SHOCK SYNNCHRONICITY BETWEEN THE NEWEST MEMBER STATES AND THE EURO ZONE

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Abstract

In line with the Optimum Currency Area (OCA) theory, the paper analyses the degree of shock synchronicity between the euro area and the two newest member states (NstMS) of the European Union, Bulgaria and Romania. The degree of synchronization between the shocks that affect an economy is seen as a “meta-prerequisite” for entering a common monetary zone with minimum costs, a criterion that includes several others. The empirical literature knows only a few studies that include these two economies, and this was mainly due to the lack of reliable and long enough data series and to the numerous institutional changes inherent to the transition period. Using data from the two national banks, as well as Eurostat, we construct an integrated empirical framework that allows us to analyse the correlation between demand, supply and monetary shocks in Romania and Bulgaria on one side, and the euro zone on the other. We employ the popular Vector Autoregressive (VAR) technique and we identify the specified models using long-run restrictions à la Blanchard and Quah (1989). Using both static and dynamic correlation measures, our findings suggest that the two newest member states don’t behave as a homogenous group, Bulgaria being more correlated with the euro area. The results are important in order to establish the position of the newest member states on the road to monetary integration, as this will be the next step after the recent accession.

Keywords: optimum currency area; vector autoregressive (VAR); structural shocks; correlation.

JEL codes: C3; E47; E52.

1 The author gratefully acknowledges the financial support awarded for this research by the Romanian Ministry of Education and Research, Grants CEx-06-8-75/2006 and TD 445/2007.
1. Introduction

The perspective of adopting the euro by the new EU member states has generated a resurgence in the interest in the theory of optimum currency areas (OCA). The theoretical background needed in order to document the decision of giving up the monetary policy independence has been laid down by the pioneer work of Mundell (1961), followed by McKinnon (1963), Kenen (1969) and many others. The recent strand in the literature of optimum currency areas focuses on the more specific case of European Monetary Union, with a special emphasis on the empirical implications of the OCA theory.

Our paper is a contribution to the empirical literature which investigates the extent to which OCA preconditions are satisfied by soon-to-be EMU member states, focusing on the newest members in the European family, namely Romania and Bulgaria. The theory surrounding the OCA properties has evolved since it first came into being (for a comprehensive survey see Mongelli (2002)). The early 1960s, spanning to early 1970s, experienced a pioneering phase, during which fundamental prerequisites have been laid down and these included price and wage flexibility, mobility of factors, financial market integration, economic openness, diversification in production and consumption, similarities in inflation rates, stable inflation rates, fiscal and political integration. What lacked the first framework of the OCA conditions was a unifying view, especially important when a country satisfied a number of criteria, but not the entire set, and there was no generally agreed upon ranking of the prerequisites.

The holistic interpretation of the theoretical OCA criteria led to an emphasis on the similarity of shocks that affect the economies of the common currency area, and this is seen as a comprehensive prerequisite, including several others, a “meta-property”, as named by Mongelli (2002), suited for determining the success or failure of a common currency project. It is acknowledged that countries that experience large asymmetric shocks would face severe costs in the case of losing the monetary independence that could have served to react to these shocks.

A recognition of the importance of shock similarity between the countries that form a monetary union is given by the extensive empirical research that investigate this particular property. Frenkel, Nickel and Schmidt (1999), Fidrmuc and Korhonen (2001), Frenkel and Nickel (2002), and Babetskii, Boone and Maurel (2002), Eickmeier and Breitung (2006) follow the structural VAR identification methodology pioneered by Blanchard and Quah.
(1989) and developed by Bayoumi and Eichengreen (1993). They use different measures for the symmetry of the identified shocks as indicators of the synchronicity of business cycles between countries in the euro area and the new member states. They also investigate the transmission of disturbances from the euro area to other countries, assessing the sources, internal vs. external, of business cycle fluctuations.

Another direction in the literature of economic similarities within a common currency area analyses the degree of business cycle synchronization. Such studies employ different filtering techniques to isolate the cyclical component from the trend within a time series that reflects the economic activity (GDP, its components, industrial production index, unemployment level). Numerous studies use different measures of correlation between business cycles, ranging from simple correlations in the early research to dynamic spectral correlations as in Eickmeier and Breitung (2006).

Our paper is a contribution to the first mentioned strand of OCA empirical literature, referring to the analysis of macroeconomic shock similarity, seen as a fundamental prerequisite for entering a monetary union. This shock similarity can be regarded as an indicator of business cycle synchronization, as we would expect that the economies which experience similar shocks to be in a similar stage of development. Moreover, business cycles can be interpreted as a result of different shocks that affect an economy. It is noteworthy that we deal in this paper only with idiosyncratic shocks, and although a small open economy is subject to substantive external influence, we leave the analysis of the shock sources (internal vs. external) to future research.

The empirical investigation conducted in this paper focuses on the case of the two newest EU member states, Romania and Bulgaria. The two countries make an interesting object of study because the transition process, which is itself painful and costly, has been in these two states more prolonged and in numerous aspects not accomplished yet. This is one of the reasons why there are very few studies that include these two economies, knowing that econometric modelling can be irrelevant in the case of numerous institutional changes or administrative control of the key macroeconomic variables. Another explanation for the scarcity of empirical studies on Romania and Bulgaria is the lack of reliable and long enough data series. The review of the business cycle correlation between the euro area and the Central and Eastern European countries written by Fidrmuc and Korhonen (2006) clearly emphasizes the fact that among other European states, Romania and Bulgaria have benefited from the smallest degree of attention.
Several studies analyse the two economies as part of a group (IMF (2000), Afonso and Furceri (2007), Korhonen (2001)). Ciurila and Murarasu (2007) study the trend of the real exchange rates in six Central and Eastern European countries including Romania and Bulgaria. They find that significant factors for the real appreciation are foreign direct investment inflows, the current account balance and the productivity differential.

Our paper adds to the existing literature by presenting statistical evidence of shock similarity between the euro area and Romania and Bulgaria together with a thorough economic analysis. This paper will shed some light on important issues regarding the imminent adoption of the euro of the two newest member states and it can easily lead the way for similar investigations. The present research has two distinct goals: (i) to establish the economic facts that favour or not the similarity of shocks with the euro area; (ii) to determine to what extent the two economies satisfy the OCA prerequisite regarding shock synchronicity.

The rest of the paper is organized as follows: the next section presents a series of economic insights that help us understand the macroeconomic similarities with the countries forming the euro area; section 3 discusses the data set and the methodology employed to isolate the supply and demand shocks, as well as the monetary shocks originating in each analysed country; the next section interprets the result and finally, section 5 offers the conclusions.

2. Stylised Economic Facts

It is generally agreed upon the fact that the NstMS have a lot to catch up in order to become fully integrated in the European Union. We will not go into the economic details that could explain why these two countries are the laggard of the EU. Yet, it is worth mentioning that both experienced during the transition period difficult situations equivalent to crisis. For the case of Romania, the first ten years after the revolution marked an environment of uncertainty, both for home and foreign investors. The prolonged communist period of constraints triggered increasing imports, that weren’t sustained by external competitiveness. The constant problems regarding the balance of payments have reached a maximum in 1999, when the default risk appeared to be imminent. External financing needs outran by far the sources available or possible to resort to. A dramatic depreciation of the leu (the national currency), along with restrictive fiscal and income policies, allowed Romania to service the peak of medium- and long-term foreign debt service in amount of USD 2.8 billion. Bulgaria, on the other hand, encountered a major financial crisis in 1996 – 1997, which led to political
and parliamentary instability. Public debt, budget deficit and inflation reached unsustainable levels. The solution found by the government was based on an IMF agreement and implied ambitious fiscal and structural reforms. Moreover, it set up a currency board and the Bulgarian Lev was pegged to the Deutsch Mark.

The upward path of the two economies begun in 1998 for Bulgaria and in 2000 for Romania. The recent period can be described by improved performance in terms of economic expansion, strengthening disinflation, reduction in budget deficit and unemployment. The expansion of the world economy triggered a boost in the foreign trade of Central and Eastern European economies, including Bulgaria and Romania. The area also benefited from a high attractiveness for foreign investors. It can be stated that B&R are increasingly integrating into world markets and more precisely, into European structures. But the question arises to what extent these commercial and financial linkages lead to an increased similarity between the NstMS and the euro area, similarity that would eventually pave the way for monetary integration.

Among the economic indicators that can be regarded as relevant for entering a common currency area, we will constrain our attention to three main categories: (i) bilateral trade intensity; (ii) foreign direct investments (FDI) intensity, and (iii) similarity of production structures.

2.1 Bilateral Trade Intensity

One would expect that the higher the bilateral trade within a group of countries, the lower the cost of entering a monetary union. Frankel and Rose (1998) present empirical evidence that supports this idea. Yet, increased trade as a factor that leads to sectoral specialization. On one hand, trade may trigger higher economic similarity by favoring the transmission of shocks that affect all industries; on the other hand, in the hypothesis that trade leads to specialization, the primary shocks that affect an economy can become sector-specific, and this decreases the shock similarity within a group of countries.

The selected indicator for trade integration ($TR$) was a variable that corrects for the differences in the size of the economy, according to the following formula:

$$TR_{i,EA} = \frac{EX_{i,EA} + IM_{i,EA}}{GDP_i \times GDP_{EA}}$$

(1)
where \( TR_{i,EA} \) reveals the degree of bilateral trade intensity between country \( i \) and the euro area, \( EX_{i,EA} \) represents the exports of country \( i \) to the euro area, \( IM_{i,EA} \) are the imports of country \( i \) from the euro area, \( GDP_i \) is the gross domestic product of country \( i \) and \( GDP_{EA} \) stands for the gross domestic product of the euro area.

Figure 1 presents the degree of bilateral trade intensity with the euro zone on one hand and Romania and Bulgaria on the other. For comparison reasons, we also computed the average value of the indicator for the countries that entered the EU in 2004.

**Figure 1 Bilateral Trade Intensity with the Euro Area**

![Graph showing bilateral trade intensity with the Euro Area for Bulgaria, Romania, and the NMS from January-December 1998 to January-December 2006.](image)

*Source: Author’s calculation*

Figure 1 reveals the fact that Romania exhibits a higher degree of trade integration with the euro area than Bulgaria, but only during the interval 2000 – 2005. Yet, for both states the level of the chosen trade intensity indicator is lower than the average among the new member states\(^2\).

### 2.2 Foreign Direct Investment Intensity

Foreign direct investments are an important factor that creates linkages and interdependencies between economies. They are a channel through which external shocks are propagated, but can also lead to a catch up process and an increased similarity in the nature of

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\(^2\) Malta and Cyprus have been excluded from the analysis.
shocks that affect a group of countries. The measure chosen for FDI intensity between country $i$ and the euro area ($FDI_{i,EA}$) is similar to the trade intensity indicator, in the sense that it accounts for the difference in the size of economies that are compared.

$$FDI_{i,EA} = \frac{FDI^{out}_{i,EA} + FDI^{in}_{i,EA}}{GDP_i \times GDP_{EA}}$$ (2)

Where $FDI^{out}_{i,EA}$ stands for the foreign direct investment made by country $i$ in the euro area and $FDI^{in}_{i,EA}$ are the foreign direct investments that enter country $i$ from the euro area.

**Figure 2 FDI Intensity with the Euro Area**

![Figure 2 FDI Intensity with the Euro Area](image)

*Source: Author’s calculation*

Due to data availability, the average for the new member states is the one computed by Eickmeier and Breitung (2006) for the year 2003 and it is presented as a constant only to have a grasp of where the NstMs find themselves as compared to the other non-euro countries. It is obvious from Figure 2 that Bulgaria is more financially integrated with the euro area, although the trend for Romania is promisingly upward.

**2.3 Similarity in Production Structures**

The criteria surrounding the entrance into a monetary union focus on the probability that candidate countries face similar shocks that will enable a common monetary policy to adjust successfully after these disturbances. According to economic theory, the synchronicity
of economic shocks is determined also by similar structural characteristics. Figure 3 depicts a measure of structural similarity \((S)\) initially proposed by Krugman (1991) and computed using the following formula:

\[
S_{i,EA} = \sum_{k=1}^{K}\left| s_{k,i} - s_{k,EA} \right|
\]  

(3)

Where \(S_{i,EA}\) measures the degree of similarity in production structures between country \(i\) and the euro area; \(K\) is the number of economic sectors\(^3\) considered, \(s_{k,i}\) represents the weight of the gross value added by the sector \(k\) in total value added for country \(i\) and \(s_{k,EA}\) has the same interpretation for the euro area. The construction of the indicator points to the fact that the closer \(S_{i,EA}\) is to zero, the more similar are the economic characteristics between country \(i\) and the euro area.

Figure 3 Similarity of Production Structure with the Euro Area

![Graph showing similarity of production structure with the euro area over time for Bulgaria, Romania, and NMS.](image)

Source: Author’s calculation

As revealed by Figure 3, Bulgaria appears to be significantly more similar in economic structure than Romania, but less similar than the new member states average. Investigating for the causes of Romania’s dissimilarity, the greatest discrepancies are explained by the agricultural sector (with an average mean percent of 2.33 for the euro area in the analyzed period and 13.41% in Romania), by the financial intermediation sector (26.68% in the euro

\(^3\) Six economic sectors have been considered, accordingly: agriculture & forestry, industry, construction, trade & hotels and restaurants & transport & communication, financial intermediation & real estate, public expenses.
area and 13.95% in Romania) and by the public expenses sector (22.58% in the euro area and 13.18% in Romania).

3. Data and Empirical Methodology

Our data span covers the period 1999: Q1 – 2007:Q1. The sample period is not very generous, comprising only 33 observations, but it eliminates serious problems inherent to the transition period in the NstMS (the adoption of the currency board in Bulgaria in 1997, the last important stage of price liberalisation in the second half of 1997 for Romania, as well as a revision in the methodology of measuring aggregate activity that occurred in Romania in 1998). Moreover, we do not have to deal with possible structural breaks due to the forming of the monetary union in 1999. The data are obtained from Eurostat and partially, from the national banks.

The empirical investigation regarding shock synchronicity between the NstMS and the euro zone employs the popular technique of the Vector Autoregressive models, extensively used in macroeconomic analysis. The most important criticism to the VAR approach is its lack of economic information and the impossibility to interpret its main results, the impulse-response functions and the variance decomposition, due to the fact that the errors in a standard VAR have no direct economic interpretation. The main three methods to identify the pure innovations are the recursive approach (or the triangular Choleski decomposition), the structural approach and the long-term restriction approach, or the Blanchard and Quah decomposition. We chose to employ long run restrictions in sense of Blanchard and Quah (1989), as used in the seminal paper of Bayoumi and Eichengreen (1993). As opposed to them, our paper takes into consideration three kinds of macroeconomic shocks: demand shocks, supply and monetary shocks. Accordingly, the VARs estimated for each economy (Bulgaria, Romania and the euro zone) comprise three quarterly variables:

- the inflation rate, calculated using log deviation of the CPI from the previous quarter;
- the nominal 3-month interest rate;
- the real GDP growth rate ($dy$);

The series are seasonally adjusted using TRAMO/SEATS (Demetra), except the interest rate, which didn’t exhibit seasonal behaviour.
Checking for shock symmetry is a two-way procedure: first, individual VARs are estimated for each considered economy and afterwards, the identified shocks are being isolated and analysed within a unifying framework.

The relevance of the results depends crucially on the statistical tests employed before the models are estimated. In order to specify the model, we performed unit root tests (ADF and PP) to check for the stationarity of the series. Table 1 illustrates the results of the Augmented Dickey Fuller test for all nine variables. Philips Peron yields similar results.

**Table 1 Unit Root Tests**

<table>
<thead>
<tr>
<th>Variable</th>
<th>ADF test statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>real economic growth BG</td>
<td>-5.82*</td>
</tr>
<tr>
<td>real economic growth RO</td>
<td>-3.26**</td>
</tr>
<tr>
<td>real economic growth EA</td>
<td>-5.00*</td>
</tr>
<tr>
<td>inflation rate BG</td>
<td>-5.36*</td>
</tr>
<tr>
<td>inflation rate RO</td>
<td>-0.42</td>
</tr>
<tr>
<td>inflation rate EA</td>
<td>-5.07*</td>
</tr>
<tr>
<td>interest rate BG</td>
<td>-2.73***</td>
</tr>
<tr>
<td>interest rate RO</td>
<td>-3.44**</td>
</tr>
<tr>
<td>interest rate EA</td>
<td>-1.97</td>
</tr>
</tbody>
</table>

* I(0) at 1% confidence level;  
** I(0) at 5% confidence level;  
***I(0) at 10% confidence level.

According to Table 1 it is reasonable to consider all the variables included in the investigation as being stationary, except the inflation rate in Romania and the interest rate in the euro zone. As far as the inflation rate in Romania is concerned, its lack of stationarity is due to the continuing process of disinflation that started in 2000 and is still in process. Indeed, a closer look at the data reveals that the series exhibits a deterministic time trend. Accordingly, an exogenous time trend variable was included in the VAR model for Romania. The case of the interest rate in the euro zone is not so straightforward. Although the tests do not reject the presence of a stochastic trend, we chose to include it in the model in level and not in the first difference, in order to maintain the comparability of the three models. Moreover, the results indicated by the unit root tests for short periods are very often affected by the lack of long series and should be cautiously interpreted.

All three models are stable (the unit roots lie inside the unit circle) and according to the informational criteria and also, considering the degrees of freedom constraints, the VAR models were estimated using one lag for all three economies.
The identification scheme follows the idea of Bayoumi and Eichengreen (1993) that the supply shocks have long-run effects on the economic activity, whereas demand shocks do not. As supported by the data, additional restrictions have been added. For example, for Romania and the euro zone, no significant long-run impact of the interest rate on prices was found. The identification matrix embraced the following form:

**The identification scheme for Romania and the Euro Area VARs**

<table>
<thead>
<tr>
<th></th>
<th>$dy$</th>
<th>inflation</th>
<th>interest rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>$dy$</td>
<td>NA</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>inflation</td>
<td>NA</td>
<td>NA</td>
<td>0</td>
</tr>
<tr>
<td>interest rate</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

* The restriction $c_{i,j} = 0$ means that the (accumulated) response of the $i$-th variable to the $j$-th structural shock is zero in the long-run.

Two other restrictions were required by the Bulgarian data: the long-run impact of the real economic growth on inflation is null, as well as the impact of the inflation rate on interest rates. The over-identifying restrictions were validated by a likelihood ratio test with the null hypothesis that the restrictions are supported by the data (with a p-value of 0.93).

**4. Results**

The estimated VAR models provided the basis for the analysis of shock synchronicity between Bulgaria and Romania and the euro zone. Although it doesn’t concern our investigation explicitly, it is interesting to look at the responses of the interest rate in the euro zone at an identified disturbance in the real economic growth and inflation. This could provide an informal control key that the interest rate doesn’t affect the stability of the VAR model.

**Figure 4 Interest rate responses to an identified shock in the real economic growth, in inflation and in itself, respectively**
As depicted by Figure 4, the interest rate responds positively to an innovation in the real economic growth. The response to an innovation in the inflation rate is also positive, but slightly less powerful. The visual representation of the impulse-response functions supports the idea that the monetary policy is guided by a Taylor rule with an interest smoothing term.

The identified supply, demand and monetary shocks are identified as being the residuals in the real GDP growth, inflation and interest rate equations. Table 2 presents the simple static correlation coefficients between these shocks in Bulgaria and Romania on one side, and in the euro zone on the other.

<table>
<thead>
<tr>
<th>Country</th>
<th>Correlation between supply shocks</th>
<th>Correlation between demand shocks</th>
<th>Correlation between monetary shocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>0.2955</td>
<td>0.4507</td>
<td>0.1050</td>
</tr>
<tr>
<td>Romania</td>
<td>0.3446</td>
<td>0.1177</td>
<td>-0.1780</td>
</tr>
</tbody>
</table>

Several conclusions can be drawn from the analysis of Table 2: (i) the supply shocks seem to be correlated between the NstMS and the euro zone, with no significant difference between Bulgaria and Romania; (ii) a much stronger correlation is pointed out by the analysis of demand shocks between Bulgaria and the euro zone, whereas the correlation for Romania is weak and finally, (iii) the Bulgarian monetary shocks are positively correlated with those in the euro zone, Romania has experimented asymmetric monetary shocks with respect to the euro area.

In order to better grasp the phenomenon of macroeconomic shock synchronization we also employed a dynamic correlation measure \( \rho_{y,z}(\omega) \) as proposed by Croux, Forni and Reichlin (2001):

\[
\rho_{y,z}(\omega) = \frac{C_{y,z}(\omega)}{\sqrt{S_y(\omega) \cdot S_z(\omega)}}
\]  

(4)

Where \( \rho_{y,z}(\omega) \) is the dynamic correlation coefficient between series \( y \) and \( z \) at frequency \( \omega \), \( C_{y,z}(\omega) \) is the co-spectrum, and \( S_y(\omega) \) and \( S_z(\omega) \) are the spectral density functions of the two series.
Figure 5 Dynamic correlation coefficients

<table>
<thead>
<tr>
<th>Correlation between supply shocks</th>
<th>Correlation between demand shocks</th>
<th>Correlation between monetary shocks</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Graph" /></td>
<td><img src="image2.png" alt="Graph" /></td>
<td><img src="image3.png" alt="Graph" /></td>
</tr>
</tbody>
</table>

Figure 5 depicts the dynamic correlation coefficients between the shocks in the NstMS and the euro area, computed frequency by frequency on 65 equally spaced points in the interval \([0, \pi]\). The dynamic correlation measure provides us with important information otherwise not available in static analysis. As it is apparent from Figure 5, the Bulgarian supply shocks tend to be more correlated with those in the euro zone as compared to the Romanian shocks in the long-run. As far as demand and monetary shocks are concerned, they are more correlated in Bulgaria than in Romania at all horizons. The results support the idea that Bulgaria is ahead of Romania on the road to monetary integration.

5. Concluding remarks

The paper investigates the degree of shock synchronicity between the newest member states and the euro area, as it is a prerequisite for entering a monetary union. The analysis suggests that although there are several features common to the two countries, such as being the laggard of the EU, there should be no tendency in treating them as a homogenous group. Bulgaria seems to be more correlated with the euro area than Romania, leading the way to monetary integration. A major reason that explains these results is the difference in the monetary policies promoted in the two economies: Bulgaria has a currency board which favoured an economic closeness with the euro area, while Romania has an independent monetary policy and a dirty float exchange rate regime. It is beyond the scope of the paper to establish wether entering the monetary union would be a costly decision for the analysed country. Considering the fact that there is strong evidence that support the endogeneity of the OCA criteria, the empirical investigations based on ex-post data fail to predict the behaviour of the macroeconomic variables after the entrance in the monetary union.

The investigation is open to further research in several ways: the shock synchronicity between the NstMS and the euro zone can be compared with that between the euro area and
other non-euro countries; the macroeconomic shocks can be isolated following alternative methods to identify VAR models; external sources for shocks can be included in the VAR models.

References


