IS THE EUROPEAN INTEGRATION SPEEDING UP THE ECONOMIC CONVERGENCE PROCESS OF THE CENTRAL AND SOUTH-EASTERN EUROPEAN COUNTRIES? A SHOCK PERSPECTIVE *

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Abstract

The objective of this research is to obtain new insights into the factors that determine the synchronisation of shocks in the Central and South-Eastern European countries vis-à-vis the euro area. The research contributes to the previous work by making a novel use of error correction model in a dynamic panel context which is extended by adding several important omitted variables related to the trade structure and policy coordination. We find that an increase in trade intensity, intra-industry trade and financial integration leads to less frequent asymmetric shocks. On the other hand, divergent fiscal policies are estimated in some model specifications to increase the shock divergence process, although the estimated impact is rather small. Overall, the identified relationships in this research are affected by the significant trade and growth slowdown in the crisis period, but are not its statistical artefacts.

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1. Introduction

The Eastern enlargements of the European Union (hereinafter: EU) in May 2004 and January 2007 have been important milestones in the history of European integration. Five out of the 12 new EU member states adopted the euro since 2007, thereby enlarging the euro area to 17 members. Given that monetary integration implies foregoing the use of monetary and exchange rate policies for national purposes alone, many researchers investigated the shock synchronisation between the Central and South-Eastern European countries (hereinafter: CSEEC) and the euro area aiming to assess the potential costs of losing the independent monetary policy (Chamie et al. 1994; Boone and Maurel, 1999; Frenkel et al. 1999; Fidrmuc and Korhonen, 2001; Frenkel and Nickel, 2002; Darvas and Szapary, 2004). The extent of synchronisation is an important indicator when assessing whether the optimum currency area conditions are met. However, this is a static measure which does not indicate how shock synchronisation evolves over time and what are the conditioning factors that determine the shock convergence process.

This research investigates the main driving forces of the synchronisation of shocks and their development as an indicator of the future movement of synchronisation in the CSEEC vis-à-vis the euro area. The empirical work is conducted in several stages. First, a structural VAR is employed to estimate supply and demand shocks for 16 CSEEC (Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia, Malta, Poland, Romania, Serbia, Slovakia, Slovenia and Turkey) by using quarterly observations for the period from q1:1995 to q4:2011. Second, Kalman filter technique is used to obtain a time-varying measure of the shocks similarity between CSEEC and the euro area over time. In the last step, a set of variables are employed in a dynamic panel framework to explain this measure of the shock convergence process in CSEEC towards the euro area.

The expected contribution of this paper is threefold: i) the model that investigates determinants of shock synchronisation in a panel framework is extended by adding several important omitted variables - those related to the trade structure and policy coordination. In particular, our model differentiates between horizontal and vertical intra-industry trade which has not been considered in any previous empirical work in this area; ii) in contrast to previous researches that were done in a static panel regression setting, we employ different and novel econometric technique - an error correction model in a dynamic panel context; iii) this research also accounts for the effects of the recent economic turmoil on shock convergence process of the CSEEC towards the euro area.

The remainder of the paper is structured as follows. The second section provides an overview of the theoretical and empirical literature related to the nexus between the international trade integration and the synchronisation of shocks (and business cycles).[1] The methodology is elaborated in the third section. The determinants which may influence the evolution of shock similarity are examined in a panel context applying the time-series error correction re-parameterisation of an autoregressive distributed lag model. The estimation of variables and data description to which our model is to be applied is provided in the fourth section. The fifth section elaborates empirical results and evaluates whether our results warrant any change in the hitherto conventional conclusion. A battery of robustness checks is conducted in the sixth section, whereas the concluding remarks are presented in the final section.

2. An overview of the theoretical and empirical literature on shock synchronisation

The synchronisation of shocks is determined by the similarity of output and trade structures. Kenen (1969) put forward this argument in linking the structural characteristics of economies, in particular the output structure, to the level of shock synchronisation. The argument suggests that more diversified economies in terms of sectoral composition of output are likely to experience smaller shocks than highly specialized economies. A high output diversification within the economy tends to average out the effect of an external shock on a particular sector, contributing to higher similarities of aggregate disturbances across economies. This argument was also considered by the European Commission (1990) conjecturing that a country joining a monetary union is expected to experience more similar shocks. The rationale was that the removal of the trade barriers is likely to increase intra-

[1] The term “business cycle” comprises both the shocks and the responses of the economy to the shocks.

industry trade among the members leading to the exploitation of product differentiation within the economy more efficiently. As the single market programme is fully implemented in the EU it may enhance the intra-industry trade and speed up the industrial diversification, thereby limiting the economy-wide impact of sector-specific shocks.

Conversely, Krugman (1993) challenged this view both theoretically and empirically by presenting the lessons of Massachusetts for Europe. Krugman argued that closer market integration could enhance greater specialisation, which has been otherwise limited by national obstacles, consequently leading to greater vulnerability of sectors (regions) to asymmetric shocks as was the case with Massachusetts, one of the most prosperous regions in the United States during the late 1980s. Accordingly, the main lessons from the Massachusetts story for Europe were that a reduction in transaction costs as a result of the process of market integration, that is removing trade barriers, leads to higher specialisation and thus to divergence between the members of a monetary union in terms of their industrial structure. Consequently, the members of a monetary union will be a subject to higher incidence of country-specific shocks. This view was also shared by Eichengreen (1992).

Empirically, several studies find support for the output structure as a determinant of shocks and business cycle synchronisation (Imbs, 1999; Kalemli-Ozcan et al. 2001; Clark and van Wincoop, 2001; Calderon et al. 2002; Dées and Zorell, 2011). Nevertheless, greater attention is being devoted to the international trade as a determinant of business cycle symmetry, since trade reflects and determines the output composition via comparative advantage. It has been empirically demonstrated that there is a strong and positive relationship between the degree of bilateral trade intensity and the cross-country bilateral correlation of business cycles. The endogeneity argument of Frankel and Rose (1998) implies that although some countries, on the basis of historical data, may appear as poor candidates for a monetary union, a country is more likely to satisfy criteria for entry into a currency union ex post. The membership in the monetary union is expected to provide a substantial impetus for trade expansion and, consequently, highly correlated business cycles. Using quarterly data from 21 industrialised countries between 1959 and 1993, they estimated that a closer bilateral trade linkage was associated with more correlated economic activity. Although Frankel and Rose (1998) emphasised intra-industry trade as a key component of the endogenous nature of the relationship of the correlation of output fluctuations, they used data for bilateral trade in the empirical part of their analysis instead. This motivated Fidrmuc (2001) to re-estimate their equation by including data for intra-industry trade in the analysis. The augmented model indicates that it is the trade structure (intra-industry trade), and not the intensity of bilateral trade, that contributes to a higher correlation of output fluctuations.

Shin and Wang (2005) identify four different channels through which trade integration influences business cycles: i) the inter-industry trade channel (the Krugman's view); ii) the intra-industry trade channel (the European Commission's view); iii) the demand spill-overs' channel, where the shock to a particular economy affects the trading partners through changes of the volume of trade; iv) the policy coordination channel according to which increased trade may create a greater need for more coordinated fiscal and monetary policies, which ultimately tend to synchronize policy shocks. They investigate the most important channel for synchronisation of business cycles by extending the Frankel and Rose (1998) model. In addition to a variable for bilateral trade intensity, the augmented model includes variables for intra-industry trade, fiscal policy coordination (correlation coefficient of the ratio of the government expenditure or tax revenue to GDP across each pair of countries) and monetary policy coordination (correlation coefficient of the monetary aggregate M2 growth rates or the short-term nominal interest rates across each pair of countries).[2] Using data over the period 1977-1999 for 14 EU member states, the model estimates that increased bilateral trade intensity itself does not lead to the synchronisation of business cycles. In their work, intra-industry trade and, to some extent, monetary policy coordination are the main channels responsible for the co-movements of business cycles. Fiscal policy coordination was not statistically significant in most of the regressions. Unlike Shin and Wang (2005), Darvas et al. (2005) find that fiscal policy is an important source of business cycles divergence. Artis et al. (2008) support the results reported in Darvas et al. (2005) regarding the fiscal policy effects on business cycles de-synchronisation.

[2] The variables indicating fiscal policy coordination and monetary policy coordination are introduced in the regression to tackle the problem of endogeneity between trade intensity and business cycle synchronisation by including the omitted variables. The alternative approach followed in the study to tackle this problem is performing estimation by instrumental variables; the industry structure similarity and income differences are used as instrumental variables for intra-industry trade.

In addition to the trade channels, the financial channels are also important for economic integration in a monetary union. Financial integration allows government and domestic companies to borrow from surplus countries in the monetary union, easing the negative effects of an asymmetric shock. In addition, financial integration enables international risk sharing which dampens the negative effects of an adverse shock. However, Kalemli-Ozcan et al. (2001) and Imbs (2004) note that the easier access to foreign financial markets in the monetary union allows more specialized production and consequently, less synchronized business cycles.

Most of the empirical work in this area investigates the effects of trade and financial integration as well as output structure patterns on business cycle synchronisation, comprising both shocks and responses. Yet the previous studies do not isolate the effects of shock incidence from the effects of responses on the synchronisation of economic variables, which is the main pillar of the optimum currency area theory. To the best of our knowledge, there is only one study considering the relationship between shocks and trade integration, conducted by Babetskii (2005). This study focuses on the determinants of shock convergence of selected transition countries vis-à-vis the euro area. The shocks are estimated by applying a structural VAR following the Bayoumi and Eichengreen (1993) approach based on the identification methodology developed by Blanchard and Quah (1989). Since the transition countries experienced structural economic changes, in particular changes of output structure and trade patterns, it is not expected that the shock synchronisation with the euro area is stable. Therefore, Babetskii (2005) applies the Kalman filter technique to estimate the time-varying coefficients of the identified supply and demand shocks. In the next step, the time-varying coefficients are modelled as depending mainly on trade intensity, using static panel (fixed effects) methodology. The model estimates suggest that an increase in trade intensity positively influences the symmetry of demand shocks. However, the effects of trade intensity on supply shocks are found to be ambiguous.

Our research combines and extends the approach of Babetskii (2005), Shin and Wang (2005) and Darvas et al. (2005) in further investigation of the determinants of shock convergence of the CSEEC towards the euro area. To a certain extent, we follow the approach of Babetskii (2005) in terms of isolation of the effects of shock incidence from the effects of responses on the synchronisation of economic variables. Yet, in the advanced stages, when the determinants of shock synchronisation are investigated this approach is extended by adding several important omitted variables - those related to trade structure and policy coordination - part of which was included in the model of Shin and Wang (2005) and Darvas et al. (2005). It was not possible to include a variable for financial integration in our core model due to lack of data for bilateral financial flows between the CSEEC and the euro area on quarterly basis. Nevertheless, in the section focused on robustness checks a proxy for financial integration is added to the core model aiming to capture its potential effects on shock convergence process of the CSEEC vis-à-vis the euro area.

To sum up, this study explains the supply and demand shock dynamics with several theoretically important variables: trade intensity, trade structure (inter- versus intra-industry trade), monetary policy coordination and fiscal policy coordination. In particular, our model differentiates between horizontal and vertical intra-industry trade which has not been considered in any previous empirical work in this area. This differentiation is an important one in the context of our investigation since the synchronisation of shocks may be affected differently by these types of two-way international trade. While the horizontal intra-industry trade should contribute to a higher symmetry of shocks in accordance with the European Commission (1990) view, the vertical intra-industry trade does not guarantee symmetry of shocks because it implies deepening of the specialisation of countries along the quality spectrum inside industries. The latter includes major differences in research and development expenses, factor endowments and qualification of labour force (Fontagné and Freudenberg, 1999).

3. Methodology

3.1. Estimation of structural shocks

A structural VAR methodology launched by Bayoumi and Eichengreen (1993), relying on the model of Blanchard and Quah (1989), is applied for identification of supply and demand shocks. The fundamental assumption of the model for identification of supply and demand shocks is that supply shocks affect output and prices permanently, while demand shocks change prices permanently but output temporarily. Regarding the sign of the effects, both shocks affect the output in the same direction, but the effect on the prices has opposite direction.

Starting from these theoretical considerations, changes in output and prices following a stationary stochastic process can be expressed in the form:

$$\Delta y_t = a_{01} + \sum_{k=0}^{\infty} a_{11k} \varepsilon_{t-k}^{S} + \sum_{k=0}^{\infty} a_{12k} \varepsilon_{t-k}^{D} \tag{1}$$

$$\Delta p_t = a_{02} + \sum_{k=0}^{\infty} a_{21k} \varepsilon_{t-k}^{S} + \sum_{k=0}^{\infty} a_{22k} \varepsilon_{t-k}^{D} \tag{2}$$

where y is output, p is prices, ε^S and ε^D are supply and demand shocks, respectively, k is number of lags, and coefficients a_{ij} denote the effects of structural shocks on the output (prices) after k periods.

In practice, it is not possible to extract the supply and demand shocks in a straightforward manner from the previous system of equations because of simultaneity issues. Instead, the reduced form VAR representation is used:

$$\Delta y_t = b_{01} + \sum_{k=1}^{K} b_{11k} \Delta y_{t-k} + \sum_{k=1}^{K} b_{12k} \Delta p_{t-k} + u_t^y \tag{3}$$

$$\Delta p_t = b_{02} + \sum_{k=1}^{K} b_{21k} \Delta y_{t-k} + \sum_{k=1}^{K} b_{22k} \Delta p_{t-k} + u_t^p \tag{4}$$

where b_{ij} denotes coefficients, K is the lag length chosen, while u^y and u^p are white noise disturbances representing unexplained components in the equations for output and prices.

The critical insight for the identification of supply and demand shocks is that the unexplained components of output and prices from equation (3) and (4) are composites of the structural shocks from equations (1) and (2). In other words, the VAR residuals are a linear combination of supply and demand shocks in the matrix form $u_t = C * \varepsilon_t$.

$$u_t^y = c_{11} \varepsilon_t^S + c_{12} \varepsilon_t^D \tag{5}$$

$$u_t^p = c_{21} \varepsilon_t^S + c_{22} \varepsilon_t^D \tag{6}$$

The main contribution of Blanchard and Quah (1989) and Bayoumi and Eichengreen (1993) consist of recovering the four coefficients in matrix C. They define four restrictions necessary for identification of the four coefficients of matrix C in the following way:

Restriction 1: the variance of supply shocks is unity Var(ε^S)=1

Restriction 2: the variance of demand shocks is unity Var(ε^D)=1

Restriction 3: supply and demand shocks are orthogonal Cov (ε^S, ε^D)=0

The first two restrictions represent simple normalization, setting the variance of supply and demand shocks to unity. The third one is derived from the assumption that the supply and demand shocks are uncorrelated. Based on these restrictions, three equations are defined relating the variance-covariance matrix from the reduced form VAR representation to the elements of *C* matrix. As Enders (2004) explains, given equation (5) and assuming that the expectation of a supply or demand shock is zero ($E\varepsilon^s\varepsilon^d = 0$), the normalization Var(ε^S)= Var(ε^D)=1 implies that the variance of u^y *is*

$$Var(u^y) = c_{11}^2 + c_{12}^2 \tag{7}$$

Similarly, given equation (6) and assuming that $E\varepsilon^s\varepsilon^d = 0$, the normalization implies that the variance of u^p is:

$$Var(u^p) = c_{21}^2 + c_{22}^2 \tag{8}$$

The covariance of VAR residuals is related to the C matrix by taking the expectation of the product of u^y and u^p ($u^y u^p = (c_{11}\varepsilon^s + c_{12}\varepsilon^d)(c_{21}\varepsilon^s + c_{22}\varepsilon^d)$), which yields the following equation:

$$Cov(u^y, u^p) = c_{11}c_{21} + c_{12}c_{22} \tag{9}$$

Restriction 4: Demand shocks do not have permanent effects on output. Relating this restriction to the system of equations defined in (1) and (2), it implies that the cumulative effect of demand shocks on output is zero i.e. $\sum_{k=0}^{\infty} a_{12k} = 0$.

These four restrictions permit the elements of matrix *C* to be uniquely defined which enables identification of the supply and demand shocks from the equation:

$$\varepsilon_t = C^{-1} * u_t \tag{10}$$

The estimated supply and demand shocks for each CSEEC are related with those in the euro area in order to measure the extent of synchronisation. However, this methodology enables estimation of a static measure of shock symmetry and does not reveal how it evolves over time. This is important because it is expected that the shocks similarity evolves in line with market integration in Europe, which is particularly relevant for the CSEEC whose economic relations have been deepening with the EU during the last two decades. Therefore, there is a need for a model that estimates time-varying coefficients of shock symmetry. The model developed by Haldane and Hall (1991) combines the concept of co-integration with time-varying parameters methodology and thus, enables an estimation of a dynamic measure of convergence. The model was adapted in the context of shocks similarity by Boone (1997) to estimate the convergence of shocks for 14 member states of the EU.

The following system of equations enables estimation of the evolution of shock symmetry, measured by time-varying coefficients for supply and demand shocks, by using the Kalman filter technique:[3]

Measurement (observation) equation

$$X_t^j - X_t^i = a_t + b_t(X_t^j - X_t^k) + u_t \tag{11}$$

Transition (state) equations

$$a_t = a_{t-1} + v_t^a \tag{12}$$

$$b_t = b_{t-1} + v_t^b \tag{13}$$

where *X* are the supply or demand shocks; *i* denotes the converging (CSEEC) country; *j* stands for the reference country (the euro area); *k* denotes the control country (the United States as a proxy for the world), which helps to distinguish convergence of one country to the reference country from the convergence in the rest of the world; *a* and *b* are time-varying coefficients defined in the transition equations as autoregressive processes; and u_t, v_t^a and v_t^b are error terms.

The variable of main interest is *b*, which is a measure of relative convergence of a particular country towards the reference country, taking into account the evolution of the spread of shocks between the reference country and the control country. If *b* tends towards zero then the movements of the spread of supply (demand) shocks between the converging and reference country are explained less over time by fluctuations of the spread of the same shocks between the reference and the control

[3] Kalman filter was developed by Rudolph E. Kalman in 1960. See Harvey (1989, 1993) and Hamilton (1994) for a mathematical explanation of the algorithm.

country; in other words, the reference country has a stronger role than does the control country in explaining the movements of shocks in the converging country, which means that a process of convergence is at work. On the other hand, if *b* tends toward 1, then the fluctuations of the spread of supply (demand) shocks between converging and reference country are explained more over time by fluctuations of the spread of the same shocks between reference and control country, which implies that there is no convergence with the reference country.

3.2. Examination of the determinants of structural shocks convergence

The determinants which may influence the evolution of shock similarity in the CSEEC with the euro area are investigated by employing a panel framework. The starting point is the model used by Babetskii (2005), which is augmented by including additional variables for intra-industry trade, monetary policy coordination and fiscal policy coordination, as examined by Shin and Wang (2005) and Darvas et al. (2005). In addition, our model differentiates between horizontal and vertical intra-industry trade, and includes a variable for vertical intra-industry trade as a dominant component of the two-way trade.

The main empirical specification has the following form:

$$b_{it}^{s(d)} = c_{1i} + c_2 TI_{it} + c_3 IIT_{it} + c_4 MPC_{it} + c_5 FPC_{it} + \varepsilon_{it} \quad (14)$$

[4]

where, $b^{s(d)}$ is the time-varying coefficient of supply (b^s) or demand (b^d) shocks estimated as explained in the previous section; *TI* is log of the index of bilateral trade intensity calculated as a sum of exports and imports between a particular country and the euro area and normalised by total trade or nominal GDP as a robustness check; *IIT* denotes the log of the index of intra-industry trade of a particular country with the euro area calculated according to Grubel and Lloyd (1975) and Fontagné and

[4] The variable for output composition is not included explicitly in the model due to two main reasons. First, its effects are expected to be reflected by the trade structure. Lee et al. (2004) estimate that if both a variable for trade structure and a variable for output composition are included together in the model, only a variable for trade structure is statistically significant in explaining synchronization of business cycles. Clark and van Wincoop (2001) and Otto et al. (2003) find that output composition has significant effects, but it is dominated by the trade structure. Second, there are no available quarterly data for output structure of substantial number of countries in our sample.

Freudenberg (1997) for differentiation between vertical and horizontal two-way trade; *MPC* denotes monetary policy coordination in quarter *t* which is defined as the correlation coefficient of the money market interest rates between each CSEEC and the euro area over the preceding eight quarters; *FPC* denotes fiscal policy coordination in quarter *t* which is defined in a similar way as in Darvas et al. (2005), and represents the difference in cyclically adjusted government budget balance (surplus or deficit), measured as a percentage of country's GDP, between the CSEEC and the euro area;[5] $i = 1,...N$ denotes the CSEEC; t is for time (quarter); and ε denotes the disturbance term.

An important issue that requires careful examination is the potential endogeneity problem due to the omitted variables. In our case, many CSEEC peg their exchange rates to the euro, and consequently make their monetary policy more coordinated to that of the euro area, which may result in both increased trade and shock convergence. Frankel and Rose (1998) have applied an instrumental variables approach in light of the potential endogeneity, using three instruments for trade: the natural logarithm of the geographical distance between the trading partners; a dummy for geographic adjacency; and a dummy for sharing a common language. None of these is appropriate in our case, since the relationship between the euro area and each CSEEC is investigated and not the bilateral relationship between pairs of countries in the sample as in the case of Frankel and Rose (1998). This brings difficulties in our case, because most of the CSEEC border the euro area and there is no common language in the euro area.

As it is difficult to find other variables which can be used as instruments for trade, it appears to be appropriate to follow the approach of Shin and Wang (2005). They have introduced possibly omitted variables from the model in order to address the problem of endogeneity between trade intensity and business cycle synchronization. Thus, two variables - proxies for monetary policy coordination and fiscal policy coordination - are included in our model that is likely to capture the effects of pegging the exchange rate on shock convergence, and thus mitigate potential endogeneity. In addition, we refer to this issue once more later when the appropriate estimator is discussed.

[5] The difference in *change* of cyclically adjusted government budget balance (surplus or deficit) measured as a percentage of country's GDP, between the CSEEC and the euro area is used as a robustness check.

3.3. Estimation strategy

The previous researches on the determinants of shock synchronisation have been conducted in a static panel regression setting. When dealing with macroeconomic variables, however, adding dynamics to a model can be very important. Estimating a static model in the presence of dynamic relationships leads to a model misspecification (Greene, 2008).[6] Accordingly, our empirical strategy focuses on dynamic panel estimators. One of the most attractive dynamic panel estimators in applied research during the past few years has been the system Generalized Method of Moments estimator. Although attractive, in particular because of its advantages related to the treatment of potential endogeneity, this estimator is not appropriate for this research since it is designed for 'small *T*, large *N*' panels (Roodman, 2009), which is opposite to our case (large *T*, small *N*).

Key to the understanding of the recent econometric literature on dynamic panels with larger *T* dimension is the research by Pesaran and Smith (1995). They accentuate that if the true parameters in a model vary across countries, then those parameters cannot be estimated consistently using a model which imposes cross-country parameter homogeneity. In other words, the assumption of slope homogeneity in the traditional procedures for estimation of dynamic panel models, such as the fixed- or random-effects estimators, seems to be unrealistic since, as pointed out by Pesaran et al. (1996), most of the evidence from larger *T* panels suggests that slope heterogeneity is pervasive.

To obtain consistent estimators of the means of the slope coefficients, Pesaran and Smith (1995) proposed the Mean Group (hereinafter: MG) estimator based on the idea of averaging the estimates of parameters obtained from *N* separate time-series regressions. While it might be reasonable to assume that parameters vary across countries in the short run, it is less likely that there are no common features in the long-run relationships. This insight is exploited by the Pooled Mean Group (hereinafter: PMG) estimator proposed by Pesaran et al. (1999) as an intermediate estimator

[6] From an econometric point of view, Greene (2008, p. 469) offers forcible arguments for the importance of modelling dynamics, as: 'adding dynamics to a model […] creates a major change in the interpretation of the equation. With the lagged variable, we now have in the equation the entire history of the right-hand-side variables, so that any measured influence is conditional on this history; in this case, any impact of the independent variables represents the effect of new information'.

which imposes homogeneity of the slope coefficients entering the long-run relationships (similar to a fixed effects estimator). Yet, it allows for heterogeneity of the coefficients characterizing the short-run dynamics, similar to the MG estimator. This advantage fits well with our research as there might be country-specific forces for each CSEEC that causes heterogeneity of the short-run coefficients, but it is also very likely that there are common features of the CSEEC shaped by the European market integration process in the long-run.

This approach is essentially a panel equivalent to the time-series error correction re-parameterisation of an autoregressive distributed lag (hereinafter: ARDL) model, which appears to be a useful platform for addressing a number of methodological issues. The error correction model has the advantage of accounting for both the short-run fluctuations and the long-run equilibrium relationship between the variables, even if they appear to be non-stationary which is very likely for relatively long macroeconomic data series, as in our case. Another major advantage of this estimator is that there is no requirement for the order of integration to be the same for all the variables since it yields consistent and asymptotically normal estimates of the parameters defining a long-run relationship between both stationary and integrated variables. Furthermore, Pesaran et al. (1999) and Pesaran and Shin (1997) point out that augmenting the ARDL specification with an adequate number of lags makes the estimation of the long-run coefficients more immune to endogeneity problems, irrespective of whether the regressors are stationary or not. This advantage is very important for our research since, apart from introducing omitted variables in the model to tackle possible endogeneity as explained in the equation (14), we are able to strengthen additionally the 'immunity' of the model to endogeneity problems. From an econometric point of view, the ARDL dynamic panel specification takes the following form:

$$\Delta y_{it} = \phi_i \left[y_{it-1} - \theta_{0i} - \theta_{ki}(X_k)_{it-1} \right] + (\delta_k)_{i0} \Delta (X_k)_{it} + \varepsilon_{it} \tag{15}$$

where Δy_{it} is the first difference of the dependent variable (time-varying coefficient of supply or demand shocks), ϕ_i is the error-correction parameter, y_{it-1} is the lagged dependent variable, θ_{0i} is a country-specific constant, θ_{ki} are parameters on the *K* lagged explanatory variables (as defined in equation 14), $(\delta_k)_{i0}$ are parameters on the differenced explanatory variables, $(X_k)_{it-1}$ is a set of K lagged explanatory variables, while $\Delta(X_k)_{it}$ is a set of differenced explanatory variables and ε_{it} is the error term assumed to be independently and identically distributed across countries and time and uncorrelated with the regressors.

The set of explanatory variables encompassed in the equations (14) and (15) is augmented by a dummy variable for the period of the most recent global economic crisis (which has come to be known as the Great Recession). The rationale is to investigate whether the crisis introduced a structural break to the shock convergence process of CSEEC towards the euro area.

4. Estimation of variables and data description

Our data set for estimating the dependent variable (supply and demand shocks) consists of quarterly observations spanning over 16 CSEEC, the euro area and the United States from q1:1995 to q4:2011.[7] A dataset with broader time and cross-sectional dimensions was limited by the unavailability of reliable data for earlier period and discontinued time series for other CSEEC (such as, Albania, Bosnia and Herzegovina, and Montenegro). The data set consists of seasonally adjusted output (real GDP) and prices (GDP deflator, or CPI if data for the GDP deflator is unavailable).

The first step before proceeding with the estimation of aggregate supply and demand shocks is to investigate the stationarity of the variables (real GDP and GDP deflator/CPI). The VAR representation requires both variables to be stationary as an input in this framework. Therefore, the stationarity of real GDP and the GDP deflator/CPI, and then the stationarity of GDP growth and inflation (year-on-year difference of real GDP and GDP deflator/CPI) is examined for all countries included in the analysis. The Augmented Dickey-Fuller (hereinafter: ADF) tests reveal that the hypothesis of a unit root cannot be rejected at conventional significance levels for all countries for real GDP and the GDP deflator/CPI. The ADF tests applied to real GDP growth and inflation give mixed

[7] Data sample starts in q1:1996 for Malta, q1:1997 for Bulgaria, Croatia, Macedonia and Serbia, and q1:1998 for Romania.

results, thereby not providing sufficient evidence to reject the null of a unit root in some cases.[8] This is not surprising given the ongoing output and inflation convergence in the Europe, which is especially pertinent to the CSEEC. Following the blossoming literature stemming from Blanchard and Quah (1989), who adjusted the growth rates of their variables by applying linear trend, other studies usually adjusted the data by applying the Hodrick-Prescott trend (for example, Suppel, 2003). Therefore, the data in our case are adjusted by applying the Hodrick-Prescott trend to transform real GDP growth and inflation into stationary variables. Thus, Hodrick-Prescott filtered fluctuations (smoothing parameter: 1600) of real GDP growth and inflation are entered into SVAR framework.

In the next step, the order of the VAR is determined. The lag length is chosen according to several tests: Likelihood ratio, Schwarz information criterion, Akaike information criterion and Hannan-Quinn information criterion. In addition, the LM test of residual serial correlation and the impulse response function were also checked. In general, five or six lags were optimal in most of the cases. More lags are necessary for some countries in order to obtain residuals free of autocorrelation. Therefore, the approach chosen by most of the papers of a symmetric specification for all countries by applying uniform lag length is not followed. Instead, an appropriate number of lags for each country is chosen aiming to obtain white noise residuals.[9] It is very important to choose the appropriate number of lags for each country because the impulse response function is very sensitive to the number of lags employed. The number of lags chosen for each country is shown in Table 1.

In the final step, the stability of the VAR is investigated by checking whether the roots of characteristic polynomial lie inside the unit circle. The results reveal that the VAR satisfies the stability condition for all countries.

Then, the identified supply and demand shocks enter the system of equations defined in the previous section related to the Kalman filter. Before estimating the equations, the initial state of the model has to be defined - the starting values of the unobserved variables and their variance-covariance matrix. Regarding this, the approach of Zhang and Sato (2005) is followed. Thus, the measurement equation (11) is estimated by ordinary least squares and the estimated constant coefficients are used as

[8] The results obtained from ADF tests are not presented here due to space limitation but are available upon request to the authors.
[9] This approach was followed by Dibooglu and Horvath (1997) as well.

starting values of the unobserved variables. At the same time, the estimated variance-covariance matrix obtained by ordinary least squares is used for the specification of the starting values of the variance-covariance matrix of the unobserved variables.

Figure 1 presents the estimated time-varying coefficient *b* for CSEEC, more precisely, the average values. With the United States as an alternative attractor, the time-varying coefficient *b* for demand shocks follows different trends during the analysed period. During the first part of the analysed period the time-varying coefficient of demand shocks is relatively stable, but considerable shock convergence of the CSEEC towards those of the euro area is evident since 2004. Surprisingly, this process is not interrupted at the beginning of the global financial crisis in 2008, but continues until 2010 when a substantial slowdown is registered. The time-varying coefficient *b* of supply shocks converges to the euro area before the crisis, albeit it seems at a slower pace than the demand shocks. However, this process turns in the opposite direction, since the beginning of the Great Recession and significant divergence effect is estimated. The time-varying coefficient *b* calculated as weighted average value using country's GDP as a weight reveals similar movements.

As discussed in the previous section, the variables that are expected to explain the shocks dynamics are: measures of trade intensity, measures of intra-industry trade, and proxies for monetary policy coordination, fiscal policy coordination and financial integration.

Trade intensity is calculated as in Frankel and Rose (1998) and represents the natural logarithm of the average bilateral trade intensity between the CSEEC *i* and the euro area *j* over time period *t*. We employ two measures depending whether the trade intensity is normalized by the total trade or the nominal GDP:

$$TI^{T}_{i,j,t} = (EX_{i,j,t} + IM_{i,j,t})/(EX_{it} + EX_{jt} + IM_{it} + IM_{jt}) \qquad (16)$$

$$TI^{Y}_{i,j,t} = (EX_{i,j,t} + IM_{i,j,t})/(Y_{it} + Y_{jt}) \qquad (17)$$

where, *TI* denotes the index of trade intensity of the CSEEC with the euro area, *EX* denotes exports, *IM* is imports, and *Y* stands for the nominal GDP.

The indices presented in Figure 2 show that trade intensity of the CSEEC vis-à-vis the euro area normalized either on total trade or GDP was experiencing an increasing trend during the analysed period, although the crisis caused a sharp decline in the trade with the euro area.

Intra-industry trade is expected to be another important factor behind the shocks convergence. The intra-industry trade component has attracted significant attention in both the theoretical and empirical literature. Still, it was not until the influential study by Grubel and Lloyd (1975) that empirical research on intra-industry trade experienced unprecedented proliferation. They proposed what has now been the most widely used measure of the degree of the intra-industry trade between two trading partners, the so called Grubel-Lloyd index (hereinafter: GLI). The GLI measures the intra-industry trade as the percentage of a country's total trade which overlaps with that of the trading partner. If all bilateral trade overlaps, the index would equal 100, which means that the trade is only intra-industry trade. On the other hand, if all trade is unmatched, then the index would be zero indicating only inter-industry trade. Consequently, the higher the value of the index, the higher the degree of intra-industry trade is. The index is calculated according to the following formula:

$$GLI = \left\{ 1 - \frac{\sum_{i=1}^{n} \left| X_{it} - M_{it} \right|}{\sum_{i=1}^{n} \left(X_{it} + M_{it} \right)} \right\} * 100 \tag{18}$$

where GLI denotes the Grubel-Lloyd index for intra-industry trade; X denotes exports; M denotes imports; n denotes number of commodity groups; t denotes the period; and i denotes the commodity group.

The main shortcoming of the index in equation (18) is related to the ignorance of the trade imbalance (surplus or deficit). If there is an imbalance in the international trade, the index theoretically cannot reach the value of 100 because the exports cannot match imports due to the trade gap. Later, Grubel and Lloyd proposed a formula for calculation of the adjusted index (hereinafter: AGLI) by subtracting global trade imbalance from total trade:

$$AGLI = \left\{ \frac{\sum_{i=1}^{n} \left(X_{it} + M_{it} \right) - \sum_{i=1}^{n} \left| X_{it} - M_{it} \right|}{\sum_{i=1}^{n} \left(X_{it} + M_{it} \right) - \left| \sum_{i=1}^{n} X_{it} - M_{it} \right|} \right\} * 100 \tag{19}$$

Nevertheless, even with the adjustment of the GLI, other important theoretical critiques remain. The index does not allow differentiation of intra-industry trade in line with the Falvey (1981) argument that commodities in the same industry can also differentiate by quality. Thus, intra-industry trade can be further divided to horizontal and vertical intra-industry trade.[10] This differentiation is important in the context of our investigation since the synchronisation of shocks may be affected differently by these two types of trade. While the horizontal intra-industry trade should contribute to higher symmetry of shocks in accordance with the European Commission (1990) view, the vertical intra-industry trade does not guarantee symmetry of shocks because it implies deepening of the specialisation of countries along the quality spectrum inside industries. The latter includes major differences in research and development expenses, factor endowments and qualification of labour force (Fontagné and Freudenberg, 1999; Fontagné et al. 2005).

Fontagné and Freudenberg (1997) offered two indices for overcoming the disadvantages of GLI. The first one considers trade on a product level as being either inter-industry trade (one-way trade) or intra-industry trade (two-way trade). Trade in a particular product is considered as intra-industry trade if the value of the minority flow (for example, imports) is a significant percentage of the majority flow (for example, exports). If the minority flow is below some defined minimum threshold, then the trade is considered as inter-industry trade. They recommend the following formula:

$$\frac{Min\left(X_{it}, M_{it}\right)}{Max\left(X_{it}, M_{it}\right)} \rangle \beta \tag{20}$$

where β denotes the defined minimum threshold; and the other symbols are the same as in previous equations.

[10] On theoretical grounds, the horizontal intra-industry trade is assumed to be more consistent with the modern theories of trade and relevant to trade among developed countries, whereas vertical intra-industry trade is expected to be more related to traditional theories of comparative advantage and to dominate the trade among countries with different income levels (so called North-South trade models). As Greenaway et al. (1995) demonstrate a failure to separate the two components can seriously undermine the interpretation of the empirical results. Not only horizontal and vertical intra-industry trade are driven by different factors, but also the adjustment implications of a given trade expansion differ between the two.

The second index allows the intra-industry trade calculated by applying equation (20) to be broken down into horizontal and vertical components. The main assumption here is that differences in prices reflect differences in quality. Intra-industry trade is considered to be horizontal if the ratio between export and import unit values[11] of some product differs by less than some defined threshold. If this condition is not satisfied, the intra-industry trade is considered to be vertical. They define the following formula:

$$\frac{1}{(1+\alpha)} \leq \frac{UV_{it}^{X}}{UV_{it}^{M}} \leq (1+\alpha) \qquad (21)$$

where *UV* denotes unit values as a common proxy for quality; α denotes the defined threshold; and the other symbols are the same as in previous equations.

In our analysis, the threshold for trade overlap defined in equation (20) is 10 percent, while the threshold for product similarity defined in equation (21) is 15 percent, which are set as in Fontagné and Freudenberg (1999).[12] All estimates reported use quarterly data at the five-digit level, which gives 3,530 commodity groups. Although in many empirical studies the decomposition of trade is done with data that use the three-digit level, it is necessary to use a higher level of disaggregated data in this study in order to estimate more precisely the horizontal and vertical intra-industry trade which depends on calculating appropriately the exports and imports unit values.

The calculated indices suggest that the share of intra-industry trade of the CSEEC with the euro area increased during the analyzed period by around 10-25 percentage points depending on the type of index (Figure 3). Nevertheless, the largest part of the intra-industry trade belongs to vertical intra-industry trade; the share of horizontal intra-industry trade is small and amounts less than one fifth of total intra-industry trade or around 8% of total trade between the CSEEC and the euro area, on average during the analyzed period.

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[11] The unit values for exports and imports are obtained by dividing the values of exports and imports by their quantity.

[12] Fontagné and Freudenberg (1997) estimate the share of intra-EU trade flows according to the degree of overlap (the minority flow as a percentage of the majority flow) and find that the highest value is for a threshold of 10 percent (almost one-third of all intra-EU trade). Regarding the share of intra-EU trade flows according to the unit value ratios of bilateral trade flows (measured by dividing the larger unit value by the smaller one), the highest value is for the threshold of 15 percent (more than a quarter of total intra-EU trade).

Variables reflecting the ***monetary policy coordination*** and ***fiscal policy coordination*** between the CSEEC and the euro area are presented in Figures 4 and 5, respectively. The average values of the variables for the CSEEC included in the analysis do not seem to support clear trend of movement during the analysed period, although the global economic crisis is reflected at the end of the sample via increased monetary policy and fiscal policy divergence.

A measure of ***financial integration*** is difficult to include in our model since there are no available data for financial flows between the CSEEC and the euro area on quarterly basis. Nevertheless, in the robustness checks we use as a proxy the log deviation of the country's real effective exchange rate index (CPI-based, 2005=100) from the euro area average. It is believed that our control variable is likely to capture the effects of, for example, higher foreign direct investments originating from the euro area on shock convergence process in the CSEEC which are reflected in appreciation of their real effective exchange rates. Indeed, by eye-balling the yearly data for the foreign direct investments flows from the euro area to the CSEEC and the real effective exchange rate of CSEEC it seems that there is a positive relationship between the variables (Figure 6).

At the end, the data set gives in total 835 observations (N=16 countries and T=59 quarters).[13] The panel is unbalanced because there are missing observations for some of the variables. The variables related to trade intensity, trade structure and proxy for financial integration are expressed in natural logarithms in the further analysis. Although the estimator developed by Pesaran et al. (1999) does not require the order of integration to be the same for all variables since it is consistent in estimating long-run relationship between both stationary and integrated variables, we run several tests for non-stationarity to inspect more systematically the data. By eye-balling the data, most of the figures presented in this section show that the series are trending upwards or downwards, except the series for monetary policy and fiscal policy coordination which seem to be stationary. Several panel unit root tests can be applied to examine the stationarity of unbalanced panel data. First, the Im-Pesaran-Shin (hereinafter: IPS) test is appropriate for dynamic heterogeneous panels and is based on

[13] Sources of the data employed in the analysis include Eurostat (Eurostat Comext database), IMF's International financial statistics, IMF's Direction of Trade statistics and the statistics agencies and central banks of the respective countries.

the average of ADF statistics calculated for each cross-section in the panel. The IPS test tests the null of a unit root in the entire panel against the alternative that some panels are stationary. Second, Fisher ADF and Fisher PP tests check similarly the non-stationarity for each individual panel and obtain the test statistic by combining p-values from the separate tests. Both tests test the null of unit root in all panels against the alternative that at least one panel is stationary.

The results suggest that time-varying coefficients of supply and demand shocks, trade intensity normalized by nominal GDP, weighted GLI, adjusted weighted GLI and intra-industry trade index calculated according to Fontagné and Freudenberg are non-stationary at the 1% or 5% significance level according to at least two tests (Table 3). Stationarity of the data is obtained by first differencing which suggest tentatively that the data are integrated of order 1 (that is, I(1)). On the other hand, the null of unit root is strongly rejected for trade intensity normalized by total trade, vertical intra-industry trade index, monetary policy coordination, fiscal policy coordination and proxy for financial integration.

5. Results

Before proceeding with the discussion of the results, we shortly focus on the consistency of the estimator and the expected signs of the coefficients. Recalling from the discussion in section 3.3, the PMG estimator constrains the long-run elasticities to be equal across all panels. If this restriction is true, the PMG estimates are efficient and consistent, while the MG is only consistent. Otherwise, if the true long-run coefficients are heterogeneous, the MG estimator is both consistent and efficient, while the PMG is inconsistent. The Hausman test enables to test the difference between PMG and MG estimator under the null that the estimates are the same – if the null cannot be rejected, the PMG is preferred, since it is both consistent and efficient in that case. The results from the Hausman test applied to core regressions are presented in Table 4 and suggest that the PMG estimates are preferred since we do not reject the null of equality between the PMG and MG at the 1% level of significance.

Regarding the expected signs, the coefficient on trade intensity variable may take either a negative or a positive value depending on whether the European Commission (1990) view or the

Krugman's (1993) view is more likely to hold. If the European Commission (1990) view is relevant, then the sign of the coefficient is expected to be negative implying that increased trade reduces the difference between the shocks of the CSEEC and those of the euro area, leading to a shock convergence. Conversely, if the Krugman's (1993) view is valid, then the sign of the coefficient is expected to be positive, suggesting that the increased trade widens the asymmetry between the shocks of the CSEEC and those of the euro area, leading to a shock divergence.

The sign of the coefficient on intra-industry trade is expected to be negative since, as it was argued in the second section, higher intra-industry trade, in particular its horizontal component, should contribute to a reduction of asymmetric shocks. However, since the vertical intra-industry trade dominates, the reduction of shock asymmetries may not occur as discussed in line with the arguments of Fontagné and Freudenberg (1999), implying that the sign of the coefficient may even be positive leading to a shock divergence.

The sign of the coefficient related to the monetary policy coordination is expected to be negative, since higher correlation of the interest rates between the CSEEC and the euro area is expected to contribute to shock convergence. On the other hand, the sign of the coefficient on fiscal policy coordination is expected to be positive, because an increase in the difference between the government budget balance of the CSEEC and the euro area is expected to cause shock divergence.

Due to the ambiguity in the interpretation of the effects of financial integration on shock synchronisation, the sign of its impact cannot be specified a priori on the basis of theoretical reasoning alone. On the one hand, financial flows from one country are likely to affect the economy of another country in a similar way as trade integration and contribute to higher shock synchronisation; that is, the sign of the coefficient is expected to be negative. On the other hand, as previously discussed, the coefficient may take a negative value because financial integration allows production specialisation leading to lower shock synchronisation.

We first present the estimations from the so called core or basic model of the determinants of the demand shocks and of the supply shocks (Table 5). One of the most important implications of the model is the evidence in support of the European Commission (1990) view that the European economic integration leads to less frequent asymmetric (idiosyncratic) shocks. The coefficient on the error correction term across all empirical specifications is statistically significant at the 1% level suggesting that the selected variables in the model show a return to a long-run equilibrium. The error-correction speed of the adjustment parameter from demand shock equations is statistically significant at the 1% level and is estimated at 0.157-0.163, suggesting that, on average, 0.160 of the deviation is corrected each quarter. This implies that the demand shock convergence is likely to occur in around 6 quarters. Similarly, the error-correction speed of the adjustment parameter for supply shocks is statistically significant at the 1% level and of similar magnitude (0.173-0.179) suggesting that the supply shock convergence is likely to occur in less than 6 quarters.

The trade intensity measure normalized on total trade flows appear to be statistically and economically significant factor of both the demand shocks and supply shocks convergence. The negative values of the long-run coefficients for trade intensity measure lend unconditional support to the European Commission (1990) view. The increase in the volume of trade between the CSEEC and the euro area contributes to demand and supply shock convergence. When the trade intensity index increases by one unit, the demand shocks in the CSEEC on average converge to those of the euro area by 0.067-0.070 units, holding other factors constant. As for the supply shocks, the convergence is on average higher (0.080-0.093), although the coefficient of trade intensity measure is not statistically significant in one equation.

Regarding the traditional measures of intra-industry trade, the estimated coefficients for demand shocks appear to be statistically significant at conventional levels of significance. The estimated negative signs of the coefficients suggest that the increased similarity in the trade patterns is also likely to contribute to convergence of the demand shocks. More precisely, an increase in the intra-industry trade index by one unit is expected to lead to convergence of the demand shocks in the CSEEC to those of the euro area, on average, by 0.022-0.038 units, ceteris paribus. On the other hand, it is difficult to extract the genuine effect of the intra-industry trade on supply shock convergence since two of the coefficients are not statistically significant. Nevertheless, it seems that further differentiation of the trade structure does matter. Since the largest part of the intra-industry trade of the CSEEC with the euro area is vertical, as presented before, and has increased more rapidly than the horizontal intra-industry trade, we place more weight on the results for the former trade pattern. The coefficient is negative and statistically significant at the 1% level, suggesting that an increase of the vertical intra-industry trade is likely to contribute to a convergence of the aggregate supply shocks by 0.083 units. Hence, even the dominant portion of the international two-way trade leads to shock convergence in the CSEEC vis-à-vis the euro area.

The fiscal policy similarity – proxied by the difference of the country's cyclically adjusted general government budget balance with the euro area average – has the expected sign, but it is statistically significant only in three regressions related to supply shocks convergence. The positive coefficient suggests that an increase in the difference between the government budget balance (normalized by GDP) of the CSEEC and the euro area by one percentage point is expected to lead to a supply shock divergence by 0.003-0.005 units. Thus, our results recognize the divergent fiscal policies as a source of idiosyncratic shocks. However, the magnitude of the coefficient is rather small to provide a meaningful economic explanation of the convergence of the aggregate shocks. On the other hand, the monetary policy coordination proxy is not significant, pointing to a very limited explanatory power for the aggregate shock behaviour during the observed period in the CSEEC.

Lastly, the Great Recession dummy variable taking values of 1 from the third quarter of 2008 onwards is statistically significant across all empirical specifications at the 5% level of significance for demand shocks and at the 10% level of significance for supply shocks. The negative coefficient in the equations for demand shocks suggests that the global economic turmoil has boosted a demand shock convergence between the CSEEC and the euro area. This empirical result could be attributed to the falling aggregate demand in most European countries during the Great Recession. It is interesting to note that the impact is in contrast with the supply shock convergence story. In this case the Great Recession has contributed to a supply shock divergence among the SCEEC, on one hand, and the euro area, on the other. Its diverging effect probably caused the volatility in significance and sign of the coefficients measuring the effect of trade intensity and trade structure on supply shock convergence which we will discuss in the next section focusing on the robustness of results.

6. Robustness checks

In order to investigate the consistency of the empirical results, a battery of robustness checks is conducted by: (a) augmenting the core model with a control variable for financial integration between the CSEEC and the euro area; (b) augmenting the core model with the lagged differences of the variables of interest in order to address the potential endogeneity problem; (c) employing an alternative proxy for fiscal policy coordination based on a change of budget balance; (d) augmenting the core model with a control dummy variable for the membership in the euro area; (e) employing an alternative measure of trade intensity normalized by GDP, and (f) estimating the core model only for the period before the Great Recession (q2:1997-q2:2008).[14]

The first set of robustness checks re-estimate the core model regressions by including a control variable – the log deviation of the country's real effective exchange rate index from the euro area average. This specification is not considered as a core model because there is no available quarterly data for financial flows between the CSEEC and the euro area and therefore, the basic model is augmented with the proxy for financial integration in the robustness checks instead. The empirical results are relatively consistent across different specifications, whereas the new variable of interest has negative sign and is statistically significant in all empirical specifications for the supply shock convergence process at the 1% level of significance and most of the equations for the demand shock convergence at the 5% or 10% level of significance (Table 6). An increase of the real effective exchange rate index implies a real appreciation and a positive value of the log deviation indicates that the country experienced larger real appreciation of the effective exchange rate index than the euro area during the observed period. The negative value of the coefficient indicates that when the real effective exchange rate in the CSEEC appreciates over and above the real effective exchange rate of the euro area by one unit, the supply shocks in the CSEEC on average converge to those of the euro area by 0.149-0.175 whereas the demand shocks converge by 0.090-0.123, holding other factors

[14] Because of the statistical insignificance of the monetary policy coordination proxy in the core model regressions, this variable is omitted and we rely on more parsimonious specifications in the robustness checks. Nevertheless, the obtained results are consistent if the monetary policy coordination proxy is included and are available upon request to the authors.

constant. Thus, the augmented model estimates a strong contribution of financial integration to the convergence process of the CSEEC towards the euro area, and in particular for supply shocks.

Apart from introducing possibly omitted variables (the two proxies for monetary and fiscal policy coordination) in the model in order to address the problem of endogeneity, we additionally attack the potential endogeneity by including lagged differences of the variables of interest. The results from the regressions including the first lag of the difference of the variables related to trade intensity, trade structure, monetary policy coordination and fiscal policy coordination are presented in Table 7. The estimated coefficients of the augmented model yield largely similar results with the core model and are relatively consistent across different specifications, and in particular for the trade intensity and the intra-industry trade measures. The negative and higher values of their coefficients lend further evidence in favour of the European Commission (1990) view that trade similarity improves the symmetry of shocks. A noteworthy difference, though, is the statistical insignificance of the coefficients measuring the effect of fiscal policy coordination. This is not very surprising given that the estimated effect of fiscal policy coordination in the core model is relatively small and statistically significant only in the regressions related to the supply shock convergence. The third set of robustness checks - conducted by employing an alternative proxy for fiscal policy coordination based on a change of budget balance - yields similar results in terms of statistical insignificance of this variable (Table 8).

Having in mind that five countries from the CSEE have become members of the euro area since 2007, it is possible that their shock convergence process was affected by this event. Therefore, a dummy for the euro area membership is added to the core model to control for this effect (Table 9). The results suggest that the dummy variable has the expected negative sign of the coefficient supporting faster convergence process, but it is not statistically significant at any conventional level of significance across any specification for both supply and demand shock convergence.

In the next step, we employ an alternative measure of trade intensity normalized by GDP and the obtained results are consistent with the estimations based on employing trade intensity measure normalized by total trade in terms of sign and statistical significance of the coefficients of this variable (Table 10).

In the last step, we investigate whether the estimation results are driven by the recent global economic turmoil. The core empirical specifications are re-estimated only for the quarterly observations in the pre-crisis period (q2:1997-q2:2008) and the results are presented in Table 11.[15] It is worth noting that the estimations fully support our earlier results. Two conclusions are worth putting forward. First, the identified relationships in the previous regressions are not statistical artefacts of the significant growth slowdown in the crisis period. Second, the intensity of bilateral trade and the similarity of trade pattern have a consistent and strong contribution to the demand and supply shock convergence process of the CSEEC.

7. Concluding remarks

This paper investigates the determinants of shock synchronisation of the CSEEC vis-à-vis the euro area. The intensity of trade and similarity of trade structure are the main drivers of the convergence of supply and demand shocks. Most of the model specifications lend unconditional support to trade intensity measure as a significant contributor to shock convergence. Thus, an increase in the volume of trade between the CSEEC and the euro area is associated with shock convergence, for both supply and demand shocks. Higher intra-industry trade is also strengthening the shock synchronisation. In particular, the vertical intra-industry trade which has a dominant share of the intra-industry trade between the CSEEC and the euro area supports the shock convergence process. Another variable introduced in the augmented model as a proxy for financial integration is estimated as a significant contributor to the convergence process of the CSEEC towards the euro area, and in particular for supply shocks. Overall, an increase in trade and financial integration leads to less frequent asymmetric (idiosyncratic) shocks.

On the other hand, divergent fiscal policies are estimated in some model specifications to increase the shock divergence process, although the estimated impact is rather small to counteract the positive effects associated with trade and financial integration. Monetary policy coordination does not

[15] The variables for supply and demand shocks are also re-estimated only for the quarterly observations in the pre-crisis period (q2:1997-q2:2008).

yield significant effects on the shock convergence of the CSEEC. Neither membership in the euro area of the five CSEEC is associated with higher shock convergence.

The recent global economic turmoil affected the supply and demand shock convergence in opposite directions. On the one hand, it boosted a demand shock convergence between the CSEEC and the euro area which could be attributed to the falling aggregate demand in most European countries during the crisis. On the other hand, the last economic and financial crisis led to a supply shock divergence among the CSEEC vis-à-vis the euro area which is reflected in a drop of statistical significance or volatility of sign of the coefficients related to trade integration in some of the model specifications. Overall, the identified relationships in this research are affected by the significant trade and growth slowdown in the crisis period, but are not its statistical artefacts.

Taken together, in the current context of continuous reassessment of the sustainability of the single currency and gradual enlargement of the euro area during the last decade this paper provides empirical evidence suggesting that the European integration supports the economic convergence process of the CSEEC. This implies that further growth of the volume of trade, intra-industry trade and the level of financial integration is expected to bring substantial benefits of the current and potential CSEEC members of the euro area in terms of higher shock symmetry and consequently leads to smaller need for an independent monetary policy. If this process is not counteracted by divergent fiscal policies which have not been very challenging issue in the past for the CSEEC according to our empirical results, the euro could again continue in the future its historical journey to conquer the independent monetary space of the Central and South-Eastern Europe.

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TABLE 1. Number of lags chosen for individual countries

Country	US	EA	BG	CY	CZ	EE	HR	HU	LT
Lags	3	3	3	5	5	6	5	6	5
Country	LV	MK	MT	PL	RO	SI	SK	SR	TR
Lags	5	6	5	5	5	6	6	6	5

Source: Authors' calculations.
Note: US-United Sates of America; EA-Euro area; BG-Bulgaria; CY-Cyprus; CZ-Czech Republic; EE-Estonia; HR-Croatia; HU-Hungary; LT-Lithuania; LV-Latvia; MK-Macedonia; MT-Malta; PL-Poland; RO-Romania; SI-Slovenia; SK-Slovakia; SR-Serbia; TR-Turkey.

TABLE 2. Descriptive statistics for the variables of interest

	Average	Min	Max
Dependent variable(s)			
Time-varying coefficients for demand shocks	0.40	-0.41	1.38
Time-varying coefficients for supply shocks	0.29	-0.59	1.32
Measures of trade intensity			
Trade intensity (normalized by total trade)	-5.98	-8.01	-3.76
Trade intensity (normalized by GDP)	-6.49	-8.57	-4.13
Measures of intra-industry trade			
Weighted GLI	3.24	1.98	4.07
Adjusted weighted GLI	3.53	2.12	4.43
Total intra-industry trade	3.73	2.46	4.52
Vertical intra-industry trade	3.53	2.20	4.34
Proxies for policy coordination			
Monetary policy coordination	0.30	-0.99	1.00
Fiscal policy coordination (budget balance)	0.00	-14.98	36.64
Fiscal policy coordination (change of budget balance)	-0.03	-17.60	36.23
Proxy for financial integration			
Deviation of the country's real effective exchange rate index from the euro area average	0.03	-0.41	0.34

Source: Authors' calculations.

TABLE 3. Summary of panel unit root tests

Variables	Original data			First difference of the data		
	IPS	Fisher ADF	Fisher PP	IPS	Fisher ADF	Fisher PP
tvc_d	0.999	0.999	0.999	0.000	0.000	0.000
tvc_s	0.103	0.149	0.545	0.000	0.000	0.000
t	0.015	0.006	0.002	0.000	0.000	0.000
tgdp	0.198	0.384	0.015	0.000	0.000	0.000
wgli	0.780	0.032	0.002	0.000	0.000	0.000
awgli	0.687	0.051	0.001	0.000	0.000	0.000
twt	0.940	0.434	0.000	0.000	0.000	0.000
vtwt	0.030	0.000	0.000	0.000	0.000	0.000
mpc	0.000	0.000	0.001	0.000	0.000	0.000
fpc	0.000	0.000	0.000	0.000	0.000	0.000
fpc(d)	0.000	0.000	0.000	0.000	0.000	0.000
dreer	0.000	0.000	0.025	0.000	0.000	0.000

Source: Authors' calculations.
Note: p-values of the tests are presented in the table. tvc_d-time-varying coefficient of demand shocks; tvc_s-time-varying coefficient of supply shocks; t-trade intensity scaled by total trade; tgdp-trade intensity scaled by nominal GDP; wgli-weighted GLI; awgli-adjusted weighted GLI; twt-intra-industry trade index calculated according to Fontagné and Freudenberg; vtwt-vertical intra-industry trade index; mpc-monetary policy coordination; fpc-fiscal policy coordination (budget balance); fpc(d)-fiscal policy coordination (change of budget balance); dreer-financial integration.

Table 4. Hausman test for the difference of estimates of MG and PMG

	Variables included in the different models[16]									Hausman test (p-value)
	tvc_d	tvc_s	t	wgli	awgli	twt	vtwt	mpc	fpc	
1	x		x	x				x	x	0.129
2	x		x		x			x	x	0.293
3	x		x			x		x	x	0.090
4	x		x				x	x	x	0.020
5		x	x	x				x	x	0.645
6		x	x		x			x	x	0.413
7		x	x			x		x	x	0.433
8		x	x				x	x	x	0.015

Source: Authors' calculations.
Note: x denotes the variables included in the different models; p-values of the tests are presented in the last column of the table; the abbreviations are the same as those described in Table 3.

[16] Each model also includes constant, dummy for the Great Recession and first difference of the corresponding explanatory variables described in the table.

TABLE 5. PMG estimation of the long-run coefficients of the determinants of supply and demand shock convergence (q2:1997 - q4:2011)

Dependent variable	Demand shocks convergence				Supply shocks convergence			
Measure of intra-industry trade	wgli	awgli	twt	vtwt	wgli	awgli	twt	vtwt
Trade intensity measure	**-0.069*** **	**-0.070*** **	**-0.068*** **	**-0.067*** **	**-0.086*** **	-0.012	**-0.080*** **	**-0.093*** **
(Normalized on total trade flows)	*0.022*	*0.021*	*0.021*	*0.021*	*0.016*	*0.024*	*0.017*	*0.024*
Measure of intra-industry trade	**-0.022***	**-0.038*** **	**-0.032** **	**-0.028** **	0.024	**-0.089*** **	-0.005	**-0.083*** **
	0.012	*0.014*	*0.014*	*0.013*	*0.020*	*0.025*	*0.021*	*0.022*
Fiscal policy coordination	0.001	0.001	0.002	0.001	**0.005*** **	0.001	**0.005*** **	**0.003***
(Based on budget balance)	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*
Monetary policy coordination	-0.005	-0.003	-0.006	-0.007	0.006	0.002	0.009	0.008
	0.005	*0.005*	*0.005*	*0.005*	*0.005*	*0.005*	*0.005*	*0.006*
Error correction term	**-0.162*** **	**-0.163*** **	**-0.157*** **	**-0.158*** **	**-0.179*** **	**-0.179*** **	**-0.176*** **	**-0.173*** **
	0.030	*0.029*	*0.030*	*0.029*	*0.030*	*0.031*	*0.027*	*0.025*
Great Recession dummy	**-0.032** **	**-0.032** **	**-0.029** **	**-0.031** **	**0.056***	**0.058***	**0.058***	**0.063***
	0.013	*0.013*	*0.013*	*0.013*	*0.031*	*0.030*	*0.031*	*0.032*
Constant	**0.016***	**0.025*** **	**0.023*** **	**0.022** **	**-0.076*** **	**0.075*** **	**-0.054*** **	-0.023
	0.009	*0.009*	*0.009*	*0.009*	*0.019*	*0.015*	*0.017*	*0.016*

Note: Numbers in *italic* are robust standard errors; asterisks indicate statistical significance at the ***1, **5, and *10 percent level. The abbreviations are the same as those described in Table 3.
Calculated in Stata 12

TABLE 6. Control variable for financial integration: Determinants of the convergence of demand and supply shocks (q2:1997-q4:2011)

Dependent variable	Demand shocks convergence				Supply shocks convergence			
Measure of intra-industry trade	wgli	awgli	twt	vtwt	wgli	awgli	twt	vtwt
Trade intensity measure	**-0.043***	**-0.050** **	-0.035	**-0.428*** **	**-0.089*** **	**-0.052** **	**-0.091*** **	**-0.078*** **
(Normalized on total trade flows)	*0.024*	*0.023*	*0.023*	*0.118*	*0.019*	*0.024*	*0.019*	*0.021*
Measure of intra-industry trade	**-0.027** **	**-0.045*** **	**-0.042** **	**-0.435*** **	0.012	**-0.074*** **	0.029	**-0.064*** **
	0.013	*0.016*	*0.018*	*0.091*	*0.023*	*0.024*	*0.024*	*0.021*
Fiscal policy coordination	0.001	0.001	**0.002***	**0.010** **	**0.002***	0.001	0.002	0.002
(Based on budget balance)	*0.001*	*0.001*	*0.001*	*0.005*	*0.001*	*0.001*	*0.001*	*0.001*
Financial integration	**-0.090***	**-0.098***	**-0.123** **	-0.133	**-0.155*** **	**-0.175*** **	**-0.152*** **	**-0.149*** **
	0.053	*0.054*	*0.053*	*0.135*	*0.025*	*0.040*	*0.033*	*0.037*
Error correction term	**-0.162*** **	**-0.161*** **	**-0.152*** **	**-0.101*** **	**-0.176*** **	**-0.173*** **	**-0.177*** **	**-0.178*** **
	0.029	*0.028*	*0.029*	*0.025*	*0.025*	*0.024*	*0.026*	*0.025*
Great Recession dummy	**-0.030** **	**-0.030** **	**-0.026** **	-0.020	**0.056***	**0.058***	**0.056***	**0.061** **
	0.013	*0.013*	*0.012*	*0.016*	*0.030*	*0.030*	*0.030*	*0.031*
Constant	**0.043*** **	**0.048*** **	**0.059*** **	**-0.070*** **	**-0.066*** **	**0.026** **	**-0.080*** **	-0.011
	0.010	*0.011*	*0.013*	*0.025*	*0.017*	*0.011*	*0.019*	*0.014*

Note: Numbers in *italic* are robust standard errors; asterisks indicate statistical significance at the ***1, **5, and *10 percent level. The abbreviations are the same as those described in Table 3.
Calculated in Stata 12

TABLE 7. Addressing potential endogeneity: Determinants of the convergence of demand and supply shocks (q2:1997-q4:2011)

Dependent variable	Demand shocks convergence				Supply shocks convergence			
Measure of intra-industry trade	**wgli**	**awgli**	**twt**	**vtwt**	**wgli**	**awgli**	**twt**	**vtwt**
Trade intensity measure	**-0.108*** **	**-0.095*** **	**-0.095*** **	**-0.314*** **	**-0.075*** **	-0.019	**-0.056** **	-0.022
(Normalized on total trade flows)	*0.024*	*0.020*	*0.023*	*0.105*	*0.019*	*0.025*	*0.025*	*0.023*
Measure of intra-industry trade	**-0.035** **	**-0.050*** **	**-0.040** **	**-0.535*** **	-0.017	**-0.069*** **	**-0.048* **	**-0.113*** **
	0.014	*0.014*	*0.016*	*0.100*	*0.021*	*0.025*	*0.029*	*0.026*
Fiscal policy coordination	0.002	0.001	0.001	0.006	0.001	-0.002	-0.001	-0.002
(Based on budget balance)	*0.002*	*0.001*	*0.002*	*0.006*	*0.002*	*0.001*	*0.002*	*0.001*
Monetary policy coordination	-0.007	-0.003	**-0.011* **	-0.012	**0.011* **	0.006	0.009	0.005
	0.006	*0.006*	*0.006*	*0.016*	*0.006*	*0.006*	*0.006*	*0.006*
Error correction term	**-0.147*** **	**-0.156*** **	**-0.139*** **	**-0.105*** **	**-0.175*** **	**-0.167*** **	**-0.165*** **	**-0.168*** **
	0.028	*0.030*	*0.028*	*0.025*	*0.024*	*0.026*	*0.023*	*0.025*
Great Recession dummy	**-0.026** **	**-0.026** **	**-0.023** **	-0.016	**0.055* **	**0.053* **	**0.057* **	**0.060* **
	0.011	*0.011*	*0.011*	*0.014*	*0.030*	*0.029*	*0.061*	*0.032*
Constant	**0.018* **	0.003	-0.001	**0.045** **	**-0.041*** **	**0.053*** **	0.000	**0.073*** **
	0.010	*0.009*	*0.009*	*0.022*	*0.014*	*0.009*	*0.010*	*0.012*

Note: Numbers in *italic* are robust standard errors; asterisks indicate statistical significance at the ***1, **5, and *10 percent level. The abbreviations are the same as those described in Table 3.
Calculated in Stata 12

TABLE 8. Alternative proxy for fiscal policy coordination: Determinants of the convergence of demand and supply shocks (q2:1997-q4:2011)

Dependent variable	Demand shocks convergence				Supply shocks convergence			
Measure of intra-industry trade	**wgli**	**awgli**	**twt**	**vtwt**	**wgli**	**awgli**	**twt**	**vtwt**
Trade intensity measure	**-0.073*** **	**-0.077*** **	**-0.073*** **	**-0.079*** **	**-0.038*** **	-0.013	**-0.031*** **	**-0.046** **
(Normalized on total trade flows)	*0.024*	*0.023*	*0.024*	*0.026*	*0.011*	*0.024*	*0.010*	*0.022*
Measure of intra-industry trade	**-0.029** **	**-0.045*** **	**-0.034* **	**-0.042** **	**0.037*** **	**-0.089*** **	**0.033*** **	**-0.083*** **
	0.015	*0.017*	*0.019*	*0.019*	*0.013*	*0.024*	*0.011*	*0.022*
Fiscal policy coordination	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000
(Based on change of budget balance)	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*
Error correction term	**-0.165*** **	**-0.164*** **	**-0.157*** **	**-0.160*** **	**-0.192*** **	**-0.181*** **	**-0.188*** **	**-0.182*** **
	0.027	*0.026*	*0.026*	*0.025*	*0.041*	*0.032*	*0.040*	*0.029*
Great Recession dummy	**-0.037** **	**-0.037** **	**-0.034** **	**-0.036** **	**0.057* **	**0.060* **	**0.057* **	**0.064* **
	0.017	*0.017*	*0.017*	*0.017*	*0.034*	*0.034*	*0.034*	*0.035*
Constant	**0.018* **	**0.025** **	**0.021** **	**0.021** **	**-0.031** **	**0.075*** **	**-0.022** **	**0.033*** **
	0.010	*0.010*	*0.010*	*0.010*	*0.012*	*0.014*	*0.012*	*0.011*

Note: Numbers in *italic* are robust standard errors; asterisks indicate statistical significance at the ***1, **5, and *10 percent level. The abbreviations are the same as those described in Table 3.
Calculated in Stata 12

TABLE 9. Dummy variable for the membership in the euro area: Determinants of the convergence of demand and supply shocks (q2:1997-q4:2011)

Dependent variable	Demand shocks convergence				Supply shocks convergence			
Measure of intra-industry trade	**wgli**	**awgli**	**twt**	**vtwt**	**wgli**	**awgli**	**twt**	**vtwt**
Trade intensity measure	**-0.033***	**-0.043****	**-0.034****	**-0.035***	**-0.078*****	-0.017	**-0.076*****	**-0.074*****
(Normalized on total trade flows)	*0.017*	*0.018*	*0.017*	*0.017*	*0.016*	*0.023*	*0.024*	*0.023*
Measure of intra-industry trade	-0.013	**-0.028****	-0.018	**-0.022****	0.022	**-0.089*****	**-0.063****	**-0.083*****
	0.010	*0.013*	*0.013*	*0.011*	*0.020*	*0.024*	*0.026*	*0.022*
Fiscal policy coordination	0.001	0.001	0.001	0.001	**0.004*****	0.001	**0.003****	0.002
(Based on budget balance)	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*
Error correction term	**-0.190*****	**-0.189*****	**-0.185*****	**-0.187*****	**-0.175*****	**-0.176*****	**-0.162*****	**-0.171*****
	0.032	*0.030*	*0.031*	*0.031*	*0.027*	*0.028*	*0.022*	*0.023*
Great Recession dummy	**-0.031****	**-0.031****	**-0.028****	**-0.029****	**0.056***	**0.057***	**0.060***	**0.062***
	0.013	*0.014*	*0.013*	*0.013*	*0.031*	*0.032*	*0.032*	*0.033*
Euro area dummy	-0.005	-0.004	-0.004	-0.004	-0.013	-0.013	-0.013	-0.013
	0.005	*0.005*	*0.005*	*0.005*	*0.013*	*0.013*	*0.013*	*0.013*
Constant	**0.056*****	**0.055*****	**0.057*****	**0.060*****	**-0.061*****	**0.071*****	-0.011	0.001
	0.011	*0.011*	*0.011*	*0.011*	*0.015*	*0.013*	*0.013*	*0.013*

Note: Numbers in *italic* are robust standard errors; asterisks indicate statistical significance at the ***1, **5, and *10 percent level. The abbreviations are the same as those described in Table 3.
Calculated in Stata 12

TABLE 10. Alternative measure of trade intensity: Determinants of the convergence of demand and supply shocks (q2:1997-q4:2011)

Dependent variable	Demand shocks convergence				Supply shocks convergence			
Measure of intra-industry trade	**wgli**	**awgli**	**twt**	**vtwt**	**wgli**	**awgli**	**twt**	**vtwt**
Trade intensity measure	**-0.063*****	**-0.063*****	**-0.063*****	**-0.062*****	**-0.085*****	**-0.115*****	**-0.122*****	**-0.110*****
(Normalized on GDP)	*0.017*	*0.017*	*0.018*	*0.018*	*0.013*	*0.021*	*0.020*	*0.018*
Measure of intra-industry trade	-0.020	**-0.031****	**-0.027***	**-0.028***	**0.066*****	**-0.048****	-0.023	**-0.055****
	0.012	*0.015*	*0.016*	*0.015*	*0.023*	*0.024*	*0.026*	*0.022*
Fiscal policy coordination	0.001	0.001	0.002	0.001	**0.002****	0.002	0.002	0.002
(Based on budget balance)	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*
Error correction term	**-0.167*****	**-0.168*****	**-0.162*****	**-0.165*****	**-0.192*****	**-0.165*****	**-0.169*****	**-0.174*****
	0.026	*0.026*	*0.027*	*0.026*	*0.026*	*0.024*	*0.024*	*0.025*
Great Recession dummy	**-0.033*****	**-0.034****	**-0.032****	-0.033	**0.052***	**0.058***	**0.060***	**0.062***
	0.013	*0.013*	*0.013*	*0.013*	*0.030*	*0.031*	*0.032*	*0.033*
Constant	**-0.016***	**0.024*****	**0.022****	**0.023*****	**-0.108*****	**-0.069*****	**-0.095*****	**-0.065*****
	0.008	*0.009*	*0.009*	*0.009*	*0.020*	*0.020*	*0.024*	*0.021*

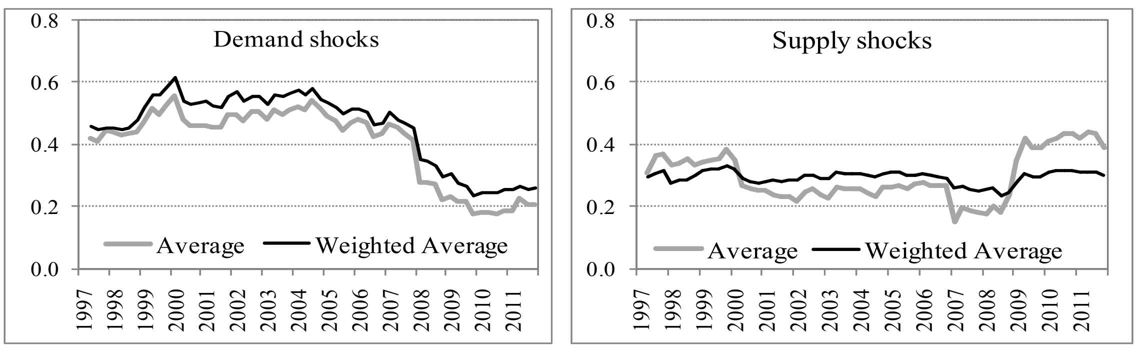
Note: Numbers in *italic* are robust standard errors; asterisks indicate statistical significance at the ***1, **5, and *10 percent level. The abbreviations are the same as those described in Table 3.
Calculated in Stata 12

TABLE 11. Great Recession: Determinants of the convergence of demand and supply shocks (q2:1997-q2:2008)

Dependent variable	Demand shocks convergence				Supply shocks convergence			
Measure of intra-industry trade	**wgli**	**awgli**	**twt**	**vtwt**	**wgli**	**awgli**	**twt**	**vtwt**
Trade intensity measure	**-0.124*****	**-0.124*****	**-0.126*****	**-0.120*****	**-0.041*****	**-0.075*****	**-0.074*****	**-0.080*****
(Normalized on total trade flows)	*0.018*	*0.018*	*0.020*	*0.021*	*0.014*	*0.016*	*0.013*	*0.012*
Measure of intra-industry trade	-0.020	0.000	**-0.053*****	**-0.069*****	**-0.142*****	**-0.033****	**-0.070*****	**-0.059*****
	0.016	*0.015*	*0.018*	*0.017*	*0.014*	*0.016*	*0.018*	*0.015*
Fiscal policy coordination	0.001	0.002	0.001	0.001	**0.002****	**0.002***	**0.003*****	**0.002****
(Based on budget balance)	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*
Error correction term	**-0.179*****	**-0.179*****	**-0.176*****	**-0.178*****	**-0.225*****	**-0.211*****	**-0.216*****	**-0.218*****
	0.030	*0.031*	*0.028*	*0.026*	*0.041*	*0.038*	*0.045*	*0.046*
Constant	**-0.079*****	**-0.089*****	**-0.055*****	**-0.038*****	**0.155*****	**0.032*****	**0.063*****	**0.045*****
	0.023	*0.024*	*0.020*	*0.018*	*0.030*	*0.012*	*0.018*	*0.015*

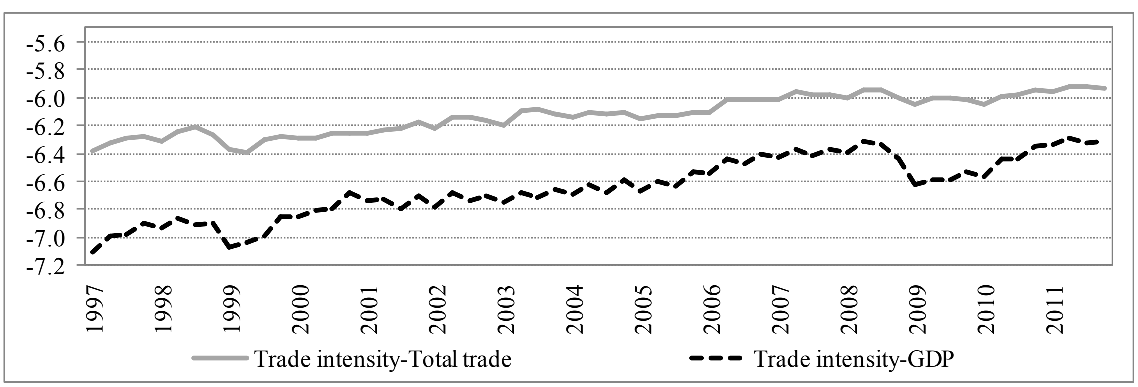
Note: Numbers in *italic* are robust standard errors; asterisks indicate statistical significance at the ***1, **5, and *10 percent level. The abbreviations are the same as those described in Table 3.
Calculated in Stata 12

FIGURE 1. Time-varying coefficient *b* for CSEEC (average and weighted average values)



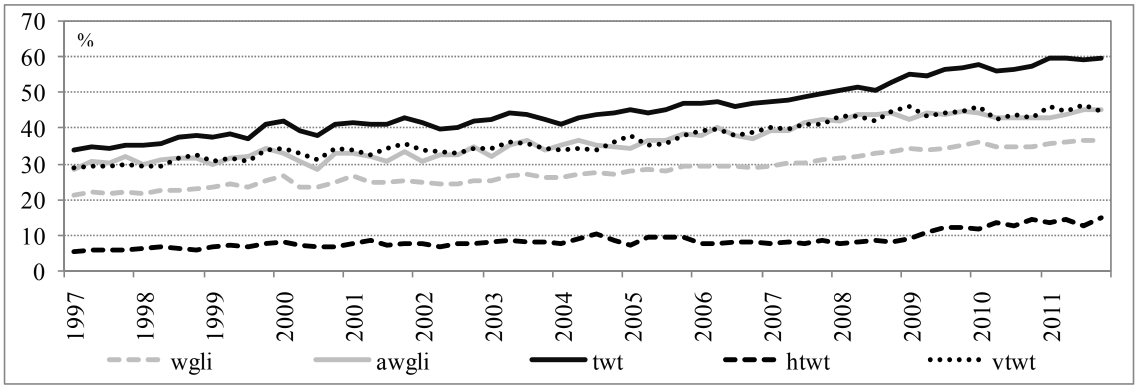
Source: Authors' calculations.
Calculated in Eviews 7

FIGURE 2. Trade intensity of the CSEEC with the euro area (average logarithmic values)



Source: Authors' calculations.

FIGURE 3. Intra-industry trade of the CSEEC with the euro area (average values)



Source: Authors' calculations.
Note: The abbreviations are the same as those described in Table 3.

FIGURE 4. Monetary policy coordination (Average values)

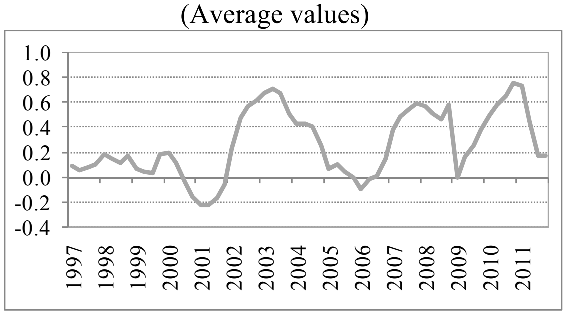
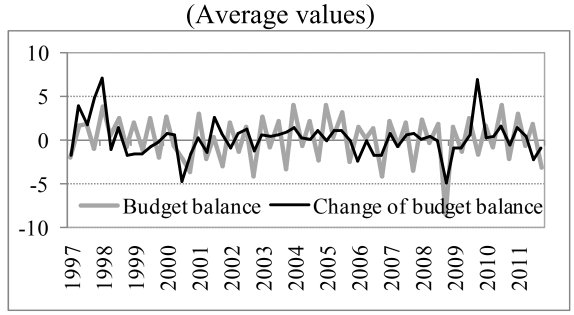
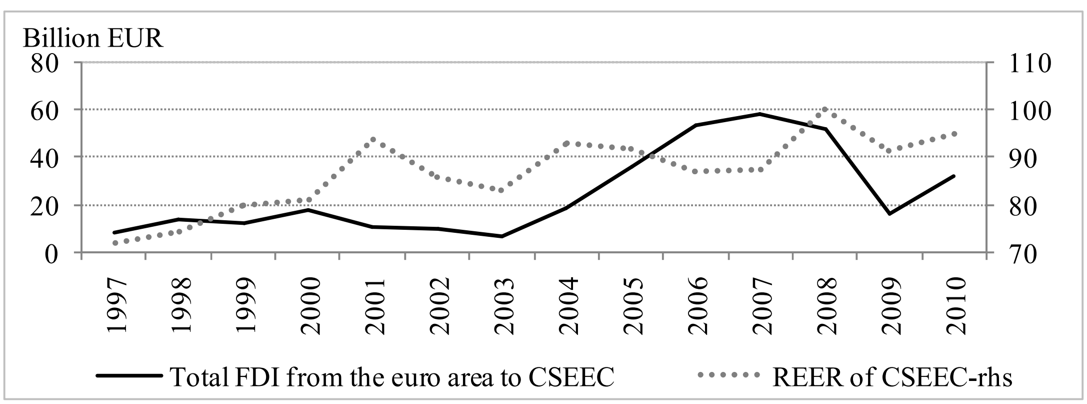


FIGURE 5. Fiscal policy coordination (Average values)



Source: Authors' calculations.

FIGURE 6. Foreign direct investments inflows and real effective exchange rate of CSEEC



Source: Authors' calculations.