

The Impact of the Global Pandemic Crisis on East and Central EU Stock Markets

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Abstract

Our research is based on an examination of capital market dynamics in four European countries, namely Poland, Romania, Hungary, and the Czech Republic, during the pandemic crisis. The paper is divided into two parts and examines the relationship between macro-financial variables and the major stock market indices of Western European (UK, Germany, and Austria) and Eastern European markets. The analysis is based on the use of the autoregressive vector model (VAR), which shows that during the global pandemic crisis, macroeconomic factors had a significant impact on the financial performance of Eastern European countries' financial markets. In the second part, the correlation of the yields of the stock indices from the countries of Western and Eastern European countries is analyzed, using the multivariate GARCH model.

Key words: stock indices, VAR model, conditional correlation, capital markets, Euro zone

J.E.L. classification: G15, F36

1. Introduction

The health crisis caused by the pandemic of 2020-2021 has resulted in high volatility on financial markets, with transmission from the American and British markets to those of Europe, Australia, and Singapore.

The transmission effect of cash flows and discount rates generated by the dependence between macroeconomic variables and stock returns influenced stock prices.

In Central and Eastern Europe, research on the evolution of financial markets was based on the comparison of macroeconomic variables and stock market returns, analyzed using VAR and VECM research and modeling structures. These models of analysis were found in the articles of the economists Horobet, Dumitrescu, 2009, and they are also found in other research works made by Condic, 2011; Kyzis, Pierdzioch, 2011; Al. -Jafari et al., 2011; Corradi et

The macroeconomic expectations generated by the evolution of the share price manifested themselves in the analysis of interest rates and financial sector risk. There are different levels of financial market return, according to Campbell's (1997) theory. With the caveat that the strong form is not a viable formula.

The study drew on literature from all fields of finance to assess the efficiency of financial markets in Central and Eastern Europe. The study is based on the markets of Poland, Hungary, and the Czech Republic, which have all completed a strong process of financial integration. Based on the assumption that financial market integration is high, it was concluded that the degree of correlation with the capital markets of Western European countries has reached a high level, which was felt even after the crisis.

Our study was based on an examination of the evolution of correlations between capital markets in Western Europe and capital markets in Eastern Europe. The impact of various macroeconomic indicators on capital market indices was also examined.

Our research confirms the close correlation between the capital markets of Eastern European countries and the international capital markets, which was felt as a result of the interconnections on both fundamental economic indicators and the speculative market generated by the market game during the 2020 pandemic crisis.

Even in these circumstances, the interconnectedness of financial markets has demonstrated that the integration process is positive, dynamic, and difficult to quantify, as evidenced by the use of empirical methods in market analysis.

Stock market returns exhibit high volatility under these conditions. To demonstrate the spread of volatility on the markets, the methods DVECH, BEKK, and the multivariate GARCH model were used.

2. Literature review

Our research on the integration of strong financial markets drew on a wide range of literature and was based on an examination of the correlation between the American and European stock markets. Karunanayake et al. (2010) conducted an analysis of the correlation between developed countries and Asian markets using a VECH diagonal model, which confirmed that the global pandemic crisis of 2021 has achieved a volatility transfer between these markets.

Xiao and Dhesi's (2010) VECH, BEKK, and Dynamic Conditional Correlation models assisted us in investigating the transmission of volatility and correlations of conditioned variables between markets in the United States and Western Europe before and after the crisis. While the UK was found to be an indicator of volatility between Europe and America, Germany and France were found to be closely correlated, indicating a high degree of interdependence.

In research, we typically use the multivariate GARCH model to examine the conditionality correlation between different markets. The conditional correlation between capital market performance and macroeconomic indicators can also be studied using this model. De Goeij and Marquering (2004) extended the VECH model to include asymmetric effects in covariates, provided the residues had the opposite sign. This type of asymmetric diagonal model has also been used to simulate the interaction of bond yields and equity prices. According to the modeling, there was a strong contagion effect in the case of negative shocks to the stock and bond markets in the case of the 2020-2021 pandemic crisis.

Lim and Brooks (2010) examined a sample of 50 markets and concluded that crisis volatility has a negative impact on GDP per capita. The Hurst coefficient (Caraianni, 2012), which was used to measure the variations in stock yields for the appreciation of multifractality in financial yields, revealed that the coefficient was extremely high during the pandemic crisis 2020-2021.

The dynamics of financial market returns were examined using methods of analysis and modeling for both interdependence and causality discovered in his research: Escanciano and Velasco (2006), Todea and Lazar (2012), and Karadigli and Donmez (2012). In addition, the component of integrability was examined using an appropriate test known as Engle-Granger, which was discovered in the literature (Nistor, Dumitriu, Stefanescu, 2012; Harrison, Moore, 2010). (Dajcman, Festic, Kavkler, 2012).

Petrowski and Horvath (2012). The VECH and BEKK diagonal models were also used to compare stock market movements in Western, Central, and Eastern European countries between 2011 and 2020. According to the study, there is a stronger correlation between Central Europe and developed countries, and the crisis has not changed the degree of integration of the European financial market.

Égert and Kocenda (2011) used a Dynamic Conditional Correlation Model to analyze 5-minute intraday movements between Western and Central European countries from 2006 to 2011. The results showed that there were significant correlations between developed capital markets and weak correlations with capital markets in Central and Eastern Europe, with the exception of Hungary, which showed a higher correlation trend. Aslanidas and Savva (2011) found an average degree of correlation between the yields of stock indices in Hungary, the Czech Republic, and Poland and the eurozone index between 2020-2021 and 2020 using VAR. The GJR-GARCH and STCC (conditional smooth transition correlation) models were used to identify the increase in correlation for the three countries beginning in 2020. While in Central Europe, the transition was gradual,

except in the Czech Republic, where financial integration was more rapid. Novotny (2010) obtained similar results when analyzing stock price increases.

Guido and Gupta (2010) used a VAR model and a multivariate GARCH model to conclude that there was a strong link between Western European markets and the three CEE countries between 1999 and 2009. Hansen demonstrated series co-integration, with an interruption in August 2020. The findings also revealed that correlations increased after Eastern European countries joined the EU.

3. Research methodology

Xiao and Dhesi (2010) used the VECM, BEKK, and Dynamic Conditional Correlation models to investigate transmissible volatilities and variable correlations between developed and Eastern European capital markets prior to the crisis. According to research, there is a strong correlation between Western European countries and a weak correlation between Eastern European countries, with the United Kingdom serving as an indicator of volatility between the US and European markets.

Conditional correlation analysis was performed using GARCH multivariate models. The same models were also used to investigate the relationship between macroeconomic indicators and capital market returns. De Goeij and Marquering (2004) extended the diagonal VECM model to include asymmetric effects when the results were of the opposite sign.

The weekly closing prices of the major western stock exchanges, such as the DAX, FTSE, and ATX, as well as the Morgan Stanley Capital International indices, served as the statistical basis for the study. EMEE emerging markets indices, as well as EM emerging market indices The weekly closing prices on the stock exchanges of the Czech Republic, Poland, and Hungary were used for long-term research of the CEE Eastern European financial markets.

The Romanian market, which later became a member of the EU, was also examined. The information was obtained from DataStream between July 2020 and June 2021.

For developed-country capital markets, the EAFE index was used. The FRED databases were used to obtain weekly statistical data for macroeconomic indicators, specifically the price of oil (WTI) and the price of gold.

4. Findings

Because VAR is an atheoretical model, we built the VAR model step by step. The following variables were employed: To begin, we looked at stock index returns such as the FTSE, DAX, ATX, MSCI for the European market (EAFE), MSCI for emerging Eastern European markets (EMEE), and MSCI for emerging markets. The spread between long-term and short-term interest rates, as well as the exchange rates for European and American currencies.

Except for one, all unit root tests (ADF and PP) revealed that all series were I (1). (0). The MSCI, EAFE, EMEE, and EM indices are collinear, so they cannot be used in step regression at the same time.

The results of the gradual regressions revealed that dynamic regressions use all three MSCI indices.

Our research shows that the indices' yields are important for other countries, but they do not correspond to the indices of the Eastern European stock exchanges, and the indices of the Bucharest BET stock exchange do not correlate with the indices of the Central European stock exchanges in Prague, Budapest, and Warsaw. 2020-June 2021. Our findings show that the indices (BET, BUX, PX, and WIG) are related to their own exchange rates; the interdependence will be investigated further using a multivariate model.

With the exception of the Warsaw stock exchange, which aspires to be a regional leader, the Austrian financial market, through the ATX index, has a significant interdependence with the European regional indices BET, BUX, and PX. This is supported by its close ties with the Frankfurt Stock Exchange (DAX), whereas Prague is influenced more by the London Stock Exchange (FTSE).

The capital markets of Hungary, Poland, and Romania are correlated with the MSCI EM index; gold yields affect both WIG and BET, while oil yields affect only WIG, TB3M only PX, and SPREAD only BET. EAFE regression results were compared.

For the four indices performed over six subperiods, several VARs were used. The variance decomposition was used to examine the effects of the shocks on index yields.

According to research on variance decomposition results, the influence of own shocks is weak during times of crisis, with VAR4 as the appropriate VAR for the fourth subperiod, when exchange rates, shocks in neighboring countries, and macroeconomic variables had a greater impact.

During the pandemic, the shock rate was higher in all three CEE countries, including Romania. External factors created a high level of shock for Romania during the crisis.

Because the normality tests for VAR (Lutkepohl, 1991) revealed that the results were heteroskedastic, we adapted the index yields in a multivariate GARCH framework to account for the effects of volatility spread in Eastern European countries.

The study of the conditional correlations of stock yield with macroeconomic data included six goods in each model because empirically, models with multiple assets were flawed. Four country indices and a combination of macroeconomic data were included in each adapted multivariate GARCH model, either diagonal VECH or BEKK.

The research findings were compared using the AIC information criteria, and it was determined that the BEKK models produced positive results. The matching of the models was investigated using a graphical representation of the standardized residue quantities. The findings revealed that the fat tails were not properly captured. A Student distribution of errors was used to solve part of the problem.

The conditional correlations between Central and Eastern European stock markets were examined, as well as the conditional correlation between the four EEC countries and the EAFE index.

The correlation was given a significance level of 0.4, with values above 0.9 interpreted as crises affecting all markets at the same time, or as a false correlation. There is empirical evidence that the multivariate GARCH model occasionally produces such a false correlation (Fuss and Gluck, 2012). Because both the DVECH and the diagonal BEKK models produced the same strong correlation, and because the strong conditional correlation results were associated with market information at the time, it was concluded that the correlations were not false and contributed to market integration.

We can conclude from the conditioned correlation research that, while dynamic, they exhibit long-term memory models or long clusters of dynamic volatility.

The dynamics of the correlation between BUX, PX, and WIG show that their capital markets had a strong correlation even before joining the EU, with an average of 0.5, and that after May 2020, the correlation increased to an average of 0.6, with WIG and BUX having the highest correlation. Before the crisis, the correlation between these three CEE countries was 0.7 on average, with a decrease between 2020 and 2021 and a correlation of over 0.75 after May 2021. At the same time, we discovered that prior to accession. In the EU, the correlation with EAFE was negligible at first, but it quickly became strong.

On the Romanian capital market, the conditional correlation with the Czech Republic, Hungary and Poland became strong only after joining the EU. BET's correlation with EAFE only became strong with the onset of the global financial crisis.

The overall structure of capital markets in Central and Eastern Europe showed a significant upward trend prior to the crisis, followed by a sharp decline during the crisis and a return to a slightly higher correlation after the crisis.

It was discovered that the Austrian index (ATX) is closely linked to BUX and PX, while the correlation with the Warsaw Stock Exchange is lower, and the Bucharest Stock Exchange has a low correlation, around 0.4, barely significant, with Pre-accession ATX.

Although the oil price was correlated with the EAFE index, the correlation increased after the crisis began in 2020 and increased significantly after the crisis ended. The BET index's correlation with oil increased during the financial crisis and then decreased. The model is similar to other regional stock exchanges.

The euro-dollar exchange rate jumped in correlation with all regional stock exchanges during the financial crisis, but in the post-crisis period the correlation became insignificant and remained so until May 2021, when it began to correlate again, a behavior that could be explained by the escalation of the sovereign debt crisis. The BET index has an inverse relationship with the EUR/RON exchange rate.

5. Conclusions

Our study looks at the evolution of the yields of four Central European indices before and after their membership in the European Union, as well as before and after the global pandemic crisis. The analysis spans two years, from 2020 to 2021, and is divided into six subperiods to provide a better understanding of index performance shocks.

The Czech Republic, Hungary, and Poland joined the European Union in May 2004, while Romania joined in January 2007. They examined the co-movements of stock index yields in the selected countries. First, the analysis was carried out using a vector autoregression model, and the impact of shocks on variance decomposition was assessed. The presence of heteroskedasticity in residues suggested using GARCH multivariate to account for fat tails and data grouping volatility. Two multivariate GARCH models, a diagonal VECH and a diagonal BEKK, each with a multivariate Student error distribution, were used.

Shock effects on index yields were measured using variance decomposition and impulse response. The variance breakdown for the six subperiods revealed that the index's own shocks had a significant influence during the crisis, when the shocks were strong on other variables such as the exchange rate and neighboring stock indices.

After May 2020, the Czech Republic was officially declared to be in recession, and it was discovered that the change in stock yields was similar to the change during the pandemic crisis, when yields were extremely vulnerable to external factors.

The VAR models, as well as the VECH diagonal and BEKK diagonal models, were registered in CEE countries, and they achieved a high increase in conditional correlations for all ECE stock market indices during the 2020-2021 pandemic crisis, followed by a decrease in correlation to the end of the crisis.

The BEKK model demonstrated the transmission of the shock waves of the sovereign debt crisis across the entire region in the following period.

The study found that, while there were no conditional correlations between the stock market indices of the Czech, Hungarian, and Polish capital markets and the main Western European indices prior to EU accession, the conditional correlations became significant after EU accession.

The Romanian capital market was significantly linked with the other three Central and Eastern European countries shortly before EU integration, and it has since been on an upward trend. Only at the start of the global financial crisis did the BET index become correlated with the EAFE index.

The effects of volatility on regional capital markets are limited by correlation jumps of approximately or greater than 0.9. The increases corresponded to international capital market uncertainties and were correlated with negative news that hit all capital markets at the same time. The end of the crisis was marked by a process of returning to a dynamic unique to each stock market in Central and Eastern Europe.

Our research's final conclusions highlight the Romanian capital market's vulnerability during adverse financial shocks, necessitating dynamic measures to protect it. Romania's capital market has developed interconnection with regional capital markets since joining the EU. However, the free flow of speculative capital made the Romanian capital market more vulnerable to financial shocks and weakened its resistance. The Romanian capital market was more vulnerable during the 2008 financial crisis than other CEE capital markets. Short-term capital inflows can have a negative impact on long-term development because they promote volatility, which can destabilize domestic investors.

6. References

- Al-Jafari, M.K., Salameh, R.M., Habbash, M.R., 2011. Investigating the Relationship between Stock Market Returns and Macroeconomic Variables: Evidence from Developed and Emerging Markets. *International Research Journal of Finance and Economics*, Issue 79, pp. 6-29.
- Aslanidis, N., Savva, C.S., 2011. *Are there still portfolio diversification benefits in Eastern Europe? Aggregate versus sectoral stock market data*. The Manchester School 79.6 (2011), pp. 1323-1352.
- Barbic, T., Condic-Jurkic, I., 2011. Relationship between macroeconomic fundamentals and stock market indices in selected CEE countries. *Ekonomski Pregled* no. 62 (3-4), pp. 113-133.
- Bauwens, L., Hafner, C. M., Rombouts, J. V., 2007. Multivariate mixed normal conditional heteroskedasticity. *Computational Statistics & Data Analysis*, 51(7), pp. 3551-3566.
- Büttner, D., Hayo, B., Neuenkirch, M., 2009. *The Impact of Foreign Macroeconomic News on Financial Markets in the Czech Republic, Hungary, and Poland. Joint Discussion Paper Series in Economics*, Universities of Aachen, Gießen, Göttingen, Kassel, Marburg and Siegen no. 3/2009
- Caraianni, P., 2012. Evidence of Multifractality from Emerging European Stock Markets. *PLoS ONE* Vol. 7, no. 7, e40693. doi:10.1371/journal.pone.0040693.
- Corradi, V., Distaso, W., Mele, A., 2012. Macroeconomic Determinants of Stock Market Volatility and Volatility Risk-Premiums. *Swiss Finance Institute Research Paper Series* No. 12 – 18, pp. 1-66.
- Dajcman, S., Festic, M., Kavkler, A., 2012. Comovement Dynamics between Central and Eastern European and Developed European Stock Markets during European Integration and Amid Financial Crises – A Wavelet Analysis. *Engineering Economics*, 2012, Vol. 23(1), pp. 22-32.
- De Goeij, P., Marquering, W., 2009. Stock and Bond Market Interactions with Level and Asymmetry Dynamics: An Out-of-Sample Application. *Journal of Empirical Finance*, Vol. 16, pp. 318-329.
- Égert, B., Kocenda, E., 2011. Time-Varying Synchronization of European Stock Markets. *Empirical Economics*, 40(2), pp. 393-407.
- Fuss, R., Gluck, T., Mutl, J., 2012. Spurious dynamic conditional correlation. *European Business School Research Paper* No.11,11.
- Guidi, F., Gupta, R., 2010. *Cointegration and conditional correlations among German and Eastern Europe equity markets*. Munich Personal RePEc Archive, MPRA Paper No. 21732.
- Harrison, B., Lupu, R., Lupu, I., 2010. Statistical Properties of the CEE Stock Market Dynamics. A Panel Data Analysis. *The Romanian Economic Journal*, Year XIII, No. 37, pp. 41-57.
- Harrison, B., Moore, W., 2010: *Non-Linear Stock Market Comovement in Central and East European Countries*. CICM Conference, vol. 20, pp. 1-42.
- Horvath, R., Petrovski, D., 2012. *International Stock Market Integration: Central and South Eastern Europe Compared*. William Davidson Institute Working Paper No. 1028.
- Karadigli, E.C., Donmez, M.G., 2012. A Nonlinear Analysis of Weak Form Efficiency of Stock Index Futures Markets in CEE Emerging Economies. *International Research Journal of Finance and Economics*, Issue 95, pp. 61-71.
- Karunanayake, I., Valadkhani, A., O'Brien, M., 2010. *An Empirical Analysis of International Stock Market Volatility Transmission*. University of Wollongong Economics Working Paper Series, WP 10-09, pp. 1-21.
- Kizys, R., Pierdzioch, C., 2011. The Financial Crisis and the Stock Markets of the CEE Countries. *Czech Journal of Economics and Finance*, 61, No. 2, pp. 153-172.
- Kobialka, M., Koivulehto, H. K., 2011. International cross-listings on CEE-stock exchanges. *International Journal of Banking, Accounting and Finance*, Vol. 3, No. 1, pp. 73-90.
- Králik, L.I., 2012. Relationship between Macroeconomic Variables And Stock Market Returns On Bucharest Stock Exchange. *Metallurgia International*, No. 08/2012, pp. 127-132.
- Lutkepohl, H., 1991. *Introduction to multiple time series analysis*. Berlin: Springer-Verlag.
- Todea, A., Lazar, D., 2012. Global Crisis and Relative Efficiency: Empirical Evidence from Central and Eastern European Stock Markets. *The Review of Finance and Banking*, Vol. 04, Issue 1, pp. 45-53.
- Tudor, C., 2011. Time varying causality between stock exchanges in the CEE region. *International Journal of Applied Mathematics and Informatics*, Issue 2, Vol. 5, pp. 27-34.
- Valdes, A.L., Vazquez, R.D., Fraire, L.A., 2012. Conditional Correlation between Oil and Stock Market Returns: The Case of Mexico. *The Mexican Journal of Economics and Finance*, Vol. 7, No. 1, pp. 49-63.
- Xiao, L., Dhesi, G., 2010. Volatility spillover and time-varying conditional correlation between the European and US stock markets. *Global Economy and Finance Journal*, Vol. 3, No. 2, pp. 148-164.