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STOCK MARKET INTEGRATION IN CENTRAL AND EASTERN EUROPE

Summary: In this paper we analyze stock market integration across a few CEE countries by estimating the series of regressions of the single-index Sharpe model type. We use MSCI country and regional indices to capture the size of the market (common) risk in the variance of national returns. Our results are somewhat surprising. We note the significant improvement at the stock market integration over the last years. However, the cross-country approach reveals the degree of market integration to be unrelated to the process of political and economic European integration. The results may be useful for both portfolio managers and to some extent for monetary authorities.

Keywords: stock market integration, diversification gains, common monetary policy.

1. Introduction

Financial market integration can be defined in several ways. One of the most common definitions quoted in the literature simply states that financial markets are integrated when the law of one price holds [Jappelli, Pagano 2008]. In other words, the cost of debt and equity capital is not determined by the country specific factors. For the last decade the process of financial market integration has been carefully monitored by the government agencies and independent researchers. The reasons of this increased interest are as follows:

– integrated financial markets create new opportunities, but also new threats;
– successful monetary integration, like establishing the Eurozone, requires integrated financial markets.

We will discuss briefly the theoretical considerations regarding these two views.

The benefits of financial integration involve improved international risk-sharing, more efficient capital allocation and the support for economic growth [Baele *et al.* 2004]. When investors are able to allocate their funds cross-country, the idiosyncratic risks are diversified away resulting in the improvement of risk-return relationship of the investment portfolios. In a macro scale, this phenomenon should therefore result in the inter-temporal smoothness of the consumption level. International investment opportunities, due to the elimination of capital flows restrictions, provide funding

for the most productive projects independent of their location. Last not least, there is also a causal relationship between financial integration and economic growth. Enhanced integration by increasing capital flows in some regions leads to financial sector development, which further support economic growth. This point of view, where creation of financial institutions and markets leads to growth in real sphere is known as "supply-leading hypothesis", was labeled by Patrick [1966]. He proposed also competing hypothesis, i.e. "demand-following", in which financial development is a passive response to economic growth. As Patrick [1966] noted, the causal role of financial sector better describes situation in underdeveloped economies and further economic growth usually reverses the causality direction. The empirical results of the numerous studies verifying these hypotheses have been summarized in Levine [1997] and Wachtel [2001].

The cost of higher integration is usually associated with a possible contagion effect during financial crisis. However, one should be able to distinguish observed financial markets co-movement that is due to interdependence in real sphere from the one that cannot be explained by the macroeconomic linkages because cause only the latter constitutes contagion [Forbes, Rigobon 1999].

Financial markets integration is also crucial for effective monetary transmission process in the Eurozone as monetary policy is implemented through the financial system. In the common currency area smooth transmission is possible only when the short- and long-term interest rates are highly cross-country correlated. Many empirical studies confirm that money and bonds markets in the Eurozone exhibit a fair degree of integration [Baele *et al*. 2004; Jappelli, Pagano 2008].

To a lesser extent, a high correlation of stock returns across local markets may also be beneficial for European Central Bank (ECB) policy. Besides operating via interest rate channel, stock prices play also some role in a monetary transmission process. Altissimio et al. [2005] list four channels through which stock prices can be considered to affect activity: (1) the wealth effect on consumption, (2) the Tobin's Q effect on investment, (3) the balance sheet effect on private spending (via the credit channel) and (4) the confidence effect on private spending. However, in the case of Eurozne, the empirical studies do not find equity channels to be significant in the overall transmission process which is still mostly determined by an interest rate channel [Elbourne, Salomons 2003; European Central Bank 2010]. On the other hand, stock market perfomance may also be interesiting from the point of view of ECB because equity prices may be useful in forecasting output fluctuations [Henry *et al*. 2003]. The identified convergence or divergence of the stock market cycles may deliver additional conclusions for the monetary policy-making process in the Eurozone.

The aforementioned arguments lead us to the conclusion that measuring stock market integration is not just another econometric exercise without important practical meaning. Therefore, we would like to verify the degree of CEE countries stock markets integration with the global equity market as well as with the European regio-

nal indices. The obtained results should be useful for analyzing the international diversification potential of the CEE's pension funds portfolios and may provide some insight into the process of monetary integration.

2. Literature review

Because of short time series, the research on stock market integration usually pertains to well developed market economies and covers only a limited number of the CEE's markets. We can distinguish two large groups of papers: firm-level studies and market indices studies.

Brooks and Del Negro [2002] estimated the model with country an industry effects using the sample of 10,000 companies in 42 countries from 1985 to 2002. The weight of industry (common) factors in explaining stocks' returns variation should be interpreted as the degree of integration. Concluding that from the late nineties the industry effects started to dominate the country effects, they confirm the results of Baca *et al*. [2000]. Another finding of Brooks and Del Negro [2002] is that country-specific shocks play a smaller role in explaining equities returns of the companies that are diversified internationally, as measured by the international component of their sales, assets and operating income. Babecký *et al.* [2010], analyzing the integration of the CEE and Eurozone financial markets[1] in the crisis times, observed significant divergence of the national stock markets returns, which they interpreted as growth in home bias effect (i.e. a preference for domestic assets). However, after some time (from the late 2008) Babecký *et al.* [2010] observed the period of "calmdown", when the CEE and Eurozone local equities markets started to drift closer again. The methodology of beta and sigma convergence used in their study was proposed by Adam *et al*. [2002] and has its origins in the economic growth literature [Barro, Sala-i-Martin 1992].

3. Methodology

To verify stock market integration, we utilize in this study the concept of Diagonal Model[2] as proposed by Sharpe [1963] in his seminal work. The model's equation presents as follows:

$$R_i = \alpha_i + \beta_i R_M + \varepsilon_i \tag{1}$$

where R_i is the return of security i, α_i and β_i are the parameters of the equation, ε_i is the error term distributed $N \sim (0, \sigma_\varepsilon)$ and R_M is the return of some index, which may

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[1] The sample consisted of 5 countries: Czech Republic, Hungary, Great Britain, Poland and Sweden.

[2] Diagonal Model is the name proposed by Sharpe [1963]. The other names for this concept that can be found in the literature are Single-Index Model or simply Sharpe's Model.

be the return of "the stock market as a whole, the Gross National product, some price index or any other factor thought to be the most important single influence on the returns of securities" [Sharpe 1963, p. 281].

We adapt the model for our purposes assuming that R_i is the return of national stock index i and R_M is the return of some worldwide or regional equity index. One should note that when model variables are defined as in our case, R_i variation depends on common factors (R_M variation) and idiosyncratic country factors (ε_i variation), which may be further diversified by international assets allocation. Firm level factors are diversified away because R_i is the return for the country-wide index, whereas R_M carries only cross-country common risks, being the return of the well internationally diversified index.

When the classical assumptions of regression analysis are satisfied, the variance of national stock market index is the sum of two components:

$$V(R_i) = \beta_i^2 V(R_M) + V(\varepsilon_i) \tag{2}$$

Now we shall recall once again the definition that financial markets are integrated when the law of one price holds. However, empirical verification of this phenomenon requires specification of the asset pricing model correctly identifying the significant risk factors, which is always a debatable issue [Baele *et al.* 2004]. Therefore, we follow the group of studies that use some alternative tests related to the degree of integration. Bekaert and Harvey [1997], analyzing the emerging equity markets returns, concluded that the proportion of local equity market variance that is explained by common news tends to be positively correlated with the degree of integration. Hence, we propose the following measure of stock market integration (SMI):

$$SMI = \frac{\beta_i^2 V(R_M)}{V(R_i)} \tag{3}$$

The SMI index takes the values between 0 and 1, being the proportion of total R_i volatility explained by the common shocks. The higher the value of SMI index the higher the degree of integration. In this case, where the (1) is the regression with one independent variable, (3) is simply the R^2 determination coefficient of the equation:

$$SMI = \frac{\beta_i^2 V(R_M)}{V(R_i)} = \frac{V(\beta_i R_M)}{V(R_i)} = \frac{V(\beta_i R_M + \alpha_i)}{V(R_i)} =$$

$$= \frac{\sum_{t=1}^{T}((\beta_i R_{Mt} + \alpha_i) - E(\beta_i R_M + \alpha_i + \varepsilon_i))^2}{\sum_{t=1}^{T}(R_{it} - E(R_i))^2} = \frac{\sum_{t=1}^{T}(\hat{R}_{it} - E(R_i))^2}{\sum_{t=1}^{T}(R_{it} - E(R_i))^2} = \frac{\sum_{t=1}^{T}(\hat{R}_{it} - \bar{R}_i)^2}{\sum_{t=1}^{T}(R_{it} - \bar{R}_i)^2} = R^2 \tag{4}$$

4. Data

In this research, we investigate data on US-dollar denominated country and regional stock indices provided by Morgan Stanley Capital International (MSCI). The list of the examined country and regions is following:

– countries: Bulgaria (BG), the Czech Republic (CZ), Estonia (ET), Germany (GER) Poland (PL), Romania (RO), the Ukraine (UA), Slovenia (SL);
– regions: European Monetary Union (EMU), Emerging Europe (EEUR) and World (WRD).

The countries' selection is the result of data availability and the efforts to create the sample of CEE countries, varying in the level of political and economic European integration. Therefore, on the one hand, we have EST and SL, which are the EU and EMU members, whereas, on the other hand, there lays UA. The group of the countries "in the middle" is also not homogenous as there are the countries that accessed EU in the different moments. In this cross-country comparison, GER serves as a benchmark of equity market integration.

We also decided to try different variables representing R_M. Comparing the results of the EMU and EEUR specification, we may asses if the examined local markets follows more the Western or Eastern European stock market trends.

For estimating the set of regressions (1) we used monthly rates of return. In general, the higher frequency data (weekly or daily) is not recommended for international comparisons as the operating hours of local markets differ as well as day-offs due to local holidays. In the case of monthly data this problem seems to be not so relevant [Roulet and Solnik 2000].

The estimation period is not the same for the selected markets as the CEE countries established their stock exchanges in the nineties. The longest dataset describes naturally GER market. Where it is possible, we decided to define sub-periods, in which the last sub-period starts in 2007:02 ending in 2011:01 in the case of the all examined countries. Estimating the model for different sub-periods gives the opportunity to monitor the changes in the integration level through the time. The earlier sub-periods are not the same for the other countries and the only criterion for specifying estimation window was to collect at least 45 observations to receive statistically significant results. We did not try to follow strictly "event-study approach" by specifying the meaningful start and ending points, e.g. EU accession or Euro adoption. As the stock markets are generally forward looking in their nature, we may be quite sure that investors started to price these events much earlier. However, to monitor carefully the process of discounting the future, one would need to estimate the appropriate measure of expectations.

5. Empirical results

We start from the general outlook regressing[3] country rates for the whole available period by WRD returns. As we expected, such specification is not very robust as for the most of the estimated equations the residuals graph and White test indicates the presence of heteroskedasticity in the error terms, which confirms the time-varying degree of stock market integration. For example see the CZ estimation output:

Table 1. The example estimation output for the whole sample period

| Dependent variable: CZ				
Method: Least squares				
Sample: 1995:02 2011:02				
Included observations: 193				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.005123	0.005481	0.934657	0.3511
WRD	0.963008	0.111101	8.667883	0.0000
R-squared	0.282312			
Durbin-Watson stat	2.022484			
White Heteroskedasticity test:				
F-statistic	3.51866 3.518661	Probability		0.031585

Source: author's own study.
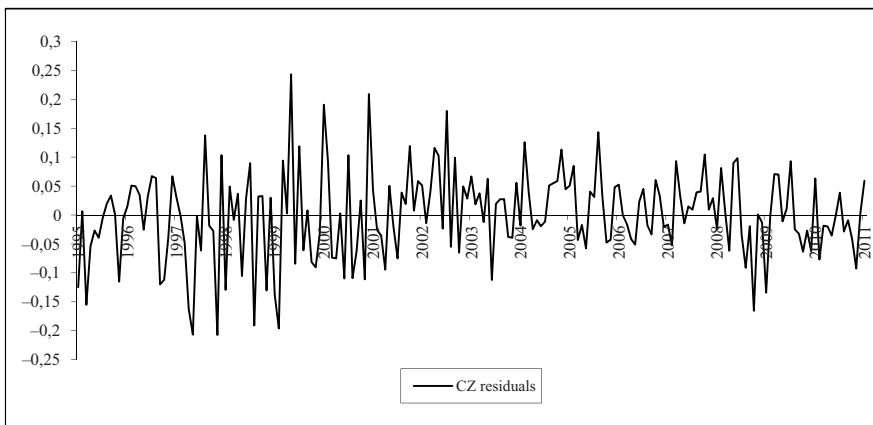
Fig. 1. The example residual graph for the whole sample period
Source: author's own study.

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[3] In all of the discussed regressions in this study we checked the stationarity of the variables. The ADF test did not reject the hypothesis on stationarity in any case.

Therefore, the next step was regressing country returns for a specified sub-periods. The summarized results of WRD specification have been presented in Table 2. To enable the convenient comparison of the of EMU and EEUR specification results, these estimates can be found in Table 3.

Table 2. The SMI index values for the national equity markets (WRD specification)

Country	1st sub-period	2nd sub-period	3rd sub-period
Bulgaria	–	–	*2007:02-2011:02*
	–	–	0.6583
Czech Republic	*1995:02-1999:01*	*1999:02-2007:01*	*2007:02-2011:02*
	0.0982	0.1076	0.7219
Estonia	–	*2002:07-2007:01*	*2007:02-2011:02*
	–	0.2585	0.4038
Poland	*1993:02-1999:01*	*1999:02-2007:01*	*2007:02-2011:02*
	0.1492	0.3849	0.7819
Romania	–	–	*2007:02-2011:02*
	–	–	0.6159
Ukraine	–	–	*2007:02-2011:02*
	–	–	0.5098
Slovenia	–	*2002:07-2007:01*	*2007:02-2011:02*
	–	0.0751	0.4640
Germany	*1990:02-1999:01*	*1999:02-2007:01*	*2007:02-2011:02*
	0.3557	0.7326	0.9207

Comment: in all the estimated regressions, the beta parameter was found to be statistically significant at 5% or 1% level.

Source: author's own study.

The results reported in Table 2 and 3 confirmed time-varying and, what is more important, rising stock market integration. The more detailed analysis presented in Table 3 exhibits also the other important pattern – some of the CEE countries i.e. CZ and PL follow very closely the EMU market trends, hence it looks like the term "emerging markets" in these cases is not so relevant as it was in the past. It is also worth noticing that the difference of the results for EMU and EEUR specifications is not large, which also confirms higher markets co-movement across the world.

Table 3. The SMI index values for the national equity markets (EMU & EEUR specification)

Country	1st sub-period		2nd sub-period		3rd sub-period	
Bulgaria	–		–		*2007:02-2011:02*	
	–	–	–	–	**0.6639**	0.7231
Czech Republic	1995:02-1999:01		*1999:02-2007:01*		*2007:02-2011:02*	
	0.1931	0.3597	**0.1285**	0.3216	**0.7696**	0.7807
Estonia	–		*2002:07-2007:01*		*2007:02-2011:02*	
	–	–	**0.2435**	0.2051	**0.3612**	0.4388
Poland	*1993:02-1999:01*		*1999:02-2007:01*		*2007:02-2011:02*	
	0.0803	0.2233	**0.4503**	0.4196	**0.8183**	0.7501
Romania	–		–		*2007:02-2011:02*	
	–	–	–	–	**0.6546**	0.6578
Ukraine	–		–		*2007:02-2011:02*	
	–	–	–	–	**0.4276**	0.6026
Slovenia	–		*2002:07-2007:01*		*2007:02-2011:02*	
	–	–	**0.0981**	0.0020	**0.4810**	0.5997
Germany	*1990:02-1999:01*		*1999:02-2007:01*		*2007:02-2011:02*	
	0.8131	0.1579	**0.9230**	0.3923	**0.9598**	0.7618

Comment: in all the estimated regressions, the beta parameter was found to be statistically significant at 5% or 1% level. The EMU specification results are bolded.

Source: author's own study.

6. Conclusions

As we expected, the rising stock market integration has been confirmed. However, the cross-country comparisons are a bit surprising for us. We found that countries (Estonia, Slovenia) being highly integrated with Europe in economic and political sense, received one of the lowest values of the SMI index. This finding naturally leads us to ask the question about a possible explanation. We think that in this case market liquidity matters. We propose to take a quick look on the yearly turnover data of the examined stock exchanges (see Figure 2).

The difference between the turnover level for PL and CZ markets, which exhibits the highest degree of integration and the rest of the group is appealing. Markets with higher turnover should attract more foreign institutional investors because only liquid markets give a chance to close out a position at a reasonable price. However, the causal relationship between market liquidity and integration as well as the link between foreign investors and liquidity are only hypotheses, which need much deeper

investigation. It would be especially interesting to find out what is the direction of causality between foreign investors and liquidity and if this relationship is stable over time.
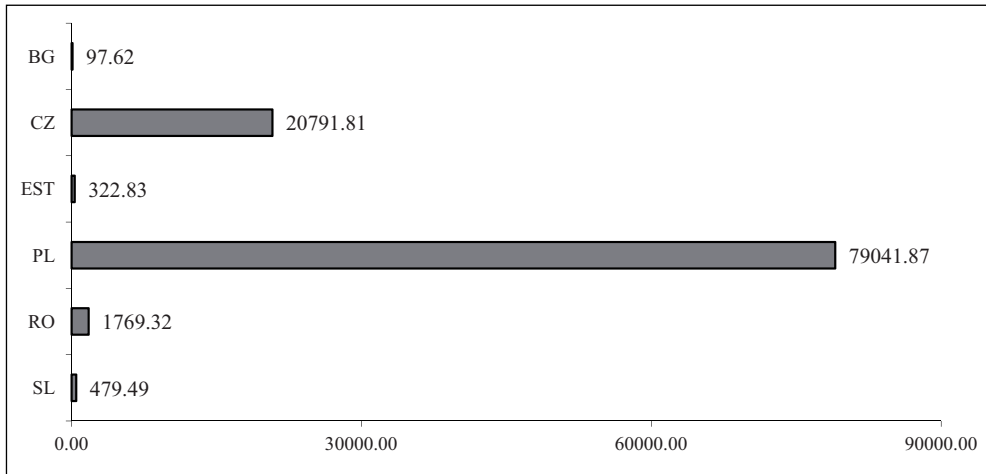

Fig. 2. Equity markets turnover for 2010

Comment: turnover in million USD.

Source: author's own study based on the data provided by the stock exchanges websites. For Ukraine, the data was unavailable.

Another conclusion emerging from the present research may be important for governments and pension funds portfolio managers. In the countries with highly integrated markets, the marginal diversification gains from international allocation are limited. In such conditions the sector (industry) diversification should dominate the portfolio choices. Therefore, increasing the limits for foreign investments of the pension funds makes sense only when the local markets are not deep enough and the risk of speculative bubbles rises.

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INTEGRACJA RYNKU AKCJI
W EUROPIE ŚRODKOWO-WSCHODNIEJ

Streszczenie: W artykule podjęto próbę pomiaru stopnia integracji rynków akcji wybranych krajów Europy Środkowo-Wschodniej. W celu kwantyfikacji wykorzystano jednowskaźnikowy model Sharpe'a, dokonując estymacji serii regresji na danych obejmujących krajowe oraz regionalne indeksy MSCI. Wyniki badania stanowią pewną niespodziankę. O ile nie jest zaskoczeniem ogólny trend coraz wyższej integracji, porównania w wymiarze międzynarodowym dają niespodziewane rezultaty. Brak jest bowiem dodatniej korelacji między poziomem integracji europejskiej w wymiarze politycznym i ekonomicznym a oszacowanym stopniem integracji rynków finansowych. Wyniki przeprowadzonego badania powinny być istotne przede wszystkim dla zarządzających portfelami aktywów, lecz również mogą dostarczyć pewnych wskazówek dla władzy monetarnej.