unsystematic risk is diversified, while systematic risk becomes the only risk to be rewarded on the capital market. This approach does not explicitly assume that the securities' returns are uncorrelated. Sharpe calls this diversification random diversification, essentially because an investor does not have to know information about the standard deviation and correlation between securities' returns.

In this paper we adopted Markowitz's methodology to demonstrate the diversification possibilities on the selected capital markets. The efficient frontier of any possible portfolio of stocks, regardless of the number of stocks in the portfolio, lies between the portfolio with the minimum standard deviation (also minimum variance) and the portfolio with the maximum rate of return (mean). The portfolio with the maximum rate of return is the upper, final point on the efficient frontier. If the short sales are not allowed, the final portfolio (up on the right) in the efficient frontier will always be represented by only the stock with the highest return in the portfolio.

The classical Markowitz portfolio model is used to determine the efficient portfolios returns

$$\overline{R}_p = \sum_{i=1}^{n} \overline{R}_i x_i \tag{1}$$

and portfolio variances

$$\sigma_p{}^2 = \sum_{j=1}^{n}\sum_{i=1}^{n} x_j x_i Cov(R_i, R_j) \tag{2}$$

if portfolio investments satisfy the constraints

$$\sum_{i=1}^{n} x_i = 1$$
$$x_i \geq 0, \quad i = \overline{1,n} \tag{3}$$

There are two types of constraints in this model. The first constraint appears in all models, and it requires that the sum of all investment weights be 1, with investments $x_i \quad \left(i = \overline{1,n}\right)$ defined as portions of money invested in each individual security in a portfolio. The other set of constraints requires that the investment be non-negative, which means that there is no lending or short-sells.

The mean-variance combination of securities is efficient if there are no other portfolios with the same return and lower variance, or the same variance and higher return. In determining the efficient combination of a set of securities (or in efficient portfolio determination) several optimization problems are detected. First, in this model the set of possible portfolios is limited, where the minimum limit is represented by the portfolio with the lowest possible variance, and the maximum limit being the portfolio with the highest possible return. In addition, in the very definition of the efficient portfolio we can see that for every rate of return the lowest variance portfolio has to be determined, and for every variance, the highest return portfolio has to be determined.

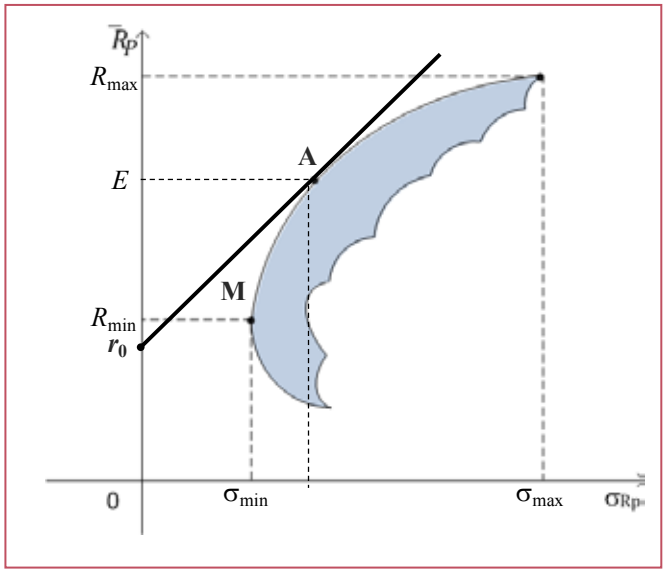
Let us assume an investor considers investing in a portfolio, with a given value of expected return on investment *E*, and is interested in the lowest variance with which the return can be achieved. The optimization model is formed as:

$$\min_{\mathbf{x}} \sigma^2 = \sum_{i=1}^{n}\sum_{j=1}^{n} \sigma_{ij} x_i x_j$$
$$\sum_{i=1}^{n} x_i = 1$$
$$\sum_{i=1}^{n} \overline{R}_i \cdot x_i = E \tag{4}$$
$$x_i \geq 0, \quad i = \overline{1,n}$$

where the constant *E* has to be between the efficient portfolio with the lowest variance, $\overline{R}_{\min}$ and the efficient portfolio with the highest expected return, $\overline{R}_{\max}$. If the following is true $E > \overline{R}_{\max}$, model (4) would be unsolvable, and if $E < \overline{R}_{\min}$ then the solution to the system (4) would not be an element of the efficient set. As a result of applying the complementary algorithm (used for solving the quadratic programming model 4) we will get the investment vectors that provide the absolutely minimum portfolio return variance $\sigma^2_{\min}$ with the pre-set return *E*.

By choosing a randomly expected return of investment in the range $\overline{R}_{\min} \leq E \leq \overline{R}_{\max}$ we can determine the efficient set of observed security.

Figure 1: Set of possible portfolios and Capital Market Line



We have selected two characteristic portfolios, the minimum variance portfolio and the portfolio with the best risk-return trade-off (maximum Sharpe ratio). In Figure 1, these two portfolios are marked as M and A, respectively.

3. DATA

In order to measure diversification possibilities and asset behavior in the German and Bosnian equity markets, we have determined and analyzed the efficient portfolios formed from selected stocks from the Frankfurt Stock Exchange (FSE) and the Sarajevo Stock Exchange (SASE), both apart and together. Input data for mean-variance (MV) analysis are the last stock weekly prices sourced from the official webpage of the SASE[2] for the Bosnian market and from the Yahoo Finance webpage[3] for stocks from the German market.

The time interval for diversification tests was determined by the global economic crisis and its effects on diversification possibilities on these two markets. The additional criterion was the liquidity of stocks on the SASE. In 2006 the SASE introduced the Multi Fixing Trading Schedule (MFTS) for the most liquid stocks. In the same year turnover on SASE was larger than EUR 332 million (BAM 650 million), which is why we have chosen the 2006 year for the beginning of our analysis. Earlier periods on the SASE were characterized by low liquidity, irregular trading activity and a small number of traded stocks. Thus, we have observed stocks in the period from the 3rd of January 2006 till the 1st of Jun 2011. Stock returns were calculated on a weekly basis, based on capital gain/loss, not including dividend yield.

According to the research goals we have selected stocks from both equity markets that represent overall market movements. Forty-three stocks have been selected from the SASE.[4] These stocks have been traded by the MFTS algorithm in the official market and in the SASE primary free market. The overall proportion of these 43 stocks in all market turnovers in the last three years (2009, 2010 and 2011) is 51.8%. Moreover, the proportion of the number of transactions is even higher, 77.85%.

By analyzing the collected data we realized that some stocks had less than 20 weekly trading data in the observed period. These stocks have been removed from the sample. In the end 22 stocks from the SASE represented the Bosnian equity market.[5]

Since the German equity market is large, we have selected 50 stocks from 9 different industries, which adequately represent the German market. There is much evidence that the risk of a portfolio of 40 even randomly selected stocks consists only of market (diversifiable) risk, (Sharpe, 1964).

According to the aim of this research, we have divided the observed period into three time samples:

- January 2006 – January 2008, the period before the crisis,
- January 2008 – January 2010, the period during the crisis,
- June 2009 – June 2011, the period after the crisis.

There is a 6 month overlapping period in 2009, due to the fact that the German economy started recovering in 2009. In addition, in this way we managed to divide the 5.5 year-long period into three equally long sub-periods; each sample consists of 104 data.

4. RESULTS

In order to test the diversification possibilities between the German and Bosnian equity markets in the observed sub-periods, we form MV efficient portfolios of sample stocks from the FSE and test the effects of

2 Sarajevo Stock Exchange: www.sase.ba (accessed in October 2011)

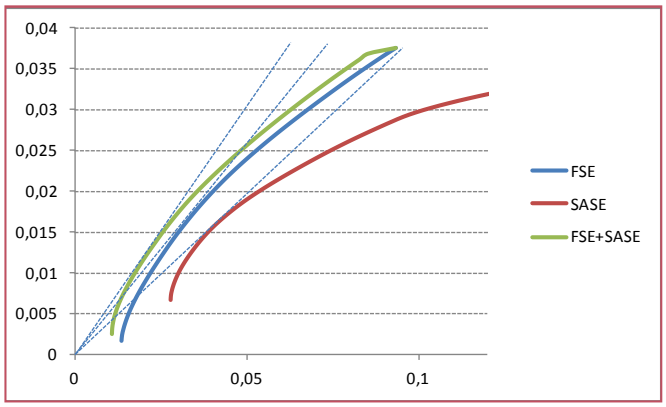
3 Yahoo Finance: www.yahoofinance.com (accessed in October 2011)

4 We found it inappropriate to use only stocks included in indices from the SASE in our analysis because of the mean-variance inefficiency of indices found in previous studies (Arnaut-Berilo, Zaimović, 2012).

5 The missing data were supplemented by the last occurring price. The stocks with sufficient liquidity had normally distributed returns, at the same time.

spreading out the investments to the sample stocks from the SASE in Figures 2, 3 and 4.

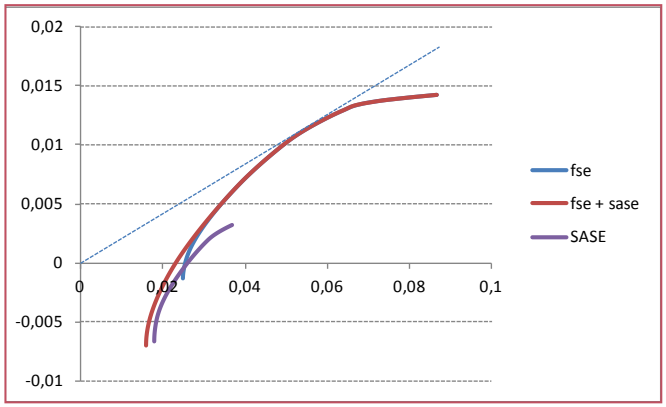
Figure 2: Efficient portfolios in pre-crisis period



Source: Authors from the official stock exchanges databases, using own portfolio optimization software

We use Sharpe ratio (SR) in measuring efficient portfolio performances, assuming that the risk free rate is zero[6], i.e. the capital market line drawn from the coordinate origin, (0.0). In addition to the graphical interpretation, where we see the efficient lines shift, we have determined the structure of minimum variance portfolios and the structure of portfolios with a minimum value of coefficient of variation[7] (CV). The last portfolios are highlighted as the portfolios with the smallest dispersion from the expected value. In addition, these portfolios show the change of the efficient frontier curvature.

Figure 3: Efficient portfolios in crisis period



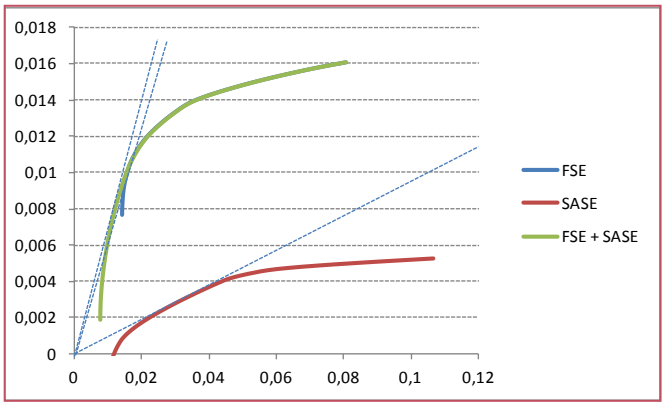
Source: Authors from the official stock exchanges databases, using own portfolio optimization software

6 . Weekly risk-free rates in observed periods are very low, especially in and after the crisis.

7 Portfolio with minimum value of CV has the steepest SR, if the capital market line is drawn from the coordinate origin.

Our results show that the minimum variance of created portfolios is reduced in the case of combining the German with the Bosnian sample stocks in all three sub-periods. In addition, we get more dominant efficient frontiers in the pre-crisis and after-crisis periods.

Figure 4: Efficient portfolios in the post-crisis period



Source: Authors from the official stock exchanges databases, using own portfolio optimization software

In Table 1 we present the minimum variance portfolio characteristic values in all three sub-periods. In addition, we present characteristic values of portfolios with the best risk-return trade-off in Table 2.[8]

We note that in the pre-crisis period there is a benefit in expanding investments from the German capital market to the Bosnian. The minimum portfolio risk decreases from 1.36% to 1.08% if we spread out the investments to 78% (FSE) versus 22% (SASE). The Sharpe ratio of best performing portfolio increases from 0.50 to 0.58.

We found no evidence of diversification possibilities in the crisis period. In this sub-period Bosnian stocks are not included in the optimal portfolio (the portfolio with the steepest Sharpe ratio). Based on this, as well as based on the analysis of Figure 3, we can conclude that the Bosnian market was more affected by the global crisis than the German.

As we can see from the Figure 4 and from Tables 1 and 2, in the post-crisis period the minimum portfolio risk on FSE decreases from 1.43% to 0.8% if we spread out our investment between the German (34%) and Bosnian markets (66%), but portfolio performance is lower. If we spread out our investment between the German (70.63%) and Bosnian markets (29.37%) the best performing portfolio has the Sharpe ratio of 0.66 and we are able to reduce the risk of our investments.

By comparing the results of the pre- and post-crisis

8 The portfolio compositions of minimum variance portfolios in all sub-periods are available from the authors.

Table 1. Min variance portfolio in observed periods

Minimum Variance Portfolio in pre crisis period	FSE	FSE and SASE		
Return	0.001758	0.002452	FSE portion	77.90%
Risk	0.013584	0.010826	SASE portion	22.10%
Sharpe Ratio	0.129414	0.226512		
Minimum Variance Portfolio in crisis period	FSE	FSE and SASE		
Return	-0.0013	-0.007073	FSE portion	34.70%
Risk	0.025019	0.015952	SASE portion	65.30%
Sharpe Ratio	N/A	N/A		
Minimum Variance Portfolio in post-crisis period	FSE	FSE and SASE		
Return	0.007661	0.001899	FSE portion	34.10%
Risk	0.014398	0.007749	SASE portion	65.90%
Sharpe Ratio	0.532099	0.245117		

Source: Authors

Table 2. Characteristic values of portfolios with the highest Sharpe ratio in the observed periods

Max Sharpe ratio	FSE	FSE and SASE		
Return	0.017477	0.014362	FSE portion	63.56%
Risk	0.034846	0.024622	SASE portion	36.44%
Sharpe Ratio	0.501540	0.58332		
Max Sharpe ratio	FSE	FSE and SASE		
Return	0.011208	0.011208	FSE portion	100%
Risk	0.054559	0.054559	SASE portion	0%
Sharpe Ratio	0.205423	0.205423		
Max Sharpe ratio	FSE	FSE and SASE		
Return	0.010014	0.008415	FSE portion	70.63%
Risk	0.015924	0.01275	SASE portion	29.37%
Sharpe Ratio	0.628819	0.659961		

Source: Authors

periods we find different diversification effects. The largest efficient frontier shift is observed in the pre-crisis period, when both markets obtained similar MV efficiency.

In the pre-crisis period the minimum variance portfolio also provided a better Sharpe ratio than the minimum variance portfolio of FSE stocks, in contrast to the post-crisis period when the minimum variance portfolio (consisting majorly of SASE stocks) has a lower Sharpe ratio than the minimum variance portfolio of FSE stocks. Moreover, SASE stocks participate with 29.37% in the portfolio with the steepest Sharpe ratio, created of stocks from both markets as shown in Table 2.

Sharpe ratio is the steepest in the post-crisis period compared to the pre-crisis and crisis periods; during the recovery most stocks tend to perform better.

5. CONCLUSIONS

We have analyzed German and Bosnian equity markets' diversification opportunities before, during and after the global financial and economic crisis. In general, the German equity market is more mean-variance efficient than the Bosnian. The German market, as a mature market, has lower market risk in all of the observed sub-periods, i.e. efficient frontiers are situated more north-west, especially in the post-crisis period. We used Sharpe ratio as a measure of portfolio performance. Based on this measure we find that market risk in the German market ranges from 3.49% in the pre-crisis period, 5.55% in the crisis-period to 1.59% in the post-crisis period, on a weekly basis.

International diversification among analyzed markets brings additional risk reduction. By spreading out investments between the German and Bosnian markets, portfolio risk decreases in the pre-crisis and post-crisis periods. The best risk-return trade-off can be found in the post-crisis period; the minimum variance portfolio's Sharpe ratio is 0.63, while the best performing portfolio has a Sharpe ratio of 0.66. As expected, in the recovery period the expected returns increase.

We find that the recent crisis has affected the Bosnian market much more strongly than the German market. In the crisis, the diversification effects among analyzed markets are negligible, i.e. the German market performed much better. The lack of diversification during the crisis is in our opinion less due to the high integration between analyzed markets than the underperformance of the Bosnian equity market.

Frontier equity markets should be seen as an attractive supplement to investments in mature and developed markets. We found evidence of benefits from international diversification among the German and Bosnian equity markets in the pre- and post-crisis periods.

REFERENCES

Arnaut-Berilo, A., Zaimović, A. 2012. "How efficient are Bosnian stock market indices?" Eastern European Economics Journal, M. E. Sharpe, 50 (1): 26-45.

Arshanapalli, B., Doukas, J. 1993. "International Stock Market Linkages: Evidence of Pre- and Post-October 1987 Period" Journal of Banking & Finance, 17 (1): 193-208.

Bekaert, G., Harver, C. R. 1995. "Time-varying world market integration" The Journal of Finance, 50 (2): 403-444.

Dickinson, D. G. 2000. "Stock Market Integration and Macroeconomic Fundamentals: An Empirical Analysis", Applied Financial Economics, 10 (3): 261-276.

Dumas, B., Solnik, B. 1995. "The World Price of Foreign Exchange Risk", Journal of Finance, 50 (2): 445-479.

Fratzscher, M. 2001. "Financial Market Integration in Europe: on the Effects of EMU on Stock Markets", Working Paper 48, European Central Bank

In, F., Kim, S., Yoon, J. H. 2002. "International Stock Market Linkages: Evidence from the Asian Financial Crisis", Journal of Emerging Market Finance, 1: 1-29.

Korajezyk, R. 1995. "A Measure of Stock Market Integration for Developed and Emerging Markets", Policy Research Working Paper 1482, World Bank

Markowitz, H. 1952. "Portfolio Selection", Journal of Finance 7 (1): 77-91.

Markowitz, H. M. 1991. Portfolio Selection, Blackwell Publishing

Masih, A. M. M., Masih, R. 1997. "A Comparative Analysis of the Propagation of Stock Market Fluctuations in Alternative Models of Dynamic Causal Linkages", Applied Financial Economics, 7 (1): 59-74.

Sharpe, W. F. 1964. "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk", The Journal of Finance, 19 (3): 425-442.

Srivastava, A. 2007. "Cointegration of Asian Markets with US Markets: International Diversification Perspectives", Global Business Review, 8: 251-265.

Vizek, M., Dadić, T. 2006. "Integration of Croatian, CEE and EU Equity Markets: Cointegration Approach", Ekonomski pregled, 57 (9-10): 631-646.

Zaimović, A., Delalić, A. 2010. "Possibilities of Risk Diversification in Regional Stock Exchanges", Ekonomska istraživanja 23 (1): 30-46.

Internet pages:

(Sarajevo Stock Exchange, http://www.sase.ba, October 2011)

(Frankfurt Stock Exchange, http://deutsche-boerse.com, October 2011)

(Yahoo Finance, http://finance.yahoo.com, October 2011)

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