GLOBAL FINANCIAL RISKS, COUNTRY SIZE, DOMINANT EFFECTS: IS THERE A LINK?

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Abstract

Recently developed by Cambridge economic school econometric techniques enabled us to investigate the impact of unobserved factors appeared through the presence of dominant effects, and domestic determinants on the short run evolution of net interest spreads for a panel of twenty seven EU Member States. To this end, using Datastream data we consider specific Global VAR approach (Pesaran 2006, 2007) to tackle the "curse of dimensionality" problem and country heterogeneity that may stem from common exogenous shocks and does not depend on a size and geographical location of a country. The results of GVAR suggest that the short-run evolution of spreads does not only depend on cross-section dominance and domestic determinants, but gives us an insight of a share of innovations to net interest spread explained by differences in banking technology, economic performance and financial stability between the countries. The endogeneity of net interest spread as a risk indicator both in the Western and Eastern European economies is ambiguous, however, crucially depends on economic performance, banking sector technology, inflation and cross-country dominance.

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1. Introduction

Net interest spread rate[1] is a standard measure of liquidity and credit risk and is one of the key macroeconomic variables, fluctuations of which are monitored by financial markets' agents and banking sector experts. Movements in the net interest spread are commonly associated with large business cycle swings in transition economies (e.g., Neumeyer and Perri, 2005) as well as with the degree of banking sector monopolisation and a fraction of investment that banking sector extracts from the economy (e.g., Pagano, 1993). As clearly shown by Blanchard (2005), some financial variables, for instance, exchange rates of a national currency and interest rates tend to be affected by net interest spread. Understanding the effects of macroeconomic variables on dynamic of net interest spread and vice versa is relevant for monetary and fiscal policy implications.

Evidence suggesting above that the net interest spreads are predominantly driven by macroeconomic fundamentals inside and outside the country is probably true, however we think there may be macroeconomic variables driving the macroeconomic performance, domestic and international interest rates having a crucial impact on the net interest spread as a degree of credit markets risk, degree of competition and a market power of a banks, etc. There should be also something in the banking sector itself to drive dynamics of net interest spread as the banking sector technology which can be proxy by efficiency of transforming bank liabilities into assets.

Above variables effect default risk, change in financial markets performance and thus the interest rate spread.

Interest rate spread fluctuations especially for the emerging markets in the Central and Eastern Europe may depend on bank passivity and regulatory failure. Banks with low equity positions have more incentives to be passive in liquidating bad loans and tend to hide distress from regulatory authorities and are ready to

offer a higher rate of interest in order to attract deposits in contrast to banks that are not in distress (Hanousek and Roland, 2007). Therefore, higher deposit rates and lower lending rates shrinking the interest rate spread in the emerging economies may act as an early warning signal of bank failure.

Taking into account suggestions that the spreads are mainly driven by global financial conditions and macroeconomic performance of developed countries (e.g., Özatay, F., Özmen, E., Şahinbeyoğlu, G., 2009) we may imply that both developed and transition economies of EU27 are subjected to exogenous shocks being cross-correlated within common European financial markets, trade openness, freedom of capital and labour movement even if they implement domestic monetary policies.

Indeed the literature on the determinants of interest rate spreads and the approaches to its assessment is growing as long as different authors prove to implement the update methodologies to reveal the macroeconomic performance and cross-country correlation affects on financial sector dynamics. One strand of authors maintains that shocks originating in developed economies drive net interest spreads and thus highlight exogenous factors, such as interest rates and the rate of inflation abroad, liquidity and credit conditions, output growth, etc (e.g., Calvo, 2002, 2005; García-Herrero and Ortíz, 2006). Another strand of authors stresses the attention on shocks originating in other developing economies and on financial portfolios (e.g., Broner et al., 2006). Third stream of authors, apply to the effects of domestic economic fundamentals and macroeconomic performance of a country, indicating the importance of country credit position and home policy (e.g., Kamin, 2002; Çulha et al., 2006).

On the other hand, methodological and empirical studies have offered important insights into the shocks in financial markets that drive macroeconomic performance of the country and vice

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1. The net interest spread is the difference between the lending and a borrowing rate in the country financial market.
2.

versa (e.g., Roubini, 1991; Pagano, 1993; Demirguc¸-Kunt and Levine, 1999). They stressed the importance of a degree of financial development and economic performance of a large cross-section of countries (e.g., Roubini and Sala-i-Martin, 1992), ambiguity of savings, inflation expectations and inflation rate, absorption of resources by the financial sector and interest spread response (e.g., Pagano, 1993). Berthelemy and Varoudakis (1996) showed that the banking sector development is a pre-condition for macroeconomic performance, while underdevelopment of it may cause low macroeconomic performance and inflation.

An alternative view is embodied in the empirical literature examining the response of macroeconomic performance to shocks in net interest spread, interest rates and banking sector capital efficiency (e.g., King and Levine, 1993; Levine and Zervos, 1996, 1998; Arestis and Demetriades, 1997, 2002; Beck et al., 2004).

Our study enriches the findings of Levine et al. (2000); Rajan and Zingales (1998) in recognising the potential biases induced by simultaneity, omitted variables and unobserved country-specific effect on the financial markets – performance nexus. Finally, it based on the examination whether monetary policy and financial markets facilitate economic performance as financial development and cross section interrelations reduce the costs of external finance to firms, hence may drive interest rate spread down.

In this context, the paper aims to investigate the impacts of domestic determinants as economic performance, financial stability and banking sector technology as well as external one driven by presence of dominant effects on the evolution of interest rate spreads and vice versa for a panel of seven transition countries using quarterly data for twenty seven EU countries from 1993 to 2009. There are two main contributions of this study. First, we investigate the impacts of cross section dominance across the panel of twenty seven EU Member States on interest rate spreads and other domestic fundamentals. Previous literature typically treats the interpretation of a given fact as the cross section average of all the countries in the panel, regardless the number of included economies. However, we collect just those of them in the panel being cross-correlated and not in the “means”. The novelty is that we consider net interest spreads responds heterogeneously to shocks in domestic fundamentals and exogenous variables and the fact, the direction of causality may run in both ways.

The literature often employs conventional panel data estimation procedures which do not allow for cross-section dependence or maintain cross-section dependence across all units both correlated and not. Our approach distinctively enables to avoid omitted common variables across the panel and do not overload a model with statistically insignificant exogenous variables inducing cross-section dominant effects which lead to consistent regression coefficient estimates. Therefore, in this study we do not only consider common correlated effects pooled method proposed by Pesaran (2006) which is advocating by some authors to yield the most efficient estimator (e.g., Kapetanios et al., 2006; Kapetanios and Pesaran, 2007; Coakley et al., 2006), but pool only those of cross-section units correlated across the panel. The procedure follows same cross section augmentations approach proposed by (e.g., Chudik and Pesaran, 2007; Pesaran et al, 2008).

The structure of the paper is as follows. The following section presents a brief review of the empirical literature on the determinants of net interest spreads and Infinite Dimension VAR approach. Section 3 is devoted to the empirical analysis of cross-section dominant effects and testing the hypothesis. Section 4 presents variance error decomposition analysis between the countries. Section 5 concludes. There are two appendixes in the paper contain summary statistics, information on the number and size of cross section augmentations, Wald test results and Cross-section augmented group affects across the endogenous variables in GVAR model.

2. General description of a model

2.1. The determinants of net interest spread

A general model for the determinants of net interest spread (r_{it}) can be defined as

$$r_{it} = \alpha + \sum_{l=1}^{pi} \Gamma_{pi} z_{it} + \sum_{l=0}^{qi} \theta_{qi} z^{*}_{it} + \eta_{it} \qquad (1)$$

where α is a constant term, z and z* are vectors of home (endogenous) and international (cross section / exogenous) explanatory variables, respectively, Γ and θ are n x n matrices of the corresponding coefficient vectors and η_{it} is the disturbance term. The subscripts i and t stand for country and time. In the literature, the set of variables in z_{it} contains output gap, y_i to proxy economic performance, bank assets to bank liabilities ratio, A/L_i to proxy banking sector efficiency and consumer price index, π_i to proxy financial stability in a unit. As argued by (e.g., Kamin and von Kleist, 1999), country spreads are expected to increase with international interest rates and shocks in financial stability caused by inflation volatility since increases in above rates deepen the borrowing country debt burden and the probability of debt default, raising the risk premium. Furthermore, increases in inflation rates and financial instability within cross-section units can reduce the demand for risky assets and thus increasing the country interest rate spread.

This is to show a crucial role of cross section dependence and presence of dominant effects. At the same time a shock in banking sector technology, usually in the countries with open markets, can increase the mark-up of investors and thus following the effect of diminishing marginal returns decrease the spread as making more profit on the size of borrowing and lending. It is worth noting that the distinction between “banking sector technology” and “diminishing marginal returns” of multinationals entering the market may affect interest rates and lower / higher spreads may not be very clear. Consequently, output gap[2] is often used also to proxy the economic performance of a country (e.g., Charemza et al., 2008).

The results by the empirical literature on the impact of international inflation rates appear to be inconclusive. Kamin and von Kleist (1999) suggest that the effect of U.S. interest rates and inflation on newly issued bond spreads are either statistically insignificant or theory inconsistent; however this does not allow us to see the cross-county effects. Other authors as (e.g., Arora and Cerisola, 2001) find that the impact of inflation rates is significantly positive when spreads for bonds actively traded in secondary markets.

According to Dailami et al. (2005) the impact of interest rates on spreads increases with the level of indebtedness of the borrowing country and is not invariant to the contagion effects of crises. Following his idea it becomes clear that the country with a high interest rates and financial instability, with the output gap dropping down will experience higher rates of net interest spread change. This result is consistent with (e.g., Kaminsky and Schmukler, 1999) suggesting that economic fragility, and country ratings make them more sensitive to changes in international environment. We disagree with them in a way that we believe exogenous factors will be economically and statistically significant only for those countries experiencing dominant effects from the cross section augmentation in a certain variable (CSA).

The prove of this they find the evidence as the changes in U.S. short-term interest rates increase country spreads and this impact is more severe in countries with low ratings. Above could have been explained by the fact that USA is a major player in the financial markets, thus effecting “dominated” emerging economies with low ratings. Our inference is supported by Gonzalez-

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[2] output gap defined for the i-th country in the model, i=1,…,27 in time t as: $y_{it} = \ln(Y_{it}) - \ln(Y^{P}_{it})$, where Y^{P}_{it} is the potential output if the i-th country established outside the model.

Rozada and Levy-Yeyati (2006) suggests that the variability of market spreads is significantly explained by global financial risks and innovations, hence exogenous factors.

The set of variables in z_{it}^{*} in Eq. (1) contains exogenous cross-section augmentations introduced by Chudik and Pesaran (2007) indicating cross-section dominance over a country in output gap, inflation, banking sector technology. It's noteworthy, that country external and home debts, account deficit, net foreign asset, fiscal balance, net foreign trade, gross reserves, debt default history and so on are one of the most commonly domestic default indicators predicting the changes in net interest spreads. Among the studies considering country specific variables are (e.g., Eichengreen and Mody, 2000; Çulha et al., 2006).

The empirical studies on the impact of macroeconomic performance, financial stability and other macroeconomic variables on net interest spread are generally based on the developed countries (e.g., Boyd et al., 2005; Gürkaynak et al., 2005; e.g., Clarida and Waldman, 2007).

However, interpretation of macroeconomic performance, banking sector technology and financial stability surprises for a given financial variable of interest may not be invariant to the state of the economy and a fact, whether the country is "dominated" or "dominating", i. e. whether there exist a group of countries correlated with the country we are interested in, and shocks in cross-section augmentation will impact the performance and (or) a level of financial risk of a country. We doubt that the direction of causality is running one way as shocks in the net interest spread may have at least temporarily effect on financial stability and economic performance.

Taking into account a possibility of two-way causality we tackle the above mentioned problem by a reduced Global VAR model with cross-section augmentations represented by (e.g., Chudik and Pesaran, 2007; Pesaran et al., 2008).

2.2. Limitations of a model and a history overview

Firstly, the problem of nonstationarity of most of the economic data seems to have a solution within the cointegration analysis. Since the emergence of the Engle-Granger concept of cointegration, there have been hundreds of models incorporating the long-run equations with the short-run error correction mechanisms. The difficulties with the long-run concept have not been initially visible, where the modellers concentrated on the evaluation of cointegration for the long-established markets and economies.

However, gradually the cointegration analysis has been applied to the small open economies in the Central and Eastern Europe with more volatile economic history. For above economies, there was simply not enough data of an undisturbed development to identify the long-run equations. While the cointegration analysis has created a substantial improvement in the short-run modelling by turning attention to the problem of nonstationarity of data and coming up with the short-run error-correction models, which usually have good forecasting properties, the attempts to identify long-run relationships have often been dubious.

The second problem is related to the fact that large cross-country empirical models are difficult to manipulate and estimate, due to their multidimensionality. In times of great popularity of large models, multidimensionality was seen as an advantage rather than disadvantage, as they allowed describing the cross-country and economic differences clearly and in deeper details. Errors in specification, data deficiency and volatility, estimation approximations tend to cumulate in large models, leading sometimes to surprising results. It seemed reasonable to reduce on the model dimension and hence to focus on a smaller models. However it is not always possible and "curse of dimensionality" problem reappears recently for cross-country models. In this case traditional aggregation over countries is complicated and cross-country linkages often increase dimension of the models significantly.

Finally, there is a problem of data reliability and availability. This is related mainly to the real macroeconomic and banking data, which is used in our analysis; quarterly data on gross domestic product (GDP), cross-country deposit rates and lending rates, bank assets and bank liabilities, import and export data. The later over a period of 1993-2008 is used in calculation of weighted averages for the presence of Wald dominant effect test. It also may happen that real economic dynamics are difficult to be measured. Data on GDP are usually published with a substantial delay from 6 to 12 month in the Central and Eastern Europe. Particularly difficulties were faced with foreign trade quarterly data over a period of 1993-1994 and 2008, which play an essential role in cross-country calculations of aggregated weighted averages as well as the deposit and lending rate quarterly data across the countries. For some countries, as Lithuania, Romania and Bulgaria the quality of import and export data is relatively low (mainly due to the amount of unregistered trade, and due to the problems in statistical data imperfections in the early 90s) and the official data is slightly related to the true extent of economic activity and varies from one statistical source of information to another. Surprisingly for Luxembourg there were particular difficulties with foreign trade data and lending rates in the beginning of 1990s. It's worth saying that the last problem of unreliability and delays in data publications of real data statistics was treated explicitly by the access to the original sources of statistical macroeconomic data. Although the problem has been acknowledged for a long time, generating a lot of criticism regarding the reliability of empirical research based on real data as (e.g., Reijer, 2006, e.g., York and Atkinson, 1997), no effective solution have been offered so far. Consequently, the authors are implementing the model by minimising the amount of real entries and decomposing countries in a separate VAR models neglecting the crucial fact of cross-section dependence and dominant effects.

All the problems presented above have been noticed for some time and various, albeit not always fully satisfactory, solutions have been proposed. Shortcomings of the backward-looking assumptions used in empirical models have been discussed in (e.g., Pesaran, 1987) findings, where some practical remedies can be discovered.

2.3. Infinite Dimension VARs and cross section dependence

Interest rate spreads can be specified as sensitive to output gap, inflation and bank assets to bank liabilities ratio as a system of numerous domestic and external exogenous variables. A set of endogenous variables z_{it} and exogenous variables z_{it}^{*} to be used in the reduced form VAR model with cross section augmentations is already discussed above and in the context of Eq. (1). All variables except of output gap are given in logarithms to keep data on the same relative scale.

Our model proposes to deal with the "curse of dimensionality" by shrinking the data as the number of endogenous variables (N) increases to a large number. Under this set up, (e.g., Chudik and Pesaran, 2007) IVAR could be approximated by a set of finite-dimensional small-scale models that can be consistently estimated separately in the spirit of global VAR (GVAR) models proposed in (e.g., Pesaran, Schuermann and Weiner, 2004).

The main problem in the EU27 IVAR is how to model a large number of endogenously related macroeconomic variables to get consistent results in a comparative analysis. This is related to GVAR model, originally developed by (e.g., Pesaran, Schuermann and Weiner, 2004) and currently extended by (e.g., Pesaran and Smith, 2007). They have shown that GVAR approach can be motivated as an approximation to an infinite-dimensional VAR featuring all macroeconomic variables, which is true for both, stationary and non-stationary systems.

By imposing a certain restrictions on the parameters of IVAR model that are binding only in the limit, we end up with shrinking of the data. Chudik and Pesaran (2007) have shown, that under the reasonably mild non-dominance assumption in the panel, the estimates of the reduced-size VAR model, where as augmentations the cross-sectional averages of corresponding variables from other parts of the model are used, are consistent and asymptotically efficient. Charemza et al. (2007) implying Monte-Carlo simulations have proved on the basis of Chudik methodology the consistency of the cross-country augmentations in case where the number of countries is even smaller and there is one dominant country in the panel.

Above enabled us to use cross-country augmentations with a presence of dominant effect within a group in the Global VAR model. Regarding the reduction of the "curse of dimensionality" we rely heavily on the Chudik and Pesaran (2007) cross-sectional augmentations originally implemented in the GVAR (e.g., Pesaran et al, 2008) as well as Monte-Carlo simulation results proposed by Charemza et al. (2007) in the LAM-4 is the simultaneous-equations model for Belarus, Ukraine and Russia.

However, an important difference between the cross-sectional augmentations used in this paper and an approach proposed (e.g., Özatay, F. et al., 2009; Pesaran and Smith, 2006) are as follows.

First, cross-sectional augmentations originally based on quarterly, country specific trade weighted cross section averages constructed as the share of a partner foreign trade which is more detailed than those implemented in the GVAR model by Chudik and Pesaran.

Second, building cross-section augmentations we assess bivariate cross-country correlation coefficients from the multiple cross-correlation matrix (2) of a considered variables, rather than employing the common correlated effects pooled (CCEP) estimator. However, one of the relevant advantages of CCEP estimators as (e.g., Kapetanios et al., 2006) shows is that the CCEP estimators are consistent regardless of whether the common factors are stationary or nonstationary.

The multiple cross-correlation matrix is symmetric and has unity on its main diagonal as the correlation between any π_i and r_i is the same as the correlation between r_i and π_i, where i=1, 2, ...27. We may write a matrix as:

(2)

Essentially, contemporaneous correlation of the variables in a model as well as structural shocks which may arise in one or in a group of transition and developed countries originated in different European and non-European financial centres may induce cross-section dependence in the data and thus lead to inconsistent regression coefficient estimates. To account for the cross-sectional dependence in the data, we employ the multiple correlation matrix (2) across the panel of EU27, followed by dominant effect Wald test by Pesaran and Chudik (2007) to identify a country specific cross-section augmented group to be included as an exogenous explanatory variable in a reduced finite VAR.

W assume weak correlation between the variables should the value of the correlation coefficient be less than 0.7, therefore excluding this country from CSA; on the contrary, we assume strong correlation should the value of the correlation coefficients approach unity.

Following Pesaran and Chudik (2007) VAR model with up to one unobserved common factor, where $x_t = (y_{1t}, y_{2t}, \dots . y_{Nt})$. The following cross section augmented regressions can be estimated consistently by least squares for each country i for each variable:

$$z_{it} = \alpha + \sum_{l=1}^{pi} \Gamma_{pi} z_{it-l} + \sum_{l=0}^{qi} \theta_{qi} z^{*}_{t-l} + \eta_{it} \quad (3)$$

where z^{*}_{i-l} is a cross section weighted average of a macroeconomic variable. Presence of dominant effects is tested by conducting Wald tests of the joint significance of the coefficients for the star variables in (3), namely

$$H_0^z: \theta_{qi} = 0 \; for \; l \in \{0, \dots, q\} \quad (4)$$

Following (e.g., Pesaran, Schuermann and Weiner, 2004) if N is sufficiently large, the null hypothesis (4) holds only for countries with zero factor loadings[3].

The same exercise is carried out for all the endogenous variables in the panel based on the same type of regressions.

There may be two options considered for the star variables: (i) country specific simple cross section averages constructed as the arithmetic average of foreign variables, as

$$Z^{*}_{s,it} = [N-1]^{-1} \sum_{J=1, J \neq I}^{N} y_{jt} \qquad (5)$$

and ii) country specific trade weighted cross section averages constructed for example as

$$Z^{*}_{\omega,it} = \sum_{J=1}^{N} \omega_{ij} y_{jt} \quad \text{, with } \omega_{ii} = 0 \qquad (6)$$

where ω_{ij} is the share of country jth trade in country ith foreign trade, estimated as the average based on the amount of export (FOB prices) and import (CIF prices) taken from IMF Direction of Trade Statistics and DataStream databases.

Trade weighted cross section averages are more reliable and hence appropriate in small samples. Computing test statistics based on unrestricted regression we measure how close the unrestricted estimates come to satisfy the restrictions under the null hypothesis. Country specific CSAs (6) are to be included in a VAR model as exogenous should the value of θ_{qi} to be more than

$\epsilon \{0, \ldots, q\}$

zero for . We are aware that the numbers of degrees of freedom becomes very large as the number of explanatory variables in a model increases. Thus, saving degrees of freedom we shall not include those CSAs proved to be non significant by Wald dominant effect test. CSAs enter in the model as exogenous variables given the null of dominant effect presence could not be rejected at 5% and 10% level of significance.

It is assumed that the variables been used to calculate cross section group augmentations are covariance stationary[4].

Note that, the coefficients of the cross sectional means (CSMs) proposed by Pesaran (2006) do not need to have any economic meaning as their augmentation simply aims to improve the endogenous variables coefficient estimates of interest. However, in our specific case, CSAs are attributed to contain relevant information for the evolution of our main variable of interest — interest rate spreads. The economic meaning of CSAs may plausibly be argued; therefore we expect the estimated coefficients to be non zero.

Should the CSMs being used, consequently, the endogenous variables coefficients in a model would have represented the net impact of external (global) financial and output conditions which is not fully represented by CSMs or vice versa. The overall impact of the external factors represented by endogenous and exogenous vector of explanatory variables appears to be comparable with the effect of the domestic condition, but that is not our case. As we have already

[3] see Chudik and Pesaran (2007, pp. 35-36)

[4] This assumption is supported by the CIPS panel unit root test recently proposed in Pesaran (2007) that allows for cross section dependence.

mentioned, we identify the significance of the exogenous and endogenous factors arising from the cross-section dependence separately in a reduced GVAR model.

2.4. Cross-section dependence of a process

Pesaran and Tosetti (2007) define the process $\{x_{it}\}$ to be cross-section weakly dependent, if for all $t \in T$ and for all weight vectors $w_t = (w_{1t}, \ldots, w_{Nt})$, satisfying the following "granularity conditions":

$$\|w_t\| = O\left(-\sqrt{N}\right) \tag{7}$$

$$\left\|\frac{w_{jt}}{w_t}\right\| = O\left(-\sqrt{N}\right) \quad \text{for any } j \leq N \tag{8}$$

$$\lim_{N \to \infty} Var\left((w_{t-1}\acute{x}_t | T_{t-1})\right) = 0 \tag{9}$$

where T is the information set at time t. The concept of cross-sectional weakly dependence can be articulated with respect to the conditional as well as the unconditional variance of weighted averages, if it exists. Pesaran and Tosetti (2007) consider T_t containing at least $x_t, \quad x_{t-1}, x_{t-2}, \ldots$ and $w_t, \quad w_{t-1}, w_{t-2}, \ldots$.

Hence, the process $\{x_{it}\}$ is called cross-sectional strongly dependent at a given point in time if there exists a weights vector $w_t = (w_{1t}, \ldots, w_{Nt})$ satisfying (7)-(8) and a constant K independent of N such that for any N relatively large the following is true

$$\lim_{N \to \infty} Var\left((w_{t-1}\acute{x}_t | T_{t-1})\right) \geqq K > 0 \tag{10}$$

Should there be an evidence of cointegration in a panel we do not choose to present the error correction model. This is for two reasons. First, we expect if there is a cointegration between the banking sector variables and economic performance, the resulting system will be stationary and thus render any test statistics asymptotically valid. Second, the cointegration relationship is not the central focus of the model's propositions. The short term dynamics, exogeneity and dominance analyses are the main focus. Inferences about these dynamics, exogeneity and dominance will be robust in this situation.

2.5. Model propositions.

Let x_{it} denote the realization of a random endogenous variable belonging to cross section unit i in period t, and assume that $x_t = (x_{1t}, \ldots, x_{27t})$ is generated according to the following GVAR (p) model:

$$x_{it} = \alpha + \sum_{l=1}^{p} \Gamma_{pi}\, x_{i,t-l} + \sum_{l=0}^{q} \theta_{q_i} x^{*}_{t-l} + \mu_{it} \qquad (11)$$

where, vector of intercept term, is N x N dimensional matrix of unknown coefficients of the endogenous variables, θ_q is N x N dimensional matrix of unknown coefficients of CSA, significant in a group cross- section augmented regressions, $\mu_t = (\mu_{1t}, \mu_{2t}, \ldots \ldots \ldots, \mu_{Nt})$ are white noise innovation terms, that is E(μ_t)=0, and , μ_t and , μ_{t+h} are independent for , h= 0. The matrix $\sum_{\mu}(\mu \acute{\mu})$ is non-diagonal. The relations among the contemporaneous components of x_{it} , instead of appearing in the functional form (as in simultaneous equation models), are embedded in the covariance matrix of the innovations.

In this study, the sample covers twenty seven EU Member States for the period from January 1993 to December 2008 (period coverage does not vary across countries). The choice of 1993Q1 is consistent with the changes on the political map of Central and Eastern Europe and the recognition of new independent states as Slovak Republic (January 1, 1993), Czech Republic (January 1, 1993) from the former Czechoslovakia, Slovenia (June 1991) from the former Yugoslavia, Lithuania, Latvia and Estonia (1991) from the former USSR. Datastream and Economic and Social Service databases as well as national sources of information have been used to provide interdisciplinary access and support for an extensive range of key economic quantitative raw data. Among the main sources of information were: Deutsche Bundesbank and Statistishes Bundesamt for Germany, Bank of Slovenia for Slovenia, Central Bank of Ireland and Central Statistical office Ireland for Ireland; Bank of England for United Kingdom, Concensus Economic Int. and National bank of Slovakia and Czech National bank for Czech Republic and Slovakia; Banque De France and I.N.S.E.E. agency for France, National bank of Hungary and National bank of Poland for Hungary and Poland; Bulgarian National bank for Bulgaria; Banca d'Italia and Instituto nazionale di statistica for Italy; Bank of Lithuania data for Lithuania; Central bank of Malta and Central bank of Cyprus for Malta and Cyprus; Banco De Portugal for Portugal; Sveriges Riksbank for Sweden; Bank of Greece data for Greece, Netherlandische Bank N.V. for Netherlands; Banque National de Belgique for Belgium; National Bank of Spain and Instituto Nacional Y Hacienda for Spain; Statistics Austria and Osterreichische National bank for Austria.

Table A.1 in Appendix A provides descriptive statistics of the considered endogenous variables across panel of EU27 Member States.

Across the cross section, which can be regarded as the small open economies, the micorfoundations of the model are identical to those derived by Gali and Monacelli (2005) and very similar to that of Benigno and Benigno (2006).

The model generates four propositions about the heterogeneity of net interest spread rates, size of the country and presence of dominant effects across the group of EU27 member States.

Proposition 1: Size of cross-section augmentations does not depend on the size of the economy and a geographical region.

Proposition 2: Presence of dominant effects being the main indicators of the cross-section dependence vary across the countries of different size; or in other words the size of the county is not significant to be subjected to dominant effect.

Proposition 3: Interest rate spread is endogenous to financial stability, economic performance and banking sector technology whether: a major part of the total variation in the net interest spread is due to innovations in banking sector technology, inflation rates and economic performance of the country.

Proposition 4. Shocks to output gap lead to a change in banking sector development pattern, degree of financial risks proxy by net interest spreads.

3. Empirical analysis

3.1. Cross section dependence: basic approach

Let's start our cross section dependence analysis with giving an informative look at the plots of net interest spread rates between Old and New EU Member States on Figure 1.

EU Members have been divided into nine groups to easy the visual interpretation of the net interest spread rates pattern. These are Baltic States (Lithuania, Latvia and Estonia) on Figure 1a, Visegrad group countries (Slovakia, Hungary, Poland and Czech Republic) on Figure 1b, Scandinavian countries (Denmark, Finland and Sweden) on Figure 1c, Mediterranean Europe (Cyprus, Malta, Greece, Italy) on Figure 1d, Benelux countries (Netherlands, Belgium and Luxembourg) on Figure 1e, Balkan States (Slovenia, Romania and Bulgaria)[5] on Figure 1f, British Isles (UK and Ireland) on Figure 1g, South-western Europe (Spain and Portugal) on Figure 1h, Germany, France and Austria on Figure 1i.

Figure1 supports the inference of a steady decrease of net interest spreads across the Eu Member States it also demonstrates the difference in the financial market turbulence and arising global risks across the countries. What we can notice from the Figure 1 is a high volatility in Baltic States, Balkan region and Mediterranean Europe both before and after the biggest EU Enlargement in May 2004.

In spite of higher level of spread for Latvia, Bulgaria and Romania they converge quicker to a steady state especially after the year 2004, although in a short run, net interest spread series seem to experience high volatility. High sensitivity of a spread to global risks and financial instability is been proved by non-stationariry of a data between the EU27 Members; positive skewness for Latvia, Slovenia, Hungary, Poland, Estonia, Spain; existence of outliers and jumps in a series. As far as we can see from the Figure net interest spread convergence dominates over divergence across the EU Members starting from 2000s. There is convergence among the Baltic States and Scandinavian countries approaching zero, convergence of net interest spreads within the Mediterranean countries with convergence over 3% spread steady state. Surprisingly, Balkan States are being converged over a high volatility of 571% for Bulgaria in 1997 and 45% for Romania in 1994 to about 5% net interest spread in the beginning of 2009. However there is a divergence in the net interest spreads taken into account a common neighbourhood which has not been expected: Belgium demonstrates an increase in the spread while the rest of Benelux countries converge to a lower level; Austria converging to zero diverges from France and Germany; net interest spreads in Spain and Portugal diverge after reaching a steady state in 2001 as UK and Ireland starting from 2006. Nevertheless starting from the Northern Rock Fall in September 2007 and the financial liquidity crises, countries such as Belgium, Sweden, Luxembourg, Hungary, Czech Republic demonstrate an increase in the

[5] Net interest spread rate of Bulgaria in a period from 1992Q2 to 1993Q2 has reached its peak of 571% and was smoothed to 33% to get a normal distribution.

net interest spread across the panel and apply an additional instruments and monetary policy toolbox to be implemented to make spreads stable to external and home shocks. At the same time there is a sharp fall in net interest spread as a response to global risks affecting the financial system for Ireland, Netherlands, Cyprus, Denmark and Finland.

Revealing cross-section dependence the following approaches has been introduced:

1. In case of having interrupted time series or limitations of observations cross-country correlation matrix can be used to calculate bivariate correlation coefficients between the one variable across the countries.
2. In case of sufficient uninterrupted time series and large number of observations, cross-country correlation matrix can be used to calculate multiple correlation coefficients between the N endogenous variable across the countries. However, multicollinearity may appear in the coefficients.

In order to avoid multicollinearity problem and looking for the robustness of our GVAR estimates we implement the first approach of bivariate correlation coefficients estimation for a specific cross-sectional augmentation. In this case the number of cross-section augmentations per each country cannot exceed the number of endogenous variables included in a model.

Let r_{yiyj} ; r_{rirj} ; $r_{\frac{A}{L}i\frac{A}{L}j}$ $r_{\pi i\pi j}$, where i≠ j, be an 1 x n vectors of bivariate correlation coefficients enable us to indicate the strength and direction of a linear relationship between pairs of estimated variables across the panel and chose an appropriate combination to be included in a country specific trade weighted cross section averages (see Table A.2 Appendix A). Cross-section trade weighted augmentations built unique on the basis of (6).

The results of Table A.2. show heterogeneity of cross-section correlations across the countries. Generally speaking, the size of cross section augmentation may depend on a level of EU integration, foreign direct investments, degree of financial services liberalisation and openness of the markets, price of labour, foreign trade, etc. Gravity concept predicting bilateral cooperation and trade across the countries based on the economic sizes and distance between them fails for banking sector in EU27 as long as neighbourhood countries appear in different cross section correlated groups and vice versa. This is a very important finding.

Despite the fact that Visegrad group and Baltic States; Baltic States and Scandinavian countries, Mediterranean and South-Western European countries often appear into the same cross correlated group does not prove the validity of gravity concept. These countries have liberalised their markets and making the best effort to integrate their banking systems into European free market area with liberalised movement of capital and labour. Above results enabled us to analyse deeper the cross-country correlations by country pairs. It's noteworthy, that the non-neighbourhood countries as well as the countries with a negligible share of foreign trade (0.02-0.30%) appear to in the same cross-section augmented group in the net interest spread and in the other endogenous variables. For instance, Cyprus, Luxembourg and Czech Republic; Greece, Luxembourg and Estonia; Baltic States, Slovakia, Slovenia and Greece; Baltic States, Cyprus, Malta and Hungary; Baltic States, Slovenia and Ireland; Slovenia and Latvia; Baltic States and Luxemburg; Latvia, Romania, Slovenia, Bulgaria, Lithuania and Netherlands; Baltic States and Austria; Bulgaria, Luxemburg, Malta and Poland; Czech Republic, Slovakia and UK, etc.

Most of the Western EU Countries such as Germany, Spain, France, Italy, Netherlands, UK and Czech Republic with the developed industrial sector have higher number of bivariate cross-country correlations in output gap than the rest of the Central and Eastern European countries following the basic theories of international trade as Economies of Scale and Inter-industry trade.

Twenty over twenty seven EU Member States have high cross-country correlations in interest net spread which means that they are subjected to financial global risks and foreign competition. In fact, some countries such as Slovenia, Sweden, Hungary, Ireland, Latvia, Luxembourg and Italy all of them from different size and different geographical regions in Europe have the highest numbers of cross-country correlations in net interest spread justifying the proposition 1, that the size of cross-section augmentations does not depend on the size of the economy and a geographical region. Surprisingly, the UK is the extreme outlier in net interest spread bivariate correlation which makes it more flexible and independent from the financial shocks within the EU members.

Eighteen over twenty seven EU Member States have high cross-country correlations in banking sector technology aiming interrelations in transformation of bank liabilities into assets across EU countries. Same proposition is true: countries of different size and from different geographical regions in Europe have the highest numbers of cross-country correlations in banking sector justifying the proposition 1.

Finally, numerous cross-country augmented groups in consumer price index evidence for Baltic States and Visegrad group countries, except Czech Republic. This means that at most Eastern European countries with emerging economies are more subjected to exogenous shocks ion prices and import inflation which could cause financial instability in the region.

The results of the cross-correlation analysis are as follows: share of foreign trade, size of the country and geographical region within the EU do not predict the number of countries in cross section augmentation and the bunch of countries appear in the same group, at least for the banking and industrial sectors. High cross-section correlations in net interest spreads and banking sector technology between the non-neighbouring countries of different size disapprove gravity concept in international economics.

3.2. Presence of dominant effects and cross-section augmentations

Taking into account the data limitations (64 observations) and in order to deal the most effectively with the "curse of dimensionality" by shrinking the data, country specific cross-section augmentations were identified on the basis of bivariate cross-country correlation coefficients mentioned in the previous section. Each endogenous variable in a VAR model is attributed with its "tailor-made" CSA.

Cross-section dependence is revealed by employing trade weighted cross section averages (see Table A.2) and analysing the values of N x N matrix of coefficients θ_{qi} from the eq. (3). It provides us with information on the presence of dominant effect for a specific variable across the countries.

Should $\theta_{qi} = 0 \text{ for } l \in \{0, \ldots, q\}$ we conclude on no dominant effect for a specific country in a considered variable. On the contrary, we conclude on presence of weak /strong dominant effect should the value of $\theta_{qi} \text{ for } l \in \{0, \ldots, q\}$ be slightly/significantly different from zero. The degree of dominance depends on the value of coefficient of a specific CSA.

Whether a proper economic model is specified, any systematic process for the disturbance term should be absent as the errors made in a model specification are usually found in a disturbance term. However in our cross section augmented time series regressions residual autocorrelation and heteroskedasticity are primary considered as an indication of specification errors of a country models. Whenever autocorrelation and heteroskedasticity are found in the residuals we respecify the systematic part of a model looking at the behaviour of autocorrelation and partial autocorrelation functions of a dependent variable to get well-behaved residuals. We notice that the violation of normality in a disturbance term across the models is not always caused by specification errors, but the data belong to the initial model.

The results for the Wald dominance test for cross section dependence and the values of trade weighted cross section augmented coefficients displayed in Table B.1 of Appendix B.

Table B.1 reveals the presence of dominant effect in the output gap for all countries in a panel except Austria. This allows us to say that EU Member States are cross-section dependent in their domestic outputs. Thirteen over EU27 Member States experience dominant effects in the net interest spread; therefore are expected to be more sensitive to global risks. These are Belgium, Cyprus, Spain, Finland, Ireland, Italy, Netherlands, Austria, Poland, Romania, Slovenia, Slovakia and the UK. The rest of the countries experience no dominant effects in credit and liquidity risks. Only eight countries such as Poland, Bulgaria, Estonia, France, Austria, Slovenia, Sweden and UK experience dominant effect in banking sector technology.

Finally, all the countries except Slovakia and Belgium experience dominant effects from cross-section augmentation. The outcomes of the Table A.2 shows that there is a strong cross section dominant effect in output gap for Cyprus, Malta, Ireland and Slovenia; Romania and Slovakia in the net interest spread; Bulgaria in the rate of inflation as the values of the CSA coefficients are relatively high.

Our findings support the proposition two made in a previous section as the presence of dominant effects (weak or strong) varies between the size and geographical regions in Europe bringing forward the statement that the size of the county and its historical background (whether the country experienced market or planning economy before 1993) based on its geographical location are not statistically and economically significant for the country to be subjected to dominant effect over a CSA.

Surprisingly, the exogenous one unit shock in transformation of bank liabilities into assets, results in a decrease in a domestic variable for Bulgaria, Estonia, France, Ireland, Austria, Slovenia and Slovakia. Moreover, a one unit exogenous shock in net interest spread results in shrinkage of domestic net interest spread rates in Belgium, Austria, Poland, Romania and Slovakia.

In fact, cross-section dominance across the endogenous variables has been revealed both for relatively large economies such as France and the UK and small economies as Estonia, Lithuania or Slovakia. Countries subjected to dominant effects in global risks appear to be heterogeneous in size of economy and a geographical region.

4. Decomposition of Forecast Error Variance

Section 2 has established the basic endogeneity relationships of the variables in the model. To determine the dynamics of the system of equations, we employ the same four-variable VAR. The VAR is unrestricted —that is, we impose no structural or exogeneity assumptions, even given Wald dominance tests across the country specific variables. This is critical, because the VAR approach is not based on using the exogeneity test to restrict a model and such restrictions may not be valid for the structural model. To understand which dynamic relationship may be part of the model, we decompose forecast error variance.

Forecast Error decomposition is based on determining how much the fitted model differs from the actual values of the vector of endogenous variables. This is done by using the vector moving average interpretation of the GVAR to compute the forecast deviation over different time horizons. The variance of the forecast error is then decomposed and the percentage of the forecast variance due to each endogenous variable corrected by CSAs is determined. If the variable of interest such as net interest spread is exogenous for a certain country in a panel we would expect to see that the innovations in the endogenous variable do not explain a variation in the spread. If the variables are contemporaneously correlated, we expect to see that the variation in one variable can begin to explain the other with a lag as the contemporaneous innovations work through the lags in the system of equations.

The forecast error decomposition for the GVAR model of global financial risks, economic performance and financial stability is presented in Figure 2a and 2b. Figure 2a and 2b show the proportion of the forecast variance for the net interest spread variable from innovations or shocks to net interest spread itself and to banking sector technology, output gap and the rates of inflation for New EU Members and Old EU Members. This decomposition depends on the correlation in the errors in the four series which is based on the covariance matrix of the residuals from the GVAR. Because net interest spread is first in ordering of Cholesky decomposition of the variables, the decomposition assumes that the initial period has all the variance in the forecast attributed to net interest spread and none to the other series. As the forecast horizon increases in our case there I more variation attributed to the other innovations expected based on the correlation of the innovations and the dynamic of a system. However, dealing with twenty seven countries we do expect heterogeneous patterns in forecast variation in the net interest spreads between the countries.

As far as we can see from the Figure 2a and 2b for Czech Republic, Hungary and Poland starting from the first quarter and up to 30 quarters (8 years), just about 8% of the forecast variation in net interest spreads can be attributed to innovations in output gap; that's almost same for Belgium and Luxembourg showing stable pattern. For Estonia, Lithuania and Malta by the 5th quarter (1,3 years) about 18% of the forecast error in net interest spread is due to innovations in banking sector technology, output gap and rates of inflation, by the way, innovations in banking sector technology have a higher impact on Estonian and Maltin financial risks, when the innovations in inflation rates are crucial for Lithuania. Surprisingly, the similar situation is observed for the EU15, where by the 5th quarter (1,3 years) about 20% for Spain, 12% for Finland, 39% for France, 27% for Greece, 26% for Ireland and 10% for Portugal of the forecast error in net interest spread is due to innovations in banking sector technology, output gap and rates of inflation. Moreover, innovations in banking technology explain more forecast variance in net interest spread for France; innovations in economic performance - for France, Greece, Ireland, Portugal; innovations in financial stability – for Spain and Finland. Net interest spread and output gap series are contemporaneously correlated as starting from the first lag 17% of the forecast error in Romanian spread and 7% forecast error in Cypriot spread is due to innovations in output gap. We can easily notice 25% of the forecast error in spread for France, 10% for Greece and 2% for Austria due to innovations in output gap contemporaneously correlated.

Indeed, the innovations in transformation of bank assets to liabilities explain 18% of innovation in Slovak spread (after 15 quarters), 20% of innovation in Slovenian spread (after 7 quarters), 6% of innovation in Romanian spread (after 5 quarters), 20% innovation in French spread (after 5 quarters), 10% innovation in Irish spread (after 2 quarters) and 15% innovation in Austrian spread (after 8 quarters). Similarly, the innovations in inflation explain 17% of innovation in Latvian spread (after 5 quarters), 22% of innovation in Slovak spread (after 5 quarters), 20% of innovation in Romanian spread (after 12 quarters), 17% innovation in Slovenian spread (after 6 quarters), 10% innovation in Denmark spread (after 2 quarters), 12% innovation in Greek and Spanish spreads (after 4 quarters) and 7% innovation in Italian spread (after 10 quarters).

There is special situation for Bulgaria where after 5 quarters about 95% of the forecast variance in spread is the result of innovation in output gap and the rest 4% in banking technology. The same situations have risen for Slovakia and Slovenia where after 15 and 10 quarters respectively about 38% of the forecast variance in spread is the result of innovation in inflation rate and banking technology. For the Western Europe innovations in output gap and banking sector technology seem to cause forecast variance in French spread (37%) after 6 quarters, Irish spread (35%) after 7 quarters, Austrian spread (22%) after 17 quarters and Swedish spread (15%) after 17 quarters.

There are several key conclusions to draw from these innovations accounting results. First shocks to output gap, banking sector technology and to a smaller extend to inflation lead to heterogeneous changes in net interest spread pattern between the countries. Innovations in inflation rates account a significant part of the forecast variance in spreads for Lithuania, Slovakia, Slovenia, Latvia, Denmark and Spain. Innovations in banking sector technology account a significant part of the forecast variance in spreads for Slovenia, France, Netherlands, Austria and Sweden. Innovations in output gap account a significant part of spread forecast error variance for Cyprus, Bulgaria, Romania, Belgium, France, Ireland and Luxembourg. It accounts more than 90% of forecast variance in Bulgarian spread. Second, nearly 80% of the forecast error variance in spreads is attributable to its own innovation both for Old and New Members except of Bulgaria, Slovakia, Romania, Slovenia, France, Greece and Ireland. For above countries the net interest spread is considered to be endogenous variable as the innovations in the other variables explain the variation in it.

Moreover, spreads, banking sector technology and output gap are in major part contemporaneously correlated. The correlation of innovations is stronger for the New EU Members, as there is more variation attributed to other innovations based on the correlation of innovations starting from the 2-3 quarters. Generally speaking for EU15 the initial shock to net interest spread attributes all the innovation in spreads to spreads itself at least within the first 7-10 quarters. It proves weaker correlation of innovations as there is less forecast variation is attributed to other innovations, especially for the UK, Belgium, Germany, Finland, Italy, Netherlands, Luxembourg and Portugal.

Above findings challenge the propositions 3 and 4 of the model. The Proposition 3 is supported for four New EU Members (Bulgaria, Slovakia, Romania and Slovenia) and three Old EU Members (France, Greece and Ireland) whether or not the dominant effect in spreads was present or not. For the rest of the countries both dominated and not in spreads, the variables are exogenous to each other in a model and the innovations in financial stability, economic performance and banking sector technology do not explain the variation in net interest spread.

Proposition 4 is not supported by the results of the forecast error variance decomposition analysis except of Bulgaria, Romania and France. Shocks to output gap do not lead to significant changes in spread pattern to proxy banking sector development and a degree of a credit and liquidity risks.

One major benefit of this method in our GVAR model is that it allowed us to compute the forecast deviations over a different time horizons and to assess the percentage of the variance in spread due to each endogenous variable determined in a model taking into accout the cross-section augmentations. A second benefit of the GVAR model used is that the possible identification and exogeneity restrictions that would have been used in a structural equation representation of the system were made explicit and have been be tested letting the data speak for itself. This revealed heterogeneity of net interest spread exogeneity concept between EU27 Members. We have seen how the inferences made in a model have or have not been supported by the empirical data for the panel of twenty seven countries. These results, combined with the Wald dominance test, provide a concise and clear way of addressing identification and dynamic specification in the GVAR model.

5. Conclusion.

According to Calvo (2002, 2005), with international financial integration, emerging economies become more vulnerable to exogenous than to domestic determinants shocks arising from cross section dependence across the countries. This cross section dependence and its impact on net interest spread is referred to as “globalisation hazard”. According to Uribe and Yue (2006), the price level and real output in a typical emerging market as in New EU members respond to exogenous monetary policy shocks by more than the price level and real output in the cross-section augmentation itself.

Our results, strongly suggest that the short run evolution of net interest spreads does not crucially depend on external surprises, even for Slovakia, Slovenia and Romania, which are proved to be the most volatile in a degree of a credit and liquidity risk. Bulgaria is an exception. Furthermore, net interest spread response in EU Members is not significantly triggered by presence of dominant effects, external financial and banking sector conditions and domestic shocks in output gap and inflation. Dominant effects do vary across the size of cross-section augmentations and geographical locations in Europe. Moreover, high cross-section correlations in spreads and banking technology between the non-neighbouring countries of different size disapprove gravity concept in international economics for the EU Members.

The crucial importance of cross section dominance in the determination of net interest spread, output gap and inflation rates that EU member State face in international financial environment does not necessarily relegate the importance of domestic macroeconomic variables. To those countries which spreads are proved to be exogenous the exogeneity concept simply implies that a strong monetary and fiscal policy is less effective in direct spread targeting and cannot improve domestic fundamentals, thus a decrease of the default risk, cost of borrowing, financial stability are more effective. Innovations in inflation and banking sector technology account a significant part of the forecast variance in spread for the EU15 as well as innovations in output gap and banking sector technology - for the EU12; although the error variance in spreads for the EU15 is to a major part explained by the innovation of spreads to spreads. Therefore, spreads which are weakly determined by so-called "globalisation hazard" or simple external shocks provide itself the main magnifying mechanisms through which the impacts of net interest spread shocks are transmitted to economic performance and financial stability.

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Appendix A

See Tables A.1 and A.2

Table A. 1
Summary statistics for EU Member States, 1993-2008

Country	Consume price index				Bank assets / liabilities ratio				Net interest spread				Output gap			
	Mean	Max.	Min.	Skewn	Mean	Max.	Min.	Skewn	Mean	Max.	Min.	Skewn	Mean	Max.	Min.	Skewn
Germany	1.85	4.59	0.27	1.22	0.94	1.07	0.84	0.18	5.44	5.44	5.44	-0.59	0.00	0.04	-0.04	0.20
Belgium	2.05	3.87	0.36	0.19	1.73	2.57	1.19	0.33	5.04	5.04	5.04	1.12	0.00	0.05	-0.06	-0.54
Bulgaria	104.9	1715.6	-0.86	4.05	1.19	1.32	1.12	0.69	36.96	36.96	36.96	4.67	-0.08	2.27	-2.01	-0.10
Cyprus	3.11	5.61	0.86	0.14	0.99	1.11	0.87	-0.09	2.35	2.35	2.35	-1.13	0.00	0.09	-0.06	0.48
Czech Rep.	5.56	13.86	-0.36	0.42	0.60	0.70	0.37	-0.72	4.96	4.96	4.96	0.87	0.00	0.18	-0.28	-1.45
Denmark	2.11	4.15	0.94	0.55	1.99	6.47	1.45	3.28	3.89	3.89	3.89	-0.95	0.00	0.06	-0.05	0.04
Estonia	18.00	256.23	0.43	4.91	0.77	0.84	0.70	-0.02	6.03	6.03	6.03	1.36	0.00	0.33	-0.34	-0.51
Spain	3.35	5.17	1.49	0.00	1.02	1.09	0.95	0.16	2.00	2.00	2.00	2.42	0.00	0.12	-0.10	0.60
Finland	1.63	4.58	-0.18	0.70	1.16	1.27	1.02	0.07	3.05	3.05	3.05	-0.94	0.00	0.06	-0.09	-0.39
France	1.70	3.31	0.23	-0.04	0.70	0.75	0.62	-0.22	2.51	2.51	2.51	0.71	0.00	0.05	-0.03	0.50
Greece	5.37	16.14	2.03	1.52	1.42	1.64	1.23	0.49	5.74	5.74	5.74	0.14	0.00	0.03	-0.02	0.61
Hungary	12.09	30.65	2.48	0.77	1.13	1.35	1.03	0.78	4.14	4.14	4.14	1.07	0.00	0.16	-0.03	3.13
Ireland	3.10	6.56	0.93	0.45	0.48	0.64	0.34	0.14	5.14	5.14	5.14	0.33	0.00	0.10	-0.06	0.66
Italy	2.83	5.68	1.39	1.03	1.28	2.18	1.04	2.12	4.12	4.12	4.12	-0.11	0.00	0.10	-0.10	0.32
Lithuania	44.02	722.85	-1.65	4.07	1.64	6.31	1.08	4.08	5.83	5.83	5.83	0.65	-0.01	0.29	-0.46	-1.41
Latvia	16.11	220.87	1.01	4.98	0.62	0.70	0.51	-0.83	10.57	10.57	10.57	1.95	0.00	0.16	-0.19	-0.23
Luxemb.g	2.22	4.06	-0.09	-0.03	1.23	1.59	1.03	0.71	1.49	1.49	1.49	0.29	0.00	0.07	-0.10	-0.50
Malta	2.83	5.30	-0.36	-0.28	0.65	0.74	0.54	-0.27	2.90	2.90	2.90	0.02	0.00	0.09	-0.09	-0.06
Netherlands	2.23	4.40	0.90	0.90	1.20	1.39	1.05	0.73	1.93	1.93	1.93	1.59	0.00	0.09	-0.08	0.38
Austria	2.05	3.87	0.36	0.19	0.94	0.98	0.91	0.18	3.42	3.42	3.42	0.38	0.00	0.02	-0.05	-1.38
Portugal	3.35	7.92	1.57	1.35	1.67	1.98	1.21	-0.71	3.69	3.69	3.69	0.85	0.00	0.13	-0.09	0.27
Poland	11.54	41.40	0.34	1.08	0.69	0.79	0.45	-1.06	5.30	5.30	5.30	-0.06	0.00	0.09	-0.07	0.31
Romania	56.20	308.21	3.80	1.99	0.84	1.03	0.67	-0.06	16.89	16.89	16.89	1.28	-0.03	0.56	-1.40	-1.62
Slovenia	9.28	56.62	2.16	3.17	0.63	0.69	0.59	0.24	6.19	6.19	6.19	2.31	0.00	0.17	-0.11	0.47
Sweden	1.62	4.96	-1.10	0.55	0.99	1.00	0.99	0.45	3.79	3.79	3.79	-0.02	0.00	0.06	-0.11	-0.66
Slovakia	7.86	22.15	2.09	1.19	1.46	1.61	1.29	-0.59	4.90	4.90	4.90	0.25	0.00	0.18	-0.18	-0.26
UK	2.83	5.51	1.05	0.26	0.86	0.90	0.83	0.11	3.02	3.02	3.02	-0.37	0.00	0.10	-0.09	0.52

Number of observations: 6912. All variables are in levels. Source: Datastream database.

Table A.2

Cross section augmented groups (based on bivariate correlation coefficients)*

Variable	GROUP	Variable	GROUP
BDy_t	CZ, EO, ES, FR,IT, LV,NT,PG,SX,UK	$IT\,{}^{A}/L_{it}$	BL, CZ, DN, GR, HU, LT, LV, LX, NT, PG, PL
BDr_{it}	BG, DN, FN, GR, IT, IR, OE, SW	$IT\pi_{it}$	GR, HU, PG, PL, ES
$BD\,{}^{A}/L_{it}$	CU, CZ, FN, FR, GR, HU, IR, IT, LX, MA, PL	LTy_t	CZ, EO, SX, LV
$BD\pi_{it}$	LX, SW, ES	LTr_{it}	IR, ES, BD
BGy_t	DN, LX, SW	$LT\,{}^{A}/L_{it}$	BL, CZ, DN, GR, HU, IT, LV, LX, MA, NT, PL
BGr_{it}	BD, DN, FN, IR	$LT\pi_{it}$	SX, GR, LV, PG, PL, SJ, EO, BD
$BG\,{}^{A}/L_{it}$	OE, SW, FR, EO	LVy_t	BD, CZ, EO, LT, SX
$BG\pi_{it}$	SW. LX, ES, BD, FR	LVr_{it}	ES, CZ, EO, GR, HU, IT, IR, MA, NT, PG, OE, PL, RO, SJ, SW
BLy_t	HU, RO	$LV\,{}^{A}/L_{it}$	CZ, DN, GR, HU, IT, LT, PL
BLr_{it}	PG, OE	$LV\pi_{it}$	SX, GR, LT, PG, PL, EO, SJ, BD
$BL\,{}^{A}/L_{it}$	CZ, DN, ES, GR, HU,IT, LT. LX, MA, NT, PL,	LXy_t	BG, PG, SW
$BL\pi_{it}$	IR, RO	LXr_{it}	CZ, EO, GR, IT, IR, NT, OE, SJ, SW
CUy_t	MA, SX	$LX\,{}^{A}/L_{it}$	BD, BL, CU, CZ, DN, ES, GR, HU, IR, IT, LT, MA, NT, PG, PL, RO, UK
CUr_{it}	FR, UK	$LX\pi_{it}$	FR, OE, SW, ES, BG, BD
$CU\,{}^{A}/L_{it}$	BD, FN, FR, GR, HU,IR, LX, MA, PG, PL, SJ	MAy_t	CU, SX
$CU\pi_{it}$	LX, SW, BG, BD	MAr_{it}	CZ, EO, GR, HU, NT, LV, PG
CZy_t	BD,EO, ES, IT, LT, LV, SX, UK	$MA\,{}^{A}/L_{it}$	BD, BL, CU, CZ, ES, GR, HU, IR, LV, LX, NT, PG, PL
CZr_{it}	EO, GR, HU, IT, LV, LX, MA, NT, OE, PG, SJ, SW	$MA\pi_{it}$	BD, CZ
$CZ\,{}^{A}/L_{it}$	BD, BL, DN, GR, HU, IR, IT, LT, LV, LX, MA, NT, PG, PL	NTy_t	BD, EO, ES, FR, IT, PG, SX, UK
$CZ\pi_{it}$	GR, HU, PL, RO, SJ	NTr_{it}	CZ, ES, ES, FN, GR, HU, IT, IR, LV, LX, OE, PG, PL, RO, SJ, SW
DNy_t	BG, FN, LV, SW	$NT\,{}^{A}/L_{it}$	CZ, BL, DN, EO, ES, GR, HU, IT, LT, LX, MA, PL, UK
DNr_{it}	BD, BG, FN, GR, HU, IT, IR, OE, PL, SW	$NT\pi_{it}$	PG, SW
$DN\,{}^{A}/L_{it}$	BD, BL, CZ, GR, HU, IT, LV, LT, LX, NT, PL	OEy_t	HU, LX
$DN\pi_{it}$	FN, IR	OEr_{it}	BD, CZ, DN, EO, ES, FN, GR, HU, IT, IR, LV, LX, PG, PL, SJ, SW
EOy_t	HU, BD	$OE\,{}^{A}/L_{it}$	FR, SJ
EOr_{it}	CZ, ES, FN, GR, HU, IT, IR, LV, LX,	$OE\pi_{it}$	LX, SW, ES, BD
$EO\,{}^{A}/L_{it}$	NT, SW	PGy_t	BD, FR, IT, LX, NT, UK
$EO\pi_{it}$	SX, GR, LT, LV, PG, PL, SJ, BD	PGr_{it}	CZ, EO, GR, HU, IT, LV, MA, NT, OE, SJ, SW
ESy_t	BD, EO, FR, IT, NT, PG, SX, UK	$PG\,{}^{A}/L_{it}$	CZ, FR, GR, HU, IT, IR, LT, LX, MA, PL
ESr_{it}	EO, FN, GR, HU, IT, IR, LV, NT, OE, SJ, SW	$PG\pi_{it}$	GR, IT, LT, LV, PL, SJ, SW, EO, BD
$ES\,{}^{A}/L_{it}$	BL, GR, HU, LX, MA, NT, PL RO, UK	PLy_t	SJ, HU
$ES\pi_{it}$	IT, LX, OE, SW	PLr_{it}	BD, DN, EO, FN, GR, HU, IT, IR, LV, NT, OE, RO, SJ, SW
FNy_t	DN, SW	$PL\,{}^{A}/L_{it}$	BD, BL, CZ, DN, GR, HU, IT, LT, LV, LX, MA, NT, PG
FNr_{it}	BD, DN, EO, ES, GR, HU, IT, IR, NT, OE, PL, SW, SJ, SX	$PL\pi_{it}$	SX, GR, HU, IT, LT, LV, PG, RO, SX, EO, CZ
$FN\,{}^{A}/L_{it}$	BD, CU, FR, HU, IR, LX	ROy_t	BL, SJ
$FN\pi_{it}$	DN, SW	ROr_{it}	EO, FN, LV, NT, PL, SJ, SW
FRy_t	BD, EO, ES, IT, NT, PG, UK	$RO\,{}^{A}/L_{it}$	ES, LX, NT, UK
FRr_{it}	UK, CU	$RO\pi_{it}$	SX, GR, PL, SJ
$FR\,{}^{A}/L_{it}$	BD, BG, CU, IR, MA, OE, PG, SJ, SW	SJy_t	HU, EO
$FR\pi_{it}$	LX, OE, ES, BG	SJr_{it}	CZ, ES, EO, FN, GR, HU, IT, IR, LV, LX, NT, OE, PG, PL, RO, SW
GRy_t	PG, DN	$SJ\,{}^{A}/L_{it}$	CU, FR, OE
GRr_{it}	CZ, DN, EO, ES, FN, HU, IT, IR, LV, LX,NT, OE, PG, PL, SJ, SW	$SJ\pi_{it}$	SX, GR, LT, LV, PG, PL, RO, EO, CZ, BD
$GR\,{}^{A}/L_{it}$	BD, BL, CU, CZ. DN, ES, HU, IR, IT, LT, LV, LX, MA, NT, PG, PL, UK	SWy_t	BG, DN, LX
$GR\pi_{it}$	SX, HU, LT, LV, IT, PG, PL, RO, SJ,EO, CZ, BD	SWr_{it}	BD, CZ, DN, EO, ES, FN, GR, HU, IT, IR, LV, LX, NT, OE, PG, PL, RO, SJ
HUy_t	SJ, IR	$SW\,{}^{A}/L_{it}$	BG, FR, IR
HUr_{it}	BD, CZ, DN, EO, ES, FN, GR, IT, IR, LV, NT, OE, PG, PL, SW, SJ	$SW\pi_{it}$	LX, OE, PG, BD, ES, BG
$HU\,{}^{A}/L_{it}$	BD, BL, CU, CZ, DN, ES, FN, GR, IR, LT, IT, LV, LX, MA, NT, PG, PL, UK	SXy_t	GR, CZ, ES, EO, IT, LT, LV,UK

$HU\pi_{it}$	GR, IT, PL, CZ	SXr_{it}	DN, FN
IRy_t	HU, SJ	$SX\,{}^{A}/_{L_{it}}$	FN, FR
IRr_{it}	BD, DN, EO, ES, FN, GR, HU, IT, LV, LX, NT, OE, PL, SW, SJ	$SX\pi_{it}$	LX, OE, PG, ES, BG, BD
$IR\,{}^{A}/_{L_{it}}$	BD, CU, CZ, FN, FR, GR, HU, LX, MA, PG, SW,	UKy_t	BD, CZ, EO, ES, FR, IT, NT, PG, SX
$IR\pi_{it}$	FN, DN	UKr_{it}	BG, CZ
ITy_t	BD, EO, ES, FR, NT, PG, SX, UK	$UK\,{}^{A}/_{L_{it}}$	ES, HU, LX, NT, RO
ITr_{it}	BD, CZ, DN, ES, EO, FN, GR, HU, IR, LV, LX, NT, OE, PL, SW ,SJ	$UK\pi_{it}$	NT, SX

Group choice is made basis on r_{yiyj} ; r_{rirj} ; $r_{\frac{A}{L}i\frac{A}{L}j}$ $r_{\pi i\pi j}$ >0.7 Variables are given in levels.
* BD- Germany, BG – Belgium, BL – Bulgaria, CU – Cyprus, CZ – Czech Republic, DN – Denmark, EO – Estonia, ES – Spain, FN- Finland, FR – France, GR – Greece, HU – Hungary, IR – Ireland, IT- Italy, LT – Lithuania, LV - Latvia, LX – Luxembourg, MA – Malta, NT – Netherlands, OE – Austria, PG – Portugal, PL – Poland, RO – Romania, SJ –Slovenia, SW- Sweden, SX – Slovakia, UK – United Kingdom.
Source: Authors calculations.

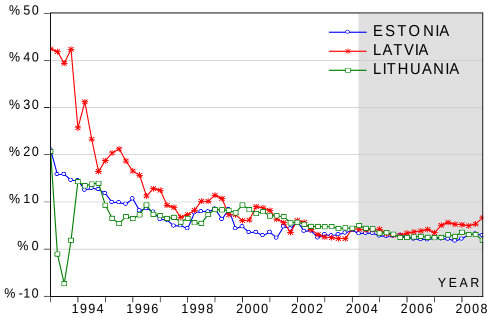
Appendix B

See Tables B.1.

Table B.1.
Cross-section augmentations and Wald dominance test for EU Member States

Country	Cross-section group augmentations, $\theta_{qi}, for\ q = \mathbf{0}$				Wald Test $H_0^y, H_0^r, H_0^{A/L}, H_0^{\pi}: \theta_{qi} = 0\ for$,			
	Output gap	Net interest spread	Bank assets to liabilities ratio	CPI	Output gap	Net interest spread	Bank assets to liabilities ratio	CPI
Germany	0.008*** (17.01)	-0.006 (-1.28)	0.001 (0.46)	0.020** (2.10)	0.00	0.20	0.64	0.04
Belgium	0.050** (2.16)	-0.006** (-2.09)	0.049 (1.18)	-0.006 (-1.00)	0.08*	0.04	0.24	0.31
Bulgaria	0.090** (2.98)	-0.020 (-0.77)	-0.020*** (-5.81)	0.521** (2.46)	0.00	0.08	0.00	0.00
Cyprus	1.110*** (5.42)	-0.006* (-1.91)	-0.005 (-0.18)	0.031*** (3.79)	0.00	0.07*	0.98	0.00
Czech Republic	-0.010*** (-6.57)	-0.006 (-0.60)	-0.005 (-0.61)	0.072*** (3.47)	0.00	0.54	0.54	0.00
Denmark	0.020*** (12.51)	9.890 (0.09)	0.010 (1.02)	0.020*** (3.24)	0.00	0.92	0.30	0.00
Estonia	0.020*** (12.18)	0.008(0.15)	-0.060*** (-3.38)	0.005*** (3.03)	0.00	0.87	0.00	0.00
Spain	0.020*** (27.26)	0.010** (2.88)	0.005 (1.03)	0.030*** (4.59)	0.00	0.00	0.30	0.00
Finland	0.020*** (6.59)	0.008* (1.95)	0.010 (1.43)	0.009*** (4.94)	0.00	0.07*	0.15	0.00
France	0.020*** (6.69)	-2.50 (-0.02)	-0.004** (-2.03)	0.010*** (4.18)	0.00	0.98	0.04	0.00
Greece	-0.060*** (-3.27)	-0.004 (-0.71)	0.003 (0.50)	0.005** (2.39)	0.00	0.48	0.61	0.01
Hungary	0.040* (1.86)	0.002 (0.40)	-0.004 (-0.96)	0.017** (2.45)	0.03	0.68	0.34	0.00
Ireland	1.090** (2.08)	0.010* (1.87)	-0.004 (-0.09)	0.032** (2.50)	0.08*	0.07*	0.92	0.01
Italy	0.010*** (15.45)	0.010*** (3.36)	-0.006 (-0.10)	-0.018*** (4.83)	0.00	0.00	0.91	0.00
Lithuania	0.030*** (4.03)	-0.003 (-0.64)	-0.007 (-1.45)	0.022*** (6.14)	0.00	0.52	0.34	0.00
Latvia	0.010*** (9.06)	-0.010 (-1.33)	-0.021 (-1.54)	0.008*** (5.11)	0.00	0.39	0.12	0.00
Luxembourg	0.040*** (8.21)	-0.006 (-0.30)	-0.01 (-1.26)	0.008***(8.45)	0.00	0.55	0.21	0.00
Malta	2.070*** (4.51)	-0.005 (-0.19)	-0.003 (-0.31)	0.013** (2.44)	0.00	0.74	0.75	0.01
Netherlands	0.020*** (21.31)	0.020* (1.92)	0.010 (0.67)	0.007** (2.65)	0.00	0.06*	0.50	0.01
Austria	0.000 (0.18)	-0.012** (-2.32)	-0.051** (-2.65)	0.009*** (5.00)	0.53	0.02	0.01	0.00
Portugal	0.030*** (8.01)	-0.005 (-0.48)	-0.006 (-1.20)	0.001 (0.86)	0.00	0.62	0.23	0.38
Poland	0.110** (2.77)	-0.020** (-2.44)	-0.005* (-1.76)	0.035*** (3.51)	0.00	0.01	0.08*	0.00
Romania	-0.130*** (-5.89)	-0.260** (-2.04)	0.030 (1.24)	-0.016 (-1.47)	0.00	0.06*	0.21	0.14
Slovenia	0.380*** (3.49)	0.010** (2.31)	-0.011** (-2.75)	0.003*** (3.40)	0.00	0.06*	0.00	0.00
Sweden	0.070*** (15.51)	0.005 (1.15)	0.005* (1.99)	0.008** (2.44)	0.00	0.25	0.05	0.01
Slovakia	0.010*** (3.63)	-0.480** (-2.37)	-0.110 (-1.46)	-0.005 (-0.98)	0.00	0.02	0.14	0.33
United Kingdom	0.020*** (23.80)	-0.050*** (-3.12)	0.004** (2.41)	-0.001** (-2.65)	0.00	0.00	0.01	0.01

Results for lag orders equal to zero are reported. If insignificant, the results of a lag order one are reported.
Number of observations: 6912. All variables are in logarithms except for output gap (in % deviation from the steady state). t Statistics in parentheses. Standard errors are estimated robustly.
(*), (**) and (***) significant at 10, 5 and 1% level, respectively
In the last four columns the estimated p-values of the Wald test are presented.



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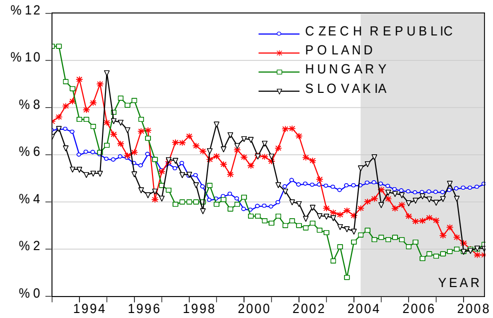

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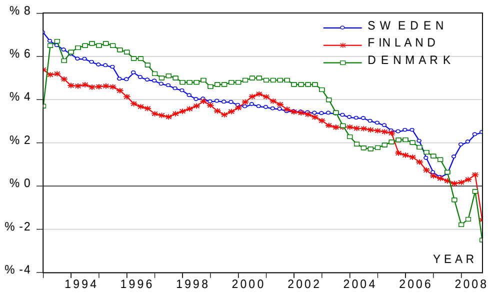

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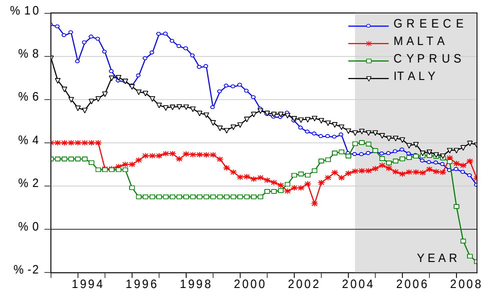

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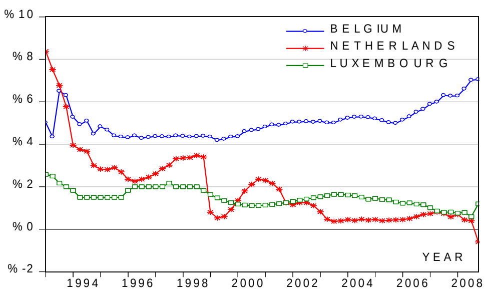

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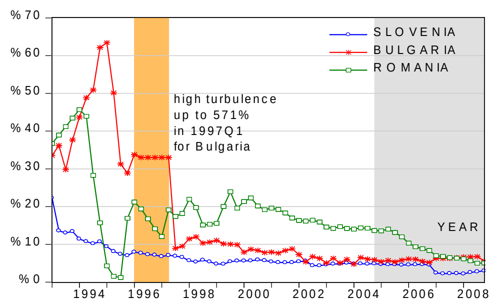

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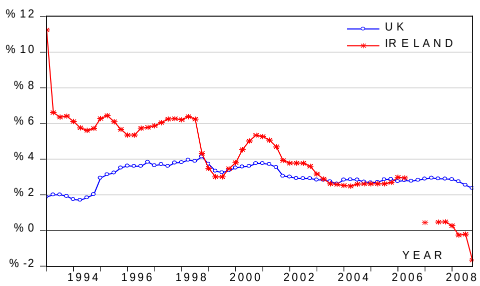

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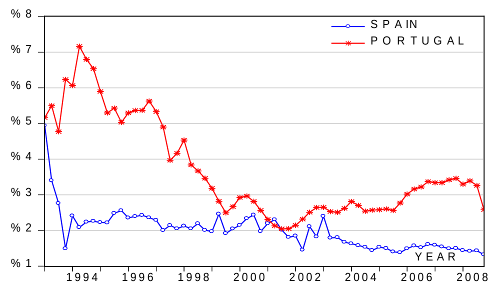

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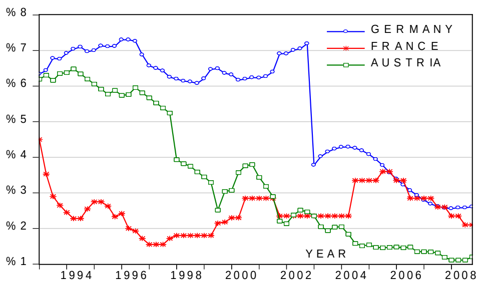

I

*All variables are given in levels in a period from 1993 to 2008 (raw data). Shadow area is the period of the biggest EU Enlargement in May 2004.
Source of data: IMF International Financial Statistics, 1993-2008

Figure 1: Net interest spreads of EU Member States, 1993-2008*

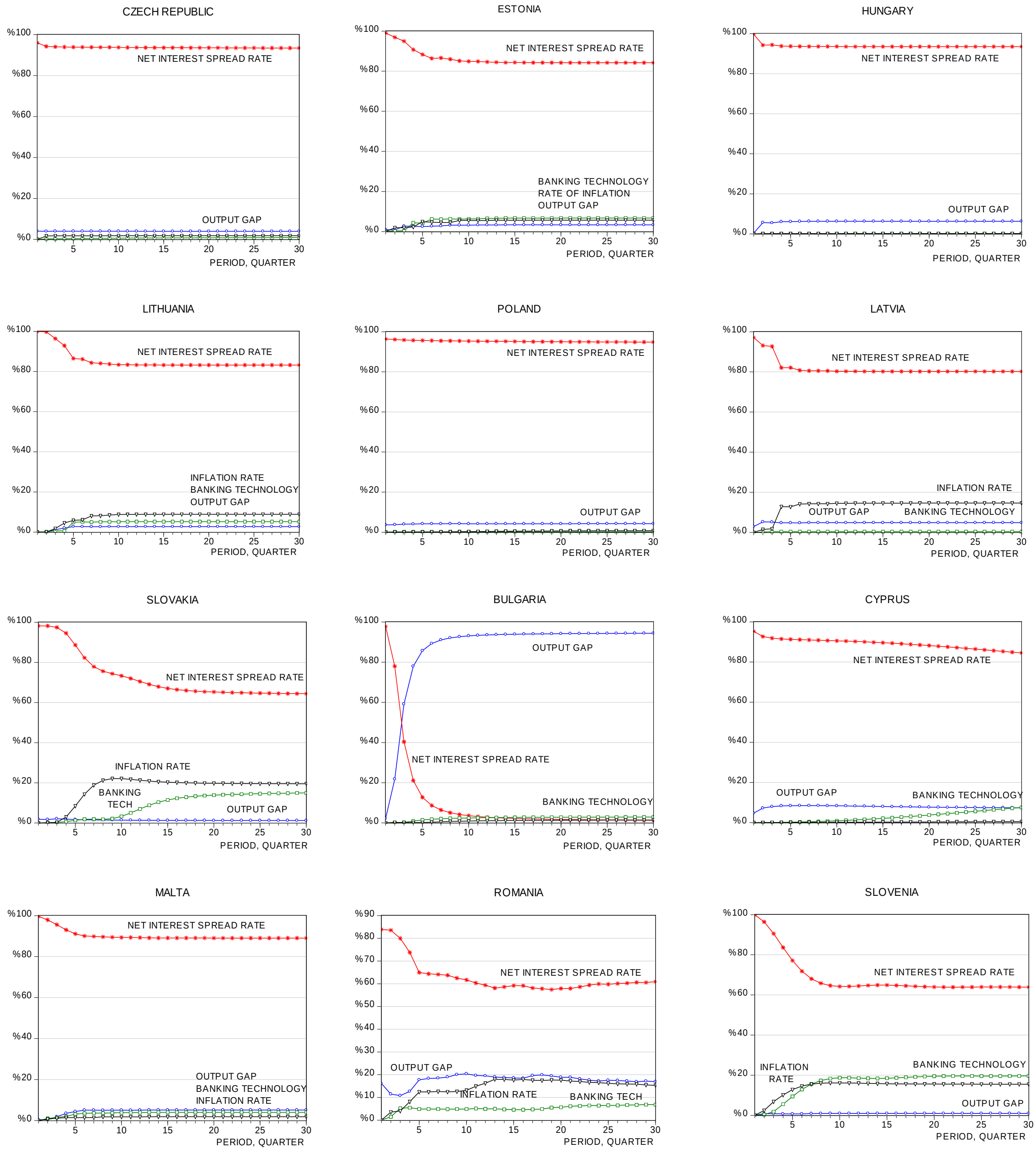

Figure 2a: Decomposition of the Forecast Error Variance for the GVAR Model of global financial risks, economic performance and financial stability (EU12)

Figure 2b: Decomposition of the Forecast Error Variance for the GVAR Model of global financial risks, economic performance and financial stability (EU15)