European Research Studies Journal
Volume XXIV, Special Issue 4, 2021

pp. 412-420

The Degree of Integration of the Bulgarian and Croatian Government Bond Markets into the Eurozone Government Bond Market*

Submitted 11/10/21, 1st revision 22/10/21, 2nd revision 14/11/21, accepted 30/11/21

Joanna Bukowska[1]

Abstract:

Purpose: *This paper attempts to answer the question to what degree the bond markets of Bulgaria and Croatia are integrated into the eurozone's government bond exchange market*.
Design/Methodology/Approach: *An econometric model based on the model of beta coefficient evolution is used to analyse the degree of integration of the Bulgarian and Croatian sovereign bond markets into the eurozone government bond market. The model is estimated by means of GARCH. Two separate research periods are adopted: 2003-2021 for Bulgaria and 2006-2021 for Croatia. Monthly data on the yields till buy-out of 10-year Bulgarian and Croatian sovereign bonds are used. The yields till buy-out of 10-year German government bonds serve as the benchmark.*
Findings: *Both the Bulgarian and Croatian government bond markets are integrated into the eurozone sovereign bond market to a low degree.*
Practical Implications: *The results presented in this paper can be employed by economists, politicians, and business practitioners who deal with the integration of financial markets including bond markets.*
Originality/Value: *This study addresses two countries that are aspiring and closest to joining the eurozone, hence research into the degree of integration of their sovereign bond markets into the eurozone market is important.*

Keywords: *Degree of integration, government bond market, model of beta coefficient evolution, GARCH.*

JEL codes: *G10, F15, C10.*

Paper type: *Research article.*

[1]*Ph.D., Department of Finance and Insurance, Kazimierz Pulaski University of Technology and Humanities in Radom, ORCID: 0000-0003-4282-5927.*
E-mail: j.bukowska@uthrad.pl

1. Introduction

A range of studies indicate the degree of integration of financial markets, including sovereign bond markets, into the eurozone market follows only the joining of the euro area by a given country. Some other research points to a growing degree of integration of sovereign bond markets as early as at the stage of joining the European Union.

The law of one price is the starting point for an assessment of the degrees and processes of integration of financial markets, including government bond markets. Practice sees a number of diversions from this theory (Adam *et al.*, 2002). A supplement is proposed, which states that a full integration of financial markets requires several conditions, namely, potential market participants of identical characteristics must be subject to the same rules of trade in financial instruments and/or services in these markets, have equal access to these financial instruments and/or services are treated identically when operating in the market (Baele *et al.*, 2004).

The path to the integration of national financial markets is rather long. The first stage of financial market integration takes place when a country joins the European Union. The next, more advanced stage includes the moment of joining the euro area.

The time necessary to attain a high degree of financial market integration results mainly from the fact the countries joining the European Union differ in their economic potentials, standards of economic and financial development or levels of deficits or public debts. In addition, the degree of their integration is conditioned by a variety of barriers like restrictions to the free flow of capital, different regulations or the asymmetry of information between foreign and domestic investors.

The joining of the euro area, adoption of the single currency, and realisation of the single monetary policy do release the allocating function of the financial markets and the mechanism of economic shock absorption, yet in spite of the elimination of most barriers, the development of a market may still differ from other countries. Therefore, the effects of financial markets integration, including the integration of government bond markets, may emerge after a relatively long time of adjustments.

The degree of international integration of sovereign bond markets is determined by means of (Bukowski, 2020):

Price and yield-based indicators,
News-based indicators,
Quantity-based indicators.

It is the aim of this paper to answer the question, to what degree are the Bulgarian and Croatian sovereign bond markets integrated into the eurozone's sovereign bond market?

2. A Review of Empirical Results

The degree of integration of sovereign bond markets in eurozone and other countries is studied by Abad, P., Chulia, H., Gomez-Puig, M. (2009). They attempt to establish if joining the euro area and the adoption of the single currency are important factors determining the effects of the global and regional risk on the European markets. To this end, they distinguish two groups of countries: those that have and have not joined the euro area. Their research implies the government bond market of the eurozone is weakly integrated into the US market. Mainly local shocks influence the yields on sovereign bonds in the euro area. They additionally show the bond markets of countries outside the eurozone are more exposed to global shocks (from the United States), whereas the yields on sovereign bonds in the euro area countries are largely determined by local shocks (Abad *et al.,* 2009).

The degree of integration of the European sovereign bond markets is also analysed by Christiansen, Ch. (2014). His empirical research points to a high degree of integration of government bond markets of the eurozone members. He proves rating is a major factor affecting the degree of integration of their markets. The lower a rating, the weaker the integration among the particular government bond markets in these countries. If only countries outside the eurozone are taken into consideration, the old European Union members exhibit a greater integration of their sovereign bond markets than new members. The rating has no effect on the degree of integration of sovereign bond markets in these countries (Christiansen, 2014).

Balli (2009) claims sovereign bond markets in European countries are highly integrated as early as the stage of entry to the European Union. The degree of their financial markets' integration grows as the single currency is adopted and the euro area is joined. Nonetheless, the integration of sovereign bond markets in the eurozone cannot be described as complete. The degrees of their integration continue to vary, chiefly because these markets differently respond to global shocks.

Leschinski, Ch., Voges, M., Sibbertsen, P. (2018) demonstrate the Economic and Monetary Union government bond markets have not been integrated at all times. This was true long before the subprime crises and EMU debt. The periods of disintegration usually coincided with bear markets, whereas the degrees of integration of these markets rose in times of prosperity. Their studies show the markets of central and peripheral Europe displayed a high degree of integration. That changed with the arrival of the financial and fiscal crises, with their clear escape towards very secure capital (Leschinsky *et al.,* 2018; 2021).

Abad, P., Chuliá, H., Gómez-Puig, M. (2019) attempt to answer the question if the participation in the euro area is an important factor determining the different impacts of the global and regional risks on the European sovereign bond market. They employ Bekaert's and Harvey's CAPM model (Bekaert, 1995) to study the systemic and idiosyncratic risks. Their results indicate government bond markets of the euro and US markets are poorly integrated. Mainly idiosyncratic risk factors influence the euro area's sovereign bond markets. In addition, the government bond markets in the United States and Germany are integrated into bond markets of euro and non-euro countries to varying degrees. External risk factors have more impact on countries which aren't euro members. The eurozone countries, meanwhile, are only partly integrated (Abad *et al.*, 2009; Gomez-Puig, 2019).

Sensoy, A., Nguyen, D.K., Rostom, A., Hacihasanoglu, E. (2019), have explored the degree of integration of the EMU sovereign bond markets. The analysis detects their nearly perfect integration before the financial and fiscal crisis. That changed with the onset of the crunch, when the structure of integration was seriously undermined. This continues to be reflected in the varying degrees of integration of sovereign bond markets of these countries. The solution to the fiscal problems in Greece has not improved the situation. The different degrees of integration of government bond markets did not relate directly to the particular EMU countries, but rather to their groupings most affected by fiscal performance, the chief cause of sovereign bond market segmentation, and those unaffected by these factors. The study suggests the fundamental ratios have no impact on the degree of integration of EMU sovereign bond markets (Sensoy *et al.*, 2019).

The degree of integration of local government bond markets has also been researched by Bukowski (2011). His results suggest a poorer integration of sovereign bond markets of Poland and the euro area in 2004-2007 and an improved integration in 2008-2009. His studies indicate a persistent considerable difference between the degrees of government bond market integration in Poland and the eurozone (Bukowski, 2011).

3. Statistical Data and Methods

The degree of integration of government bond market is determined by means of the beta coefficient evolution (Bukowski, 2020). Two countries are studied, Bulgaria and Croatia. Two separate research periods are adopted, 2003-2021 for Bulgaria and 2006-2021 for Croatia. Monthly data about yields on 10-year Bulgarian and Croatian government bonds are utilised. The yield till buyout of the 10-year German sovereign bonds serves as the benchmark. All the figures are derived from EBC Statistical Data Warehouse. The model is estimated using GARCH (1.1.).

In order to determine the degree of integration of the Bulgarian and Croatian government bond markets into the euro area sovereign bond market in the research periods, the following regression equation is constructed (Beale *et al.*, 2004):

$$\Delta R_{i,t} = \alpha_{i,t} + \beta_{i,t}\Delta R_{b,t} + \varepsilon_{i,t} \quad (1)$$

where:
$\Delta R_{i,t}$ – the yield variation in the country *i*, in Bulgaria and Croatia, respectively, at the time *t*,
$\alpha_{i,t}$ – constant (intercept),
$\beta_{i,t}$ – the beta coefficient at the time *t* in the country *i* and with reference to the beta value adopted as the benchmark,
$\Delta R_{b,t}$ – the yield variation adopted as the benchmark,
$\varepsilon_{i,t}$ – the economic (idiosyncratic) shock specific for a given country.

It must be pointed out the risk in the government bond market in a given country is identical with the risk in the benchmark country.

$\beta_{i,t}$for the sovereign bond market in the country *i* becomes:

$$\beta_{i,t} = \frac{cov_{t-1}(\Delta R_{i,t} R_{b,t})}{Var_{t-1}(R_{b,t})} = \rho_{i,b,t}\frac{\sigma_{i,t}}{\sigma_{b,t}}$$

where:
$\sigma_{i,t}$ – the standard deviation for the yields in the country *i*,
$\sigma_{b,t}$ – the standard deviation for assets adopted as a benchmark,
$\rho_{i,b,t}$ – the correlation coefficient between yields on assets in the *i*-th country and in the country adopted as a benchmark.

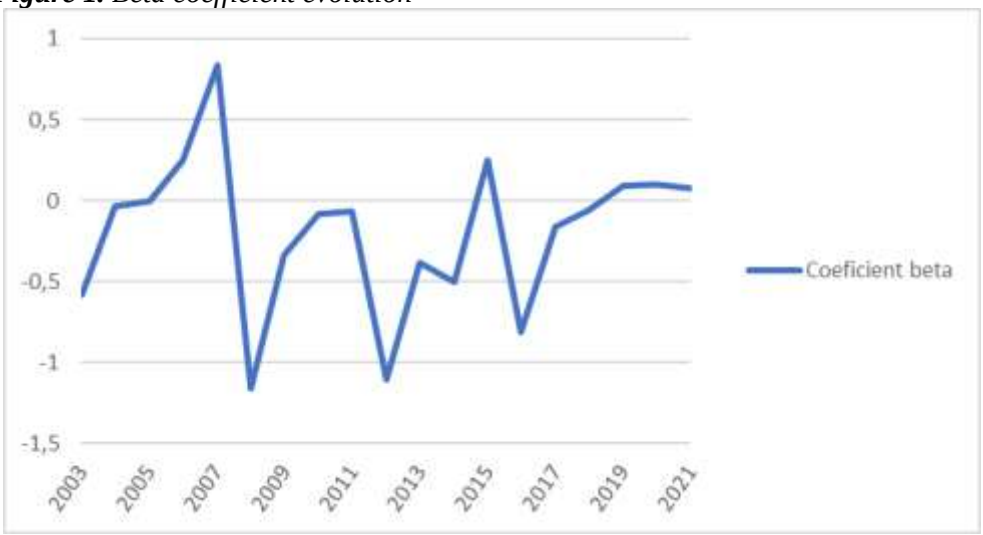
In this case, $\beta_{i,t}$ illustrates the level of integration of the government bond market of the country *i*, respectively, Bulgaria and Croatia, with reference to the sovereign bond market of the country serving as the benchmark, that is, Germany (representative of the government bond market of the euro area). If it is 0, there is no integration of a local sovereign bond market into the eurozone market, whereas the coefficient of 1 denotes a full integration.

In highly integrated financial markets, the intercept $\alpha_{i,t}$ should be close to 0, since in fully integrated markets, yield variations in the country *i* cannot be greater than in a benchmark country. As the degree of integration rises, the value of $\alpha_{i,t}$ should tend towards 0, whereas as the integration diminishes, its value should tend in the other direction.

4. Empirical Results

The beta coefficient indicates a high degree of integration of the Bulgarian sovereign bond market into the euro area market in 2005-2007. The remaining period is characterised by a disintegration of the Bulgarian market.

Figure 1. *Beta coefficient evolution*



Source: *The author's compilation based on the model estimation using GRETL (1.1) – the model of beta coefficient evolution.*

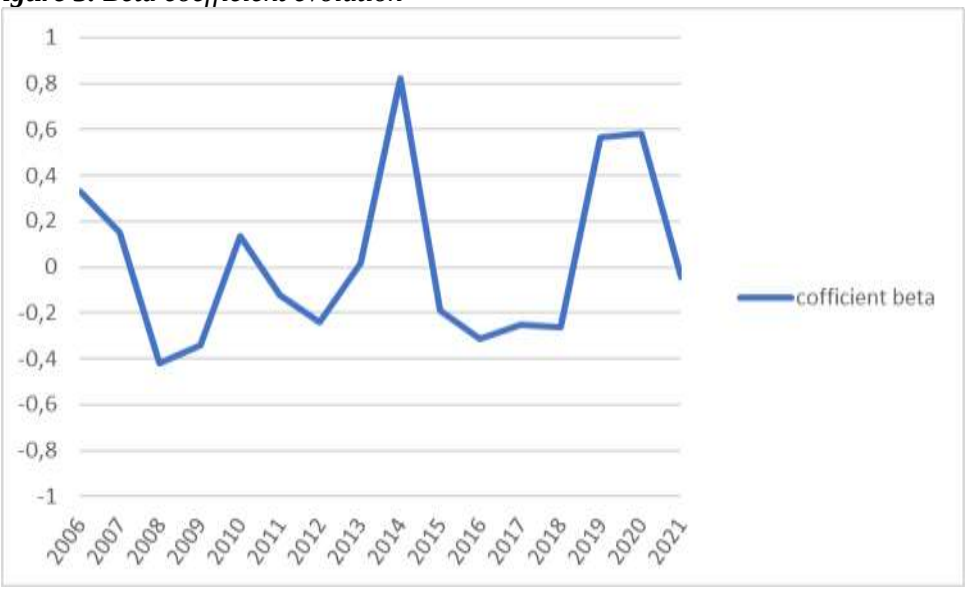
The evolution of the beta coefficient is reaffirmed with that of the intercept.

Figure 2. *Intercept evolution*

Source: *The author's compilation based on the model estimation using GRETL (1.1) – the model of beta coefficient evolution.*

The intercept evolution points to a high degree of integration of the Bulgarian sovereign bond market into the euro area market in 2005-2013 and 2015-2021.

Figure 3. *Beta coefficient evolution*



Source: *The author's compilation based on the model estimation using GRETL (1.1) – the model of beta coefficient evolution.*

In 2013-2015, a high degree of integration of the Croatian sovereign bond market into the euro area bond market could be observed. The integration was rather high in 2019-2020 as well. This is upheld by the evolution of the intercept in that period.

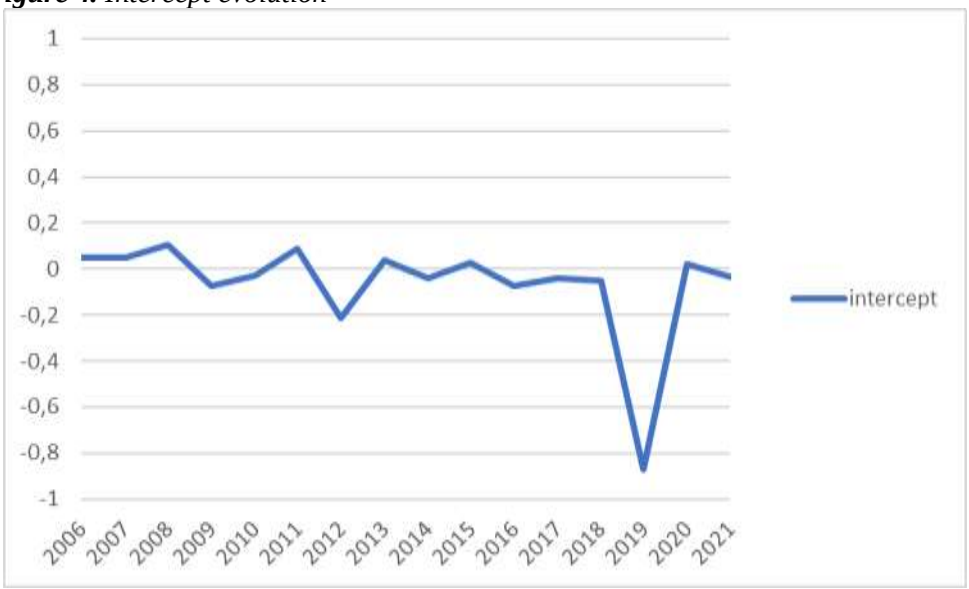
The analysis of the intercept evolution shows the Croatian and the eurozone government bond markets to approach and move away a little from their full integration in 2006-2018. The degree of integration declined dramatically at the turn of 2018 and 2019, to climb back to a high level again in 2020-2021.

5. Conclusion

The results suggest both the Bulgarian and the Croatian sovereign bond markets are relatively weakly integrated into the government bond market in the euro area. A survey of the evolution of the beta coefficient and of the intercept demonstrates a high degree of integration of the government bond market in Bulgaria into the eurozone sovereign bond market in 2005-2007. Both the markets disintegrated in the remaining period of time.

As for the integration of the Croatian sovereign bond market into the government bond market in the euro area, the situation is a little different. A high degree of integration of both these markets was present in 2013-2015 and 2019-2020.

Figure 4. *Intercept evolution*



Source: *The author's compilation based on the model estimation using GRETL (1.1) – the model of beta coefficient evolution.*

References:

Abad, P., Chuli, A H., Gomez-Puig, M. 2009/. EMU and European government bond market integration. European Central Bank, Working Paper Series, No 1079, 7-21.

Baele, L., Ferrando, A., Hordahl, P., Krylova, E. i Monnet, C. 2004. Measuring financial integration in the euro area. European Central Bank Occasional Paper Series, No 14, 18-19.

Bekaert, G., Harvey C.R. 1995. Time-Varying World Market Integration. Journal of Finance, 1(2), 403-444.

Balli, F. 2009. Spillover effects on government bond yields in euro zone. Does full financial integration exist in European government bond markets? Journal of Economics and Finance, 33(331). DOI: 10.1007/s12197-008-9029-3, 331-363.

Bukowski, S.I. 2020. Financial integration in the European Monetary Union. Routledge, London.

Bukowski, S.I. 2011. Integration of the Treasury Bond Market in Poland and the Eurozone. Eastern European Economics, 49(6), 27-37.

Christiansen, Ch. 2014. Integration of European bond markets. Elsevier Journal of Banking and Finance, 14, 191-198.

Gomez-Puig, M. 2009. Systemic and Idiosyncratic Risk in EUâ€ 15 Sovereign Yield Spreads after Seven Years of Monetary Union. European Financial Management, 15(5), 971-1000.

Leschinski, Ch., Voges, M., Sibbertsen, P. 2018. Fractional Cointegration and EMU Government Bond Market Integration. Leibniz University Hannover, Hannover.

Leschinski, Ch., Voges, M., Sibbertsen P. 2021. Integration and Disintegration of EMU Government BondMarkets. Econometrics, 9(13), 1-17.

Sensoy, A., Nguyen, D.K., Rostom, A., Hacihasanoglu, E. 2019. Dynamic integration and network structure of the EMU sovereign bond markets. Annals of Operations Research, 281(1), No 14, 297-314.