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"CONVERGENCE OF SHOCKS AND TRADE IN THE ENLARGED EUROPEAN UNION"

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Revised, June 2008

ABSTRACT

This paper explores the relation between trade flows and cross-country symmetry of supply and demand shocks using data from the EU27 countries. Increased bilateral trade intensity is found to have a positive impact on the correlation of both demand and supply shocks. Intra-industry trade is found to be positively linked to correlations of supply-side shocks but negatively linked to correlation of demand shocks. Our results thus provide support for the argument that aggregate demand spill-overs and intra-industry trade, rather than specialization, dominate in the process through which trade flows affect the cross-country transmission of shocks in Europe. At the same time, our estimates suggest that monetary-policy convergence in Europe (the circulation of the euro), while having increased symmetry of supply-side shocks, has had no direct favourable impact on symmetry of demand shocks. By contrast, the process of fiscal-policy convergence is found to have resulted in more correlated demand shocks across the EU member states.

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1. INTRODUCTION

With the enlargement of the European Union from 15 to 27 member states European integration has entered a new era. This new era involves challenges for all the member states. On the one hand, the old member states need to facilitate growth in the newcomers to enable them to increase their per capita incomes. At the same time, all the new member states (NM12) are required to join the EMU as in the Accession Treaty no opt-outs are permitted.[1] And while EMU membership will undoubtedly be beneficial for all the EU economies in the long run, the loss of monetary independence may be costly in the short run for the newcomers if their macroeconomic shocks and business cycles are not sufficiently symmetric with those of the other eurozone participants. The optimum-currency-areas (OCA) theory[2] emphasizes this point, suggesting that the major cost of sharing a common currency is the loss of monetary autonomy. When national business cycles are not synchronized enough and member states face asymmetric shocks, country-specific adjustment policies are needed and a common monetary policy cannot be tailored to each country's needs. Indeed, a pressing matter for EU policymakers today is to what extent similarity of shocks and business cycles across the twenty-seven member states can be expected to increase in the near future. In this respect, how the process of trade integration in Europe has influenced shock asymmetries and

business-cycle patterns is crucial. Intra-EU trade has shown an upward trend since the start of the enlargement negotiations, and, as the literature on the trade effects of currency unions suggests[3], this upward trend is likely to continue with an expansion of EMU membership. Thus knowing whether or not trade integration reduces shock asymmetries and induces greater convergence of business cycles has important implications for assessing the success of an enlarged EMU.

In the international economics literature there is an ongoing debate as to whether trade integration accompanies highly correlated business cycles. Emphasising that increased trade will facilitate specialization according to comparative advantage, Krugman (1993) and Eichengreen (1992) have pointed to a negative association between more intense trade ties and cross-country synchrony of business cycles. Kalemli-Ozcan *et.al.* (2001, 2003) support this view, suggesting that the increased opportunities for income diversification, which result from economic integration, may lead to greater specialization in production and thus more asymmetric business-cycle co-movements. Kose and Yi (2001), using a standard business-cycle model, also fail to establish a positive relation between larger trade flows and cross-country symmetry of macroeconomic fluctuations, while Imbs (2004) stresses that the overall impact of increased trade on business-cycle synchronization is ambiguous as trade integration affects national economies through a variety of channels.[4] Several other authors, however, emphasising international spill-over effects, have reached different conclusions. Frankel and Rose (1998) have been the first to find a large positive effect of more intense trade on cross-country synchrony of cyclical fluctuations, but evidence suggesting a favourable impact of trade on business-cycle correlations can also be found in, for example, De Haan *et.al.* (2002), Bordo and Hebling (2003), Inklaar *et. al.* (2005) and Calderón *et.al.* (2002,2007). There also seems to be disagreement in the literature regarding whether overall bilateral trade or intra-industry trade is the most important factor in inducing synchronization of business cycles. Some authors point out that by increasing the diffusion of knowledge and technology and by being a major channel through which spending shocks are spread internationally, trade linkages in general (and thus overall bilateral-trade intensities) can play a role in strengthening business-cycle co-movements (see, for instance, Coe and Helpman (1995), Clark and van Wincoop (2001), Ambler *et. al.* (2002) and Bergman (2005)). Others argue that trade within the same industries (intra-industry trade), not overall bilateral trade, is the key factor which, through industry-specific productivity spill-overs and income transfers, determines the degree to which business-cycle fluctuations across countries can become more synchronized (see, for example, Imbs (2001, 2004), Fidrmuc (2004) and Shin and Wang (2005)).

Much of this literature examines cross-country output or industrial-production co-movements paying no attention to the association between trade integration and symmetry of demand and supply shocks. However, exploring how trade flows affect diversity of shocks across economies is important, given that shock similarity is a crucial determinant of the degree of synchronization of national business cycles. Indeed, the way in which closer trade may affect cross-country business-cycle co-movements can be better understood if the association between increased trade ties and correlations of demand and supply shocks is separately and explicitly examined.

This paper explores the relation between convergence of shocks and trade using data from the EU27[5] countries covering the period 1995Q1-2005Q4. The purpose of the paper is twofold. First, it attempts to add to the existing

literature on business-cycle synchrony by directly examining convergence of macroeconomic shocks and by assessing within this context the role of both overall bilateral trade and intra-industry trade. Second, by exploring how the upward trend in intra-European trade, which we have observed in recent years, has affected shock correlations and has thus shaped business-cycle patterns, it attempts to provide evidence regarding the prospects for business-cycle convergence in the enlarged European Union. The issue is important for the debate on the right timing of EMU entry by all NM12, given that the OCA theory predicts that intra-EU27 trade is likely to increase further with a rise in eurozone membership.

The rest of the paper is organized as follows. Section 2 discusses the empirical literature on the association between trade integration and synchrony of macroeconomic fluctuations and considers trade flows within EU27. In Section 3 we proceed to identify demand and supply shocks in each of the EU27 economies, employing a structural-VAR methodology along the lines suggested by Blanchard and Quah (1989). Following that, correlation coefficients for the identified structural demand and supply shocks versus Germany, France and the eurozone are computed and the nature of the relationship between such correlations and trade flows is examined. Since similarity of economic policies may influence cross-country symmetry of shocks independently of trade flows, policy integration is also considered. We consider three different samples: the EU27 member states, pooling two sub-periods of equal length (1996q1-2000q4 and 2001q1-2005q4); only the EU15 group, pooling the same two sub-periods; and the EU27 for the second, more recent, sub-period 2001q1-2005q4. Section 4 contains concluding comments.

In all our samples, increased overall trade is found to have a strong positive effect on the correlations of both demand and supply shocks. Intra-industry trade is found to be significantly and positively linked to correlations of supply-side shocks but negatively linked to correlations of demand shocks. In this respect, our results provide support for the argument that international spill-overs, via aggregate productivity and spending channels and via industry-specific technological and income transfers, rather than specialization, dominate in the process through which trade affects the transmission of shocks across the EU. They also implicitly provide evidence in favour of the endogeneity approach to the OCA criteria, namely that the criterion of similarity of shocks can be satisfied *ex post*. In particular, to the extent that our results suggest that more intense overall intra-EU trade would imply both less asymmetric demand shocks and less asymmetric supply shocks, then, provided that intra-EU27 trade continues on an upward trend, the process of European integration should lead to more synchronized national business cycles. From this point of view, our results provide evidence in support of a quick entry of all NM12 into the EMU to the extent that, as much of the literature on the trade effects of currency unions indicates, an expanded EMU can be expected to further boost intra-EU27 trade. At the same time, our estimates indicate that the circulation of the euro has been associated with increased symmetry of supply-side shocks in Europe but has had no direct favourable impact on symmetry of demand shocks. By contrast, the process of fiscal-policy convergence is found to have resulted in more correlated demand shocks across the EU27 member states. As far as interest-rate convergence is concerned, our results reveal that it has been accompanied in general with greater symmetry of shocks within the EU15 group.

2. BUSINESS CYCLES AND TRADE FLOWS

2.1. The empirical literature

Much of the empirical literature on the link between trade and business-cycle synchronization focuses on the impact of trade integration on cross-country cyclical co-movements of some measure of real economic activity, such as output, industrial production, employment or unemployment. The evidence is mixed, both as far as whether trade induces synchronization and as far as whether overall-bilateral trade or intra-industry trade is the key factor influencing output co-movements. There also seems to be conflicting conclusions regarding the effect of policy convergence on cyclical symmetry.

A seminal study in this literature is Frankel and Rose (1998). Using data from 21 industrial countries over the period 1959-1993, Frankel and Rose (1998) examined the extent to which co-movements of quarterly real-GDP growth, industrial production growth, employment growth and unemployment could be explained by average bilateral trade flows (normalized by total trade or nominal GDP). Determinants of international trade from gravity models (i.e. distance between countries, geographic adjacency and common language), which were uncorrelated with policy co-ordination, were used as instrumental variables for overall bilateral-trade intensity in their regressions. Their estimates suggested a strong positive effect of increased overall trade on correlations of macroeconomic fluctuations. Employing the Frankel-Rose (1998) methodology, several other papers, including Calderón *et. al.* (2002, 2007), De Haan *et. al* (2002) and Bordo and Hebling (2003), confirmed the strong association between trade intensity and business-cycle synchronization. In particular, Calderón *et. al.* (2002) found evidence of a significant positive effect of trade on business-cycle correlations for OECD countries, while Calderón *et. al.* (2007) confirmed the existence of a statistically significant, although weaker, link between trade and output co-movements for a sample of 147 developing countries. On the other hand, Baxter and Kouparitsas (2004) confirmed the robustness of the proposition that overall trade intensity increases business-cycle correlations using Leamers' (1983) extreme-bound approach and a large sample of both developed and developing countries.

Gruben *et. al.* (2002) refined the Frankel-Rose specification. Pointing out that the instruments for trade intensity employed by Frankel and Rose (1998) were inappropriate, due to their possible association with omitted variables, they included gravity variables directly into their regressions. They also decomposed the total trade-intensity variable into inter-industry and intra-industry intensity. Their findings were consistent with the general argument of a positive relation between closer trade links and synchrony of business cycles, but their estimates suggested that the Frankel-Rose coefficients of overall trade intensity were biased upwards. At the same time, Gruben *et. al.* (2002) found no evidence in support of the Krugman (1993) specialization hypothesis, as no significant negative effect of greater inter-industry trade on business-cycle correlations was detected. Inklaar *et.al.* (2005), also arguing against using an instrumental-variable methodology due to bias resulting from the effects of omitted variables, included as explanatory variables in their regressions for 21 OECD countries specialization and

policy integration, in addition to total bilateral trade. Their results suggested a significant association between bilateral-trade intensity and cross-country business-cycle synchrony, although the association was weaker than in Frankel and Rose (1998) as other factors in their model, including policy integration, also had an impact on business-cycle correlations.

Using cyclical industrial-production as well as real-output data as measures of business-cycle fluctuations in OECD during the 1990s, Fidrmuc (2004) extended the Frankel-Rose (1998) specification by incorporating directly as explanatory variables in his regressions both total bilateral trade and intra-industry trade. For all the measures of cyclical fluctuations, the coefficients of the overall bilateral-trade intensity were found close to zero (or with negative signs). By contrast, the intra-industry-trade coefficients were positive and significant in most specifications, thus identifying trade within the same industries, rather than overall bilateral trade, as the key determinant of cross-country convergence of macroeconomic fluctuations. Garnier (2004), on the basis of spectral analysis, reported only a weak effect of intra-industry trade on synchronization, but evidence broadly in line with Fidrmuc (2004) was found by Imbs (2001, 2004). Using simultaneous equation techniques and a dataset containing 18 countries over the period 1983Q1-1998Q3, Imbs (2004) considered as a factor influencing output co-movements an index of similarity in national industrial structures, a variable highly correlated with intra-industry trade. His results implied a strong positive association between this index and output co-movements and only a low effect of overall trade on business-cycle symmetry. The Imbs (2004) findings were not confirmed by the studies of Clark and van Wincoop (2001) and Otto *et.al.* (2001), which, using data from 17 OECD countries and from 14 EU countries plus the US respectively, found evidence broadly in line with that in Frankel and Rose (1998). That is, the effect of overall bilateral trade was revealed to be positive and statistically significant even when controlling for similarity of industrial structures, with the industrial-similarity index in Otto *et al.* (2001) being insignificant in some of their specifications. The results of Imbs (2004) were also not confirmed by Baxter and Kouparitsas (2004) who failed to establish a robust relation (in Leamer's (1983) terms) between sectoral similarity and business-cycle co-movements. Also, Traistaru (2004), in examining business-cycle synchrony between the eurozone and several CEECs, found the bilateral-trade-intensity variable, in addition to the industrial-similarity index, to be always positively and significantly related to cross-country output co-movements.

Several authors have examined the role of monetary- and fiscal-policy coordination, in addition to trade, in cross-country cyclical synchronization. Shin and Wang (2005), in his panel regressions for 14 European countries, could detect no significant effect of fiscal-policy convergence on output co-movements. Also, the impact of monetary-policy convergence was sensitive to the proxy used, with cross-country correlations of M2 growth rates having no effect on synchronization while correlation of short-term interest rates appearing as an important determinant of synchrony of cyclical GDP fluctuations. As far as trade is concerned, the overall trade-intensity coefficients, like in Fidrmurc (2001), were found significant only when intra-industry trade was not included in the regressions. Bergman (2004), based on a sample of industrial-production co-movements in EU-15, Canada, Japan, Norway, Switzerland and the US, found evidence suggesting that fiscal-policy convergence increases cyclical synchrony across national economies but a common monetary policy decreases synchrony. At the same time, bilateral trade intensity was always significant in explaining business-cycle synchronization in Bergman's (2005) specifications, even when fiscal- and monetary-policy co-ordination variables were included in the model.

Conflicting conclusions regarding the effects of monetary- and fiscal-policy similarity are also reported in several other studies. Clark and Van Wincoop (2001) could detect no significant direct effect of policy co-ordination in general on business cycle synchronization, while Camacho *et al.* (2005), based on a sample of OECD countries, found evidence indicating that fiscal but not monetary policy affects cyclical synchronization. By contrast, the estimates of Inklaar *et al.* (2005) suggested that both monetary- and fiscal-policy similarity had a positive and significant effect on cross-country output co-movements.

Babetskii (2005) is to our knowledge the only existing paper that focuses directly on the link between trade and cross-country asymmetries of shocks, rather than asymmetries in cyclical fluctuations of output or industrial production. Using data from seven CEECs plus Spain, Portugal and Ireland for the period 1990Q1-2002Q4 and a structural-VAR methodology, he first identified demand and supply shocks in these economies and then examined how time-varying correlation coefficients of shocks versus Germany (or the EU15) were affected by overall bilateral-trade intensities. His estimates implied a positive effect of total bilateral trade on cross-country symmetry of demand shocks. The impact of more intense bilateral trade on supply-shock symmetry could not be established. Also, the role of intra-industry trade and of policy convergence was not considered. As a result, the different channels through which increased international trade might have affected similarity of different types of shocks in these countries were not explored.

We add to this literature in two ways: we directly examine the association between shock asymmetries and overall bilateral trade intensities, controlling at the same time for intra-industry trade and policy convergence; and we use recent trade data from all the twenty-seven European-Union countries to derive policy implications regarding the success of an expanded EMU.

2.2. Intra-EU trade flows

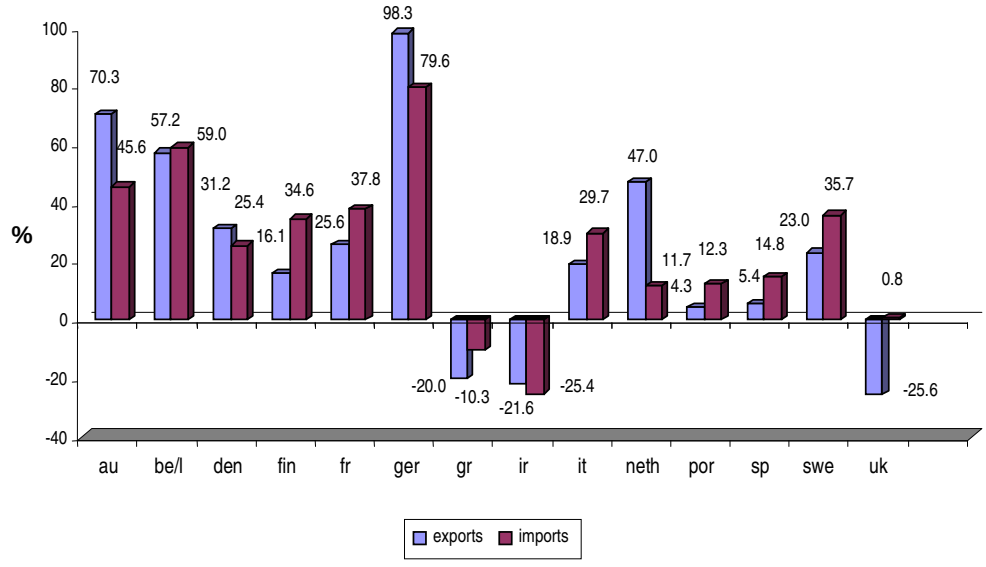
Intra-European trade increased in almost all the EU15 member states since the beginning of the 1990s, following the decision to adopt a common currency, and also since 1995 following the start of the enlargement discussions. Between 1991 and 1995, exports as a percentage of GDP within the EU15 increased by 43% and imports by 39%. Between 1996 and 2007, intra-EU27 exports increased on average for the EU15 countries as a group by 26.1 percent (from 19.9% of GDP to 25.1%) and intra-EU27 imports by 24.0 percent (from 19.2% of GDP to 23.8%). Of the six original EU member states, Germany, Belgium-Luxemburg (taken together) and the Netherlands showed the biggest increase in intra-EU27 exports (98.3%, 57.2% and 47.0% respectively), while France followed with an increase of 25.6% for exports and 37.8% for imports (see Table 1 and Figure 1). As regards the other EU15 states, intra-EU27 exports to GDP increased by 70.3% in Austria, by 31.2% in Denmark, by between 25% and 15% in Sweden, Finland and Italy and by around 5% in Spain and Portugal. The rise in intra-EU27 imports to GDP over the same period amounted to between 50% and 25% in Austria, Finland, Sweden and Italy, and by between 10% and 15% in Spain, Portugal and the Netherlands. Only Greece and Ireland experienced a drop in both intra-EU exports and imports as a percentage of GDP and the UK a drop in intra-EU exports.

Table 1 Intra-EU27 Trade of the EU15 countries (% of GDP)

	Intra-EU exports		Intra-EU imports	
	1996	2007	1996	2007
AU	15.8	26.9	21.5	31.3
BE/L	45.1	70.9	40.0	63.6
DEN	18.6	24.4	17.3	21.7
FIN	17.4	20.2	15.9	21.4
FR	12.1	15.2	12.7	17.5
GER	12.3	24.4	11.3	20.3
GR	5..0	4.0	14.6	13.1
IR	43.5	34.1	31.1	23.2
IT	11.1	13.2	10.1	13.1
NETH	40.0	58.8	28.1	31.4
POR	16.3	17.0	22.8	25.6
SP	11.1	11.7	13.5	15.5
SWE	17.8	21.9	16.8	22.8
UK	12.5	9.3	13.0	13.1
EU15	19.9	25.1	19.2	23.8

Notes: *based on Eurostat data.* AU = Austria, BE/L= Belgium/Luxemburg, DEN = Denmark, FIN = Finland, FR = France, GER = Germany, GR = Greece, IR = Ireland, IT = Italy, NETH = Netherlands, POR = Portugal, SP = Spain, SWE = Sweden, UK = United Kingdom

Figure 1 Intra-EU trade of the EU15 countries (% of GDP), percentage change between 1996 and 2007



***Notes*:** based on Table 1

As far as the NM12 are concerned, their EU trade has increased considerably since 1995, and especially after 1999, following the enlargement process. Between 1995 and 1998 intra-EU27 exports and imports increased in the NM12 as a group by 13% and 8.5% respectively. Between 1999 and 2007, intra-EU27 exports to GDP increased by approximately 80% in the case of Poland, Lithuania and Cyprus, by between 50% and 40% in the case of Slovenia, the Czech Republic, Slovakia and Estonia, and by 29.2% and 21.3% in Hungary and Latvia respectively. Imports from EU27, as a percentage of GDP, increased by around 60% in Lithuania and Cyprus, by around 40% in Slovakia, the

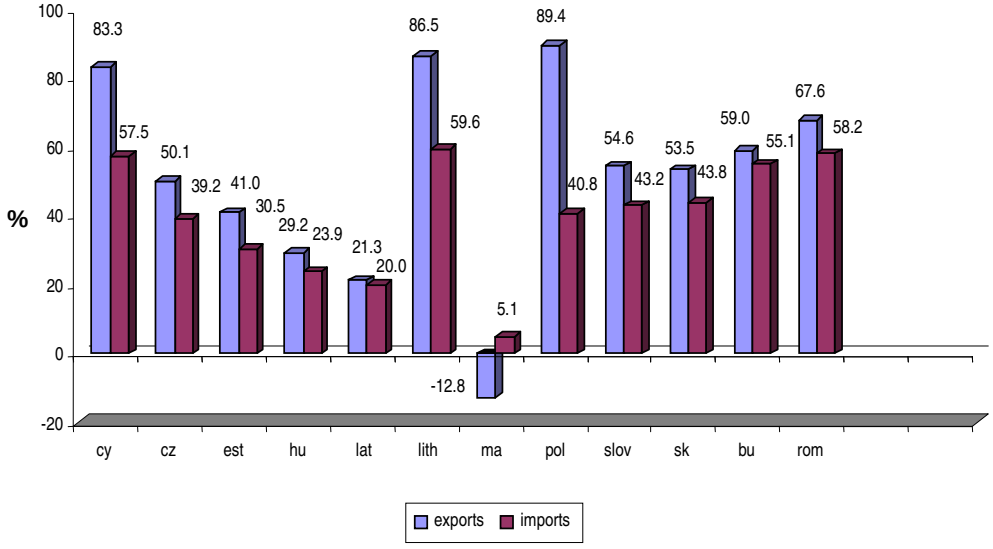
Czech Republic, Slovenia and Poland, by 30.5% and 23.9% respectively in Estonia and Hungary and by 20.0% in Latvia. Only Malta experienced a drop in intra-EU27 exports as a percentage of GDP and a small increase in intra-EU27 imports (see Table 2 and Figure 2). In Bulgaria and Romania exports to the European Union increased from 16.6 and 13.9 percent of GDP respectively in 1999 to 26.4% and 23.3% in 2007. Intra-EU imports in these two countries have also been rising, from 17.6% of GDP in Bulgaria and 18.9% Romania in 1999 to, respectively, 27.3% and 29.9% in 2007.

Table 2 Intra-EU Trade of the New Member States (% of GDP)

	Intra-EU exports		Intra-EU imports	
	1999	2007	1999	2007
CY	3.6	6.6	18.1	28.5
CZ	38.3	57.5	36.2	50.4
EST	36.1	50.9	43.9	57.3
HU	41.8	54.0	40.2	49.8
LAT	18.3	22.2	30.5	36.6
LITH	18.5	34.5	25.5	40.7
MA	24.3	21.2	47.2	49.6
POL	13.2	25.0	19.6	27.6
SLOV	27.1	41.9	35.9	51.4
SK	43.9	67.4	40.9	58.8
BU	16.6	26.4	17.6	27.3
ROM	13.9	23.3	18.9	29.9
NM12	24.6	35.9	31.2	42.3

Notes: *based on Eurostat data.* BU = Bulgaria, CY = Cyprus, CZ= Czech Republic, EST = Estonia, HU = Hungary, LAT = Latvia, LITH = Lithuania, MA = Malta,POL = Poland, ROM = Romania, SLOV = Slovenia, SK = Slovakia

Figure 2 Intra-EU trade of the NM12 (% of GDP), percentage change between 1996 and 2007



Notes: based on Table .2

Intra-EU27 trade is likely to increase further with an expansion of EMU membership. A common currency eliminates the risk of exchange-rate volatility among the participating states and reduces the uncertainty involved in trade transactions within the group. Thus, with the entry of all the NM12 into the EMU, trade across Europe can be expected to rise. Some authors focusing on the impact of exchange-rate volatility on trade suggest that this effect may be small.[6] Others, however, stress that exchange-rate stability is not a substitute for sharing a common currency and that entering a currency union has a substantially stronger effect on trade than eliminating exchange-rate volatility and still using national currencies. This is because a currency union leads to permanently lower transaction costs in trade, greater price transparency, increased competition among firms and a long-term commitment to common objectives and economic policies.[7] Rose (2000), the first paper to investigate empirically the direct impact of currency unions on trade, found, on the basis of a cross-section of 186 countries, that pairs of countries participating in currency unions traded with each other about three times more than countries which retained their national currencies. Glick and Rose (2002) extended Rose's (2000) analysis by examining trade in 217 countries over a period of 50 years, controlling at the same time for a large number of factors that, from gravity models, might influence trade. Their panel estimates suggested a lower, but still large, positive effect of currency unions on trade, ranging between 65% and 100%.[8,9] Using historical data from the gold-standard period (thus having large countries in pairs involved in currency unions in their sample), Estavadeordal *et.al.* (2002) and Lopez-Córdova and Meissner (2002) also found a strong currency-union effect on trade, of about the same magnitude as in Glick and Rose (2002) (that is, between 34% and 72%, and up to 60%, respectively). Indeed, the Rose and Stanley (2005) meta-analysis of the effects of currency unions on trade, has indicated that, although the magnitude of the effect varies considerably across the different studies, combining the estimates produces a statistically significant effect between 30% and 90%. Recently, using post-2000 data and controlling for other standard influences on trade flows, several studies have attempted to estimate the trade effects of EMU.[10] Most of them confirm that the EMU has boosted trade, indicating that the effect is not only statistically significant but also economically noticeable, although smaller compared to that implied from panel studies based on historical data. For instance, euro's short-run effect on trade has been estimated between 4% and 16% in Micco *et al.* (2003), between 9% and 10% in De Nardis and Vicarelli (2004) and about 10% in Faruqeé (2004), while Bun and Klaassen (2002) using a dynamic panel model suggest a longer-run[11] effect of EMU on trade of about 40%.

If currency unions can indeed be expected to boost trade, then knowing whether or not trade integration also accompanies greater symmetry of shocks and business cycles is important. If trade integration does lead to reduced shock asymmetries, the loss for prospective union members of monetary independence will be less costly: by entering the currency union, their trade with the other member states will increase and this increase in trade will in turn facilitate shock convergence and symmetry of business cycles within the group, thus requiring no country-specific adjustment policies. In the case of Europe the issue is crucial. Since the effect of EMU on trade appears significant and economically noticeable, whether or not larger trade flows also reduce shock asymmetries and increase synchronization of business cycles is important for assessing the success or failure of a quick expansion of EMU membership and thus an early adoption of the euro by all the NM12.[12] The issue is also important for the EU15 countries that have not yet joined the eurozone, namely the UK, Sweden and Denmark. In general, even if they do not meet the criterion of shock similarity *ex ante*, they are likely to achieve it *ex post* to the extent that

union membership would increase their trade with the other members and this, in turn, would induce greater synchronization of business cycles.

3. CONVERGENCE OF SHOCKS AND TRADE: METHODOLOGY AND RESULTS

3.1. Identifying structural demand and supply shocks

Fluctuations in real output and prices can be assumed to result from both demand and supply innovations, with the former having a permanent effect only on prices while the latter having a permanent effect on both prices and output. Such demand and supply innovations can be recovered from a 2x2 vector auto-regression (VAR) for each country involving real-GDP growth and GDP-deflator growth by imposing restrictions on the system's estimated coefficients along the lines suggested by Blanchard and Quah (1989).[13] More specifically, current real-output growth (inflation) can be assumed to be influenced by contemporaneous inflation (real output growth) and by past real-output growth rates and inflation rates:

$$\Theta_0 X_t = \Theta_1 X_{t-1} + \Theta_2 X_{t-2} + ... + \Theta_i X_{t-i} + \varepsilon_t \qquad (1.1)$$

$$\text{with} \quad X_t = \begin{bmatrix} \Delta y_t - \Delta\hat{y} \\ \Delta p_t - \Delta\hat{p} \end{bmatrix}, \quad \varepsilon_t = \begin{bmatrix} \varepsilon_{dt} \\ \varepsilon_{st} \end{bmatrix}$$

where ε_d and ε_s are (white-noise) structural demand and supply shocks respectively, Θ_i are 2x2 coefficient matrices, $\Delta(.)$ is the difference operator, y_t (p_t) is (the log of) the current real GDP (GDP deflator), and $\hat{y}$ and $\hat{p}$ represent steady-state values. (1.1) can be taken to represent a Keynesian-type system of aggregate demand and aggregate supply schedules with nominal rigidities, with ε_d and ε_s being innovations relating, respectively, to the demand- and supply-side of the economy. Solving for X_t , (1.1) becomes

$$X_t = A_1 X_{t-1} + A_2 X_{t-2} + ... + A_i X_{t-i} + A_o \varepsilon_t \qquad (1.2)$$

where $A_o = \Theta_o^{-1}$ and $A_i = \Theta_o^{-1}\Theta_i$ for $i = 1,2,\ldots$. From (1.2), through appropriate substitutions, current deviations of real-GDP growth and GDP-deflator growth from initial steady-state values can be explained by the contemporaneous and the lagged effects of the structural demand and supply shocks:

$$X_t = B_0\varepsilon_t + B_1\varepsilon_{t-1} + B_2\varepsilon_{t-2} + B_3\varepsilon_{t-3} + ... = B_0\varepsilon_t + \sum_{i=1}^{\infty} B_i L^i \varepsilon_t \qquad (1.3)$$

where L^i is the lag operator (with $L^i\varepsilon_t = \varepsilon_{t-i}$), $B_o = A_o$ and the B_i's (for $i = 1, 2\ldots$) are 2x2 coefficient matrices representing the lagged effects of shocks on Δy and Δp. Assuming that a demand shock cannot have any long-run impact on real-output growth implies that

$$\beta_{11,o} + \sum_{i=1}^{\infty} \beta_{11,i} = 0 \tag{1.4}$$

where $\beta_{11,o}$ and $\beta_{11,i}$ are elements (1, 1) of the matrices B_o and B_i respectively.

Using ordinary least squares (1.2) can be estimated as a VAR. Having estimated the VAR, the structural demand and supply shocks can then be identified from the residuals. In particular, the estimated VAR can be expressed as:

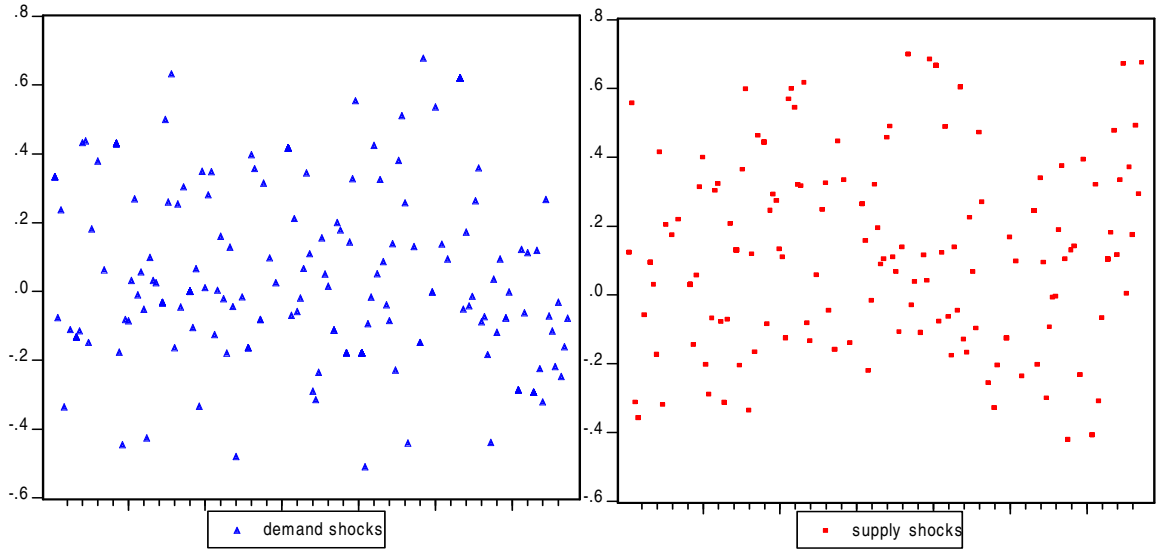
$$\mathrm{X}_t = e_t + C_1 e_{t-1} + C_2 e_{t-2} + C_3 e_{t-3} + \ldots = e_t + \sum_{i=1}^{\infty} C_i L^i e_t \tag{2}$$

where e_t is the vector of residuals and the C_i's (for $i = 1,2$ ..) are 2x2 matrices of estimated coefficients. Given (1.3) and (2), the contemporaneous structural shocks ε_t can be derived from the residuals e_t using the relationship $\varepsilon_t = B_o^{-1} e_t$. To find ε_t, the B_o matrix needs to be computed. This can be achieved by imposing restrictions on its elements. As B_o is a 2x2 matrix, four restrictions are required. The first restriction comes from the proposition that a demand shock can exert no long-run influence on output growth, namely from (1.4). The other three restrictions come from the variance-covariance matrix of the residuals. For this matrix, Ψ, we have $\Psi = \mathrm{E}(e_t e_t') = \mathrm{E}(\mathrm{B}_0\varepsilon_t \cdot (\mathrm{B}_0\varepsilon_t)') = \mathrm{B}_0\mathrm{E}(\varepsilon_t\varepsilon_t')\mathrm{B}_0'$. Two restrictions follow from normalizing the variance of the structural shocks ε_{dt} and ε_{st} to unity, while the third comes from the proposition that, by definition,[14] structural demand and supply shocks in (1.1) are contemporaneously orthogonal. Accordingly, Ψ can be written as $\Psi = \mathrm{B}_0\mathrm{B}_0'$, from which, given $\mathrm{E}(e_t\, e'_t)$ from the estimated VAR, the elements of B_o, and thus ε_{dt} and ε_{st}, can be computed.

A VAR like (1.2) has been estimated, using quarterly real output-growth data (GDP at constant, 1995 prices) and inflation data (GDP-deflator, 1995=100), for each of the EU27 countries and for the eurozone as a whole. The data (seasonally unadjusted, except for Greece and Portugal) are from Eurostat covering the period 1995Q1-2005Q4, except for Ireland, Malta, Lithuania and Romania for which appropriate quarterly real-GDP series are available only from 1999Q1 onwards[15] (see Table A.5). The Akaike and Schwarz criteria for lag structure suggested the inclusion of 3 to 4 lags for most countries, and for all the estimated VARs the eigenvalues of the system's estimated matrix were inside the unit circle thus ensuring stability. The impulse-response functions also suggested consistency of the estimated VARs with the underlying economic model, i.e. in all the estimated VARs, except for Denmark, the accumulated response to a positive demand shock and a positive supply shock was, respectively, an increase and a decrease in inflation (see Figure A.1).[16,17] Short-run responses to the identified structural shocks, except for Denmark[18], were also in accordance with economic theory (i.e. a positive demand shock would increase both inflation and output-growth in the short run while a

positive supply shock would reduce inflation and increase output growth). Table A.1 shows summary statistics for the identified structural shocks, indicating that they tend to be equally distributed[19] between positive and negative values. On the basis of the identified structural shocks, shock-correlation coefficients for each of the EU27 countries versus Germany, France and the eurozone have then been computed for two sub-sample periods of equal length, namely 1996q1-2000q4 and 2001q1-2005q4. Pooling the two sub-sample periods yields the plot of shock-correlation coefficients shown in Figure 3, while summary statistics are reported in Table A.2.

Figure 3 Correlations of structural shocks, pooled EU27 sample



3.2. Trade intensity and intra-industry trade

Trade intensity between trading partners *i* and *j* can be measured in terms of bilateral trade turnover (exports plus imports) scaled by total trade or nominal GDP:

$$TRADE1_{ij,\tau} = \left[\frac{X_{ij} + M_{ij}}{X_i + M_i + X_j + M_j} \right]_\tau , \qquad TRADE2_{ij,\tau} = \left[\frac{X_{ij} + M_{ij}}{Y_i + Y_j} \right]_\tau \tag{3}$$

where X_i and M_i ((X_j , M_j) refer to total exports and imports of partner *i* (partner $_j$) and Y_i (Y_j) to nominal GDP, while X_{ii} (M_{ij}) are the bilateral exports (imports) of *i* and *j*. Thus, a higher value for $TRADE1_{ij,\tau}$ or $TRADE2_{ij,\tau}$ would indicate greater trade intensity between trading partners *i* and *j*. (3) has been computed from quarterly data from Eurostat (see Table A.5), with τ referring to the period-average under consideration.[20, 21]

An index of intra-industry trade ($INTRA_{ij,\tau}$) is constructed along the lines suggested by Grubel and Lloyd (1975):

$$INTRA_{ij,\tau} = 1 - \omega_{ij,\tau}, \quad \text{with } \omega_{ij,\tau} = \left[\frac{\sum_{k} \left| X_{ij} - M_{ij} \right|}{\sum_{k} (X_{ij} + M_{ij})} \right]_{\tau} \tag{4}$$

where κ is the number of industrial branches. (4) has been computed using industry-disaggregated quarterly data at the SITC-2 level from Eurostat, with the disaggregation involving 70 industries.[22] Larger intra-industry trade flows would reduce the numerator in $\omega_{ij,\tau}$, so $INTRA_{ij,\tau}$ would increase as more intra-industry trade takes place. Summary statistics for *TRADE* and *INTRA* are shown in Table A.2.[23]

3.3. The association between trade and shock symmetry

In the light of the existing literature, we can consider two conflicting propositions regarding the association between trade flows and symmetry of shocks. The first follows from the specialization hypothesis of, for example, Krugman (1993) and Kalemli-Ozcan *et.al.* (2001): closer trade links will facilitate increased specialization in production. In such a case, asymmetries of supply-side shocks across national economies can be expected to rise as trade integration progresses. The second hypothesis follows from the argument about international spill-over effects and from the new theory of international trade (see, for instance, Frankel and Rose (1998), Coe and Helpman (2001) and Ambler *et al.* (2002)). Trade between national economies increases the diffusion of knowledge and technology and therefore can be expected to result in a more rapid transmission of aggregate productivity shocks. Trade is also a major channel through which aggregate spending and income shocks are spread internationally. Thus, as overall bilateral-trade intensities increase, these spill-overs increase, something implying that similarity of both supply and demand shocks can be expected to rise. At the same time, trade among several economies appears to be increasingly taking place within the same industries. In such cases, increased overall trade will also imply more intense intra-industry trade. More intense intra-industry trade will in turn lead to less export specialization and greater similarity of industrial structures across national economies and thus more comparable supply-side shocks, through intra-industry spending transfers and industry-specific technological spill-overs.

These propositions have testable implications. On the basis of our sample, if international spill-overs are dominant and the argument about intra-industry trade is correct, overall bilateral-trade intensities should be positively and significantly related to cross-country correlations of both demand and supply shocks: to demand shocks through aggregate spending and income spill-overs, and to supply-side shocks through aggregate productivity spill-overs and through similarity of industrial branches. If, on the other hand, specialization dominates, increased overall bilateral trade should be negatively associated with cross-country correlations of supply-side shocks but may still have a positive impact on correlations of demand shocks through income and spending spill-overs. At the same time, when introduced together with total bilateral trade, more intense intra-industry trade, while being positively linked to supply-shock correlations due to cross-country similarity of industrial branches, it can be expected to be negatively related to correlations of aggregate demand shocks to the extent that it would imply relatively large industry-specific transfers rather than large aggregate spending spill-overs.

3.4. Regression results: trade flows and similarity of shocks

As we pool two sub-sample periods, time-varying characteristics, other than those reflected in the variables $TRADE_{ij,\tau}$ and $INTRA_{ij,\tau}$ may have had an impact on shock correlations. In the case of the countries in our sample, an important time-varying characteristic is monetary- and fiscal-policy similarity across Europe, which increased as the date for the replacement of national currencies by the euro was approaching. To account for this, we consider as an additional explanatory variable a dummy (*EURO*) that takes the value 1 for all observations in the period 1996Q1-2000Q4, when all the EU27 member states still had their national currencies, and the value 0 in the 2001Q1-2005Q4 period, which was characterized by the free circulation of the euro across the whole of Europe (even along national currencies in countries like the UK, Denmark and Sweden, which did not participate in the eurozone). Alternatively, the discrepancy of short-term interest rates between trading partners *i* and *j* ($RATES_{ij,\tau} = |r_i - r_j|_\tau$) and the correlation of their budget deficits ($BUDGET_{ij,\tau}$) are used respectively as proxies for monetary- and fiscal-policy convergence/divergence. Including directly into the regressions policy-convergence variables, which themselves may have influenced shock symmetry independently of trade flows, also controls for potential simultaneity between trade and shocks (due to both being affected by policy).[24] The data for *RATES* and *BUDGET* are from Eurostat, *Government Statistics* and *Interest Rates* respectively (summary statistics are shown in Table A.2). Short-term interest rates refer to six-month money-market rates, while the budget data refer to annual deficits as percentage of GDP. To account for any likely effect on shock symmetry of economic size, the (log) of GDP discrepancy between trading partners ($DINC_{ij,\tau} = \log|Y_i - Y_j|_\tau$) has also be considered as explanatory variable. As much of the international economics literature suggests (see, e.g., Fidrmuc (2004)), larger economies may have a stronger influence on the shocks facing smaller economies, in which case *DINC* will enter the regressions with a positive sign. *DINC* has been computed using annual per capita GDP data at PPS (purchasing power standards, 1995) from Eurostat, *National Accounts.*

TABLE 3.1, TABLE 3.2

Regression results for the EU27 from pooling the two sub-sample periods, 1996q1-2000q4 and 2001q1-2005q4, are summarized in Tables 3.1 to 3.3. The estimates suggest that there are important links between trade flows and cross-country symmetry of shocks, although the nature of the linkages differs depending on the source of the disturbances. In columns (a) and (f) of Tables 3.1 and 3.2 there is evidence of a strong positive association between greater overall bilateral trade and symmetry of demand as well as supply shocks. The estimated coefficients of both measures of bilateral trade intensity in (3) have a positive sign, are highly significant (1%) and large in magnitude.[25] Nevertheless, from this, one cannot identify the channels through which more intense trade ties influence shock correlations. Thus, in all the other columns of Tables 3.1 and 3.2, overall bilateral trade intensity and intra-industry trade are introduced separately as explanatory variables. With both *TRADE* and *INTRA* included in the regressions, the *TRADE* variable can be taken to capture the effects of inter-industry, and thus specialized, trade.

In the case of demand-shock convergence, controlling for intra-industry trade has little impact on the estimated overall-bilateral-trade-intensity coefficients. In columns (b) and (g) of Table 3.1, these coefficients

remain positive, highly significant, and large in magnitude. By contrast, the coefficients of the intra-industry-trade variable have a negative sign, suggesting that more intense intra-industry trade does not by itself imply greater cross-country symmetry of demand shocks. On the other hand, in columns (b) and (g) of Table 3.2, the intra-industry-trade index enters with a positive sign and is highly significant independently of how overall trade intensity is defined. The estimated coefficients of the overall bilateral-trade-intensity variable, although they drop relative to columns (a) and (f), remain positive and significant (at 10 or 5 percent) for both measures of (3). These results are robust with respect to changes in the specification of the regressions by including other variables. Controlling for the circulation of the euro and for fiscal-policy convergence and interest-rate differences does not affect the direction of the trade effects, while at the same time increases the significance of the estimated trade coefficients and the goodness-of-fit of the regressions. Thus, for the case of demand shocks, in columns (c) to (e) and (h) to (j) of Table 3.1 the bilateral-trade-intensity coefficients are still highly significant (1%) regardless of the inclusion of *EURO, BUDGET* or *RATES,* while the coefficients of intra-industry-trade are all negative and significant at 5 or 10 percent. For the supply-shock correlations in columns (c) to (e) and (h) to (j) of Table 3.2, the coefficients of intra-industry trade are positive and highly significant (1%) in all specifications. The estimated coefficients of overall-bilateral-trade intensity are also positive and significant (at 5% or 10%), independently of the different measures of (3).

Our results thus suggest that international spill-overs, rather than specialization, dominate in the process through which more intense inter-industry trade affects symmetry of supply-side shocks across the enlarged European Union. From this point of view, they provide evidence in support of a Coe-Helpman (2001) and Frankel-Rose (1998) type of effect, rather than a Krugman-type (1993) effect, of trade on convergence of business cycles. In particular, the fact that the overall trade-intensity variable is positively and significantly linked to both the supply-shock and the demand-shock correlations even when intra-industry trade is included in the regressions, suggests that specialized trade (inter-industry trade) has on balance correlation-increasing effects through international spill-overs. At a more general level, the results in Tables 3.1 and 3.2 provide an explanation for the mixed evidence in the empirical literature regarding the association between cross-country cyclical co-movements of output on the one hand, and overall bilateral trade and intra-industry trade, on the other. They suggest that more intense overall bilateral trade would tend to be positively and strongly associated with correlations of output growth or industrial-production growth when the driving force of business cycles is a demand innovation. The association, while still positive, would be weaker if the main cause of business cycles is a supply-side innovation. At the same time, intra-industry trade would tend to be positively and strongly associated with tighter cross-country output co-movements when cycles are mainly the result of supply-side shocks. It would have little impact on synchronization of output fluctuations, and could even lead to less synchronization, when cycles are caused primarily by demand innovations.

On the other hand, the estimates in Tables 3.1 and 3.2 suggest that policy convergence, in addition to trade, has also been responsible for determining the degree of shock symmetry in Europe. *EURO* is highly significant (1%) in all the regressions of supply-shock convergence in Table 3.2 and is also significant at 5% or 10% in the demand-shock correlations in Table 3.1 for all the specifications. The direction of the effect depends on the type of the shock, with the estimates suggesting that the circulation of the euro has caused supply shocks to become more

correlated but has led to greater asymmetries of demand shocks. One explanation could be that, ceteris paribus, with a common currency, product-price differences across national economies tend to become more apparent, leading in the short run to shifts in relative demand schedules, which in turn appear as asymmetric demand shocks. Another explanation is that for counties sharing a common currency, the direct effect of monetary-policy convergence on demand-shock symmetry may be negative to the extent that these countries loose their ability to respond to idiosyncratic demand shocks, with only the indirect effect through trade being positive (that is, a common currency increases trade and this increase in trade induces shock convergence). As far as fiscal policy is concerned, in columns (d),(e) and (i), (j) of Table 3.1 the estimated coefficients of *BUDGET* are all positive and significant, even when controlling for the euro effect, suggesting that the process of fiscal-policy convergence has reduced asymmetries of demand shocks across the EU27 member states. Fiscal-policy convergence, however, does not appear to have had any favourable impact on symmetry of supply-side shocks, and in columns (d),(e) and (i),(j) of Table 3.2 *BUDGET* has a negative and significant sign. The *RATES* variable enters in the regressions in Table 3.2 (columns (e) and (j)) with a minus sign, implying that interest-rate convergence (reduced discrepancies of interest rates) has had a positive effect on cross-country symmetry of supply shocks across the EU, something also consistent with the impact of *EURO*. But the effect is weak and insignificant. In the case of the demand shocks, *RATES* appears to have virtually no impact on demand-shock symmetry (columns (e) and (j) of Table 3.1). Indeed, in the context of the pooled EU27 sample considered in Tables 3.1 and 3.2, the *RATES* effect can be expected to be weak as large fluctuations in short-term interest rates had occurred in several NM12 during the 1995-2005 period and the *RATES* variable for this sample shows a large variance (see Table A.2). Allowing for economic size (per capita GDP differences) also does not change much the results regarding the role of trade flows, with the estimated effects being similar for the two measures of the overall bilateral-trade intensity variable in (3) (see Table 3.3). At the same time, the coefficients of *DINC* have wrong (negative) signs, and, except for columns (ii) and (iv) for the case of supply shocks, controlling for per-capita GDP differences does not improve the adjusted-R^2 of the regressions either. Thus, income differences *per se* are revealed to play no direct role as a shock-transmission mechanism in the enlarged European Union.[26]

TABLE 3.3

To further assess the robustness of our results, in Tables 4.1 and 5.1 we restrict our pooled sample to the EU15 group, while in Tables 4.2 and 5.2 we consider all the EU27 for the second sub-sample period 2001q1-2005q4 (summary statistics for these two samples are shown in Tables A.3 and A.4 respectively[27]). Focusing only on the second sub-sample period allows for potential bias in the results arising from the fact that trade data for the NM12 in the early years of the 1995q1-2005q4 period might not have been sufficiently reliable and also from the fact that in some of them structural changes might still have been taking place. On the other hand, considering only the EU15 allows for examining possible differences in behaviour between the two groups. However, the results concerning the effects of trade are not very different qualitatively from those in Tables 3.1 and 3.2: there are no large differences between the estimates across the three samples, except for the interest-rate effect and the larger goodness of fit of most of the regressions in the pooled EU15 sample. In particular, in Tables 4.1 and 4.2, in the regressions for demand-shock convergence, the overall bilateral-trade intensity coefficients are always positive and highly significant across the two samples in all the specifications, even when controlling for policy

convergence, while the coefficients of the intra-industry-trade variable are negative and significant (columns (b), (d) and (f), (h)) or relatively small in absolute value and insignificant (columns (a),(c) and (e),(g)). In the regressions for supply-shock convergence in Tables 5.1 and 5.2, again the coefficients of both measures of trade (overall and intra-industry) have the expected positive signs, with the intra-industry variable being more significant than the overall bilateral-trade variable. In the EU15 sample the coefficients of overall bilateral-trade intensity in the demand-shock regressions drop a bit relative to Table 3.1, but the effect remains significant for all the specifications. On the other hand, the estimated coefficients of both overall bilateral-trade intensity and intra-industry trade in the supply-shock regressions are in general larger for the second half of the sample period (see columns (e) to (h) in Table 5.2 relative to columns (b),(e) and (g),(j) in Table 3.2)). This is an indication that the role of trade in supply-shock symmetry across Europe has increased in recent years. At the same time, Table 5.1 reveals a strong positive relationship between symmetry of supply-side shocks across the EU15 and the circulation of the euro and Table 4.1 a strong positive relationship between demand-shock symmetry and fiscal-policy convergence. Across all three samples considered, fiscal-policy similarity does not appear to have exerted any positive effect on symmetry of supply shocks. By contrast, interest-rate convergence is revealed to have had a favourable impact on symmetry of both supply and demand shocks for the group of the EU15 member states: the coefficients of *RATES* are negative and statistically significant in Tables 4.1 and 5.1, indicating that interest-rate similarity has induced more symmetry of shocks in general among the EU15.

TABLE 4, TABLE 5

4. CONCLUSIONS

As a successful expansion of EMU membership requires a sufficient degree of business cycle synchronization across the EU27, a pressing matter for European policymakers today is the extent to which synchronization of macroeconomic fluctuations across the twenty-seven member states is likely to increase in the near future. Since an expanded EMU is most likely to boost further intra-European trade, if trade integration is to facilitate convergence of business-cycles, the cost for the new member states (or the three non-eurozone EU15 countries) from loosing monetary independence will be relatively small. Thus, assessing the role of trade in cross-country synchronization of business-cycles across the EU27 has important implications for the success or failure of an expanded EMU.

In the international economics literature there is an ongoing debate regarding the effect of increased trade on business-cycle synchrony. Some authors argue that larger trade flows are likely to be accompanied by greater specialization in production according to comparative advantage, thus leading to less synchronized macroeconomic fluctuations across national economies. Others, however, stress that as trade integration progresses, output co-movements across countries will become more synchronized through productivity and spending spill-overs and through intra-industry trade. The existing empirical evidence is mixed, with some studies indicating a large positive effect of more intense trade ties on business-cycle synchrony while others suggest a weak association between trade flows and synchronization. Whether overall bilateral-trade intensity or intra-industry trade is the major channel through which national business cycles become synchronized is another point

of disagreement in the literature. Opinions also diverge in the literature regarding the influence on synchronization of policy convergence.

Our results suggest that assessing the role of trade in business-cycle synchronization by simply looking at its impact on cross-country cyclical co-movements of output can be misleading because the cause of fluctuations in output is not taken into account. Using trade data from the EU27 countries and identifying structural demand and supply shocks in these economies over the period 1995Q1-2005Q4 employing the Blanchard-Quah (1989) structural VAR methodology, we have found evidence suggesting that trade flows strongly influence the international transmission of business cycles but the way in which this occurs depends on the source of the shocks. Thus, as intra-industry trade becomes more dominant, synchrony of business cycles across the enlarged European Union would tend to increase if the main reason for them is a supply-side innovation. If the driving force of cycles is a demand innovation, the effect could be just the opposite, with business-cycle fluctuations across Europe becoming less correlated. On the other hand, increased overall trade, and thus higher bilateral-trade intensities, is found to have, on balance, correlation-increasing effects through international spill-overs, via productivity and income channels. Our results therefore provide evidence in support of a Frankel-Rose (1998) type of effect, rather than a Krugman-type (1993) specialization effect, regarding the association between trade and cross-country business cycle co-movements. This implies that a quick entry of all the new member states into the EMU may not be so costly in terms of a loss of monetary autonomy. Our results also suggest that the circulation of the euro has been associated with a fall in supply-shock asymmetries in Europe but has had no direct favourable impact on demand-shock symmetry. By contrast, the process of fiscal-policy convergence appears to have led to more symmetric demand shocks across the EU27 member states. Interest-rate convergence is revealed to have induced more symmetry of both demand and supply shocks across the EU15 group.

FOOTNOTES

1. Some NM12 expressed their desire to join the EMU soon after the signing of the Accession Treaty. Slovenia joined the EMU in January 2007 and Cyprus and Malta became formal EMU members at the beginning of this year. A preliminary timetable for EMU entry has also been set for several other NM12.

2. See De Grauwe and Mongelli (2005) for a recent discussion of the OCA theory.

3. See Rose and Engel (2002), Micco *et al.* (2003), Rose and Stanley (2005) and Baldwin (2005) for a survey of this literature.

4. Some other studies also find weak evidence that larger trade flows increase the synchrony of business cycles, see, for example, Kose *et.al.* (2003) and Canova and Dellas (1993).

5. Comparable quarterly real-GDP series for the EU15 are available only from 1991q1 onwards, while consistent bilateral trade data for all the EU27 are not available prior to 1995q1.

6. See Klaassen (2004) for a survey of the literature on the effects of exchange-rate volatility on trade.

7. For a discussion see De Grauwe and Mongelli (2005) and Rose and Engel (2002).

8. Rose's (2000) large estimate of the trade effect of currency unions was severely criticised. Many authors questioned the appropriateness of making generalizations from estimates derived from broad-based cross-section studies like Rose (2000) because historically pairs of countries participating in currency unions either had strong political ties or were small and poor. Controlling for political ties in the Rose (2000)

dataset, Melitz (2001) found a lower trade effect, amounting to about 200%. Also, Persson (2001) pointed to bias resulting from non-linear effects of some of the Rose (2000) explanatory variables and from the fact that the pairs of countries involved in currency unions in his sample were non-random. Using non-parametric methods, instead of standard regression techniques, he found a smaller effect of currency unions on trade, between 13% and 65%. Other authors pointed to the possibility of bias due to endogeneities and reverse causality. Accounting for potential endogeneity due to omitted variables, by explicitly allowing for the decision to participate in a currency union, Tenreyro (2001) estimated the currency-union effect on trade at 50%. However, Tenreyro and Barro (2003), using an instrumental-variable approach, found an effect larger than that in Glick and Rose (2002).

9. Some other authors proposed a time-series approach to the trade effects of currency unions, rather than a cross-sectional approach, stressing the importance of exploiting additional information based on individual-country experience. Thom and Walsh (2002), for example, focused on the influence on the Irish trade of the break between sterling and the Irish pound in 1979 (when Ireland joined the European Monetary System). Their results suggested no significantly negative effect of such change in exchange-rate regime on the Anglo-Irish trade.

10. Much of this literature tests for the significance of coefficients on dummy variables from January 2000 onwards for the eurozone countries. See Baldwin and Di Nino (2006) for a different approach, concentrating on the effects of the euro on trade in new products.

11. De Nardis and Vicarelli (2004) also suggest a larger longer-term effect of EMU on trade, of about 19%. Indeed, some authors argue that the smaller trade-effect of EMU compared to that implied from panel studies may be due to the fact that the EMU is a relatively new phenomenon and thus its full impact across Europe has yet to be seen. Others, however, point out that monetary integration in Europe has a long history and thus part of its effect has already worked through in the member states. Persson (2001) and Thom and Walsh (2002), for example, expressed doubts as to whether the EMU would have any significant trade effect. Nitsch and Berger (2005) have also questioned the argument that, by itself, the euro has increased trade, suggesting that any trade effect will soon fade away.

12. Indeed, in the last few years, several authors have argued in favour of a "euroization", namely the adoption by all the new EU member states of the euro as legal tender even before their official entry into the eurozone (see, for example, Buiter and Grafe (2002) and Von Hagen and Traistaru (2006)).

13. The structural-VAR methodology has several limitations. It assumes structural stability regarding the association between the variables under consideration, and it requires estimating many coefficients which is problematic in cases of relatively short samples. Also, in a structural-VAR model no distinction can be made between domestic and foreign shocks. Nevertheless, this methodology has been very popular in the international economics literature in recent years and has been employed by a number of studies to identify demand and supply shocks across regions or countries. See, for example, Frenkel and Nickel (2005), Korhonen (2003) and Fidrmuc and Korhonen (2003, 2006).

14. The assumption that the structural shocks ε_d and ε_s are contemporaneously orthogonal is the standard approach suggested by Blanchard and Quah (1988) and employed by many other authors. See the references in footnote 13.

15. For some other NM12 the estimation period was also slightly shorter (see Table A.5).

16. This pattern of long-run inflation response (the so-called 'over-identifying restriction') is not imposed on the empirical model and its presence is an indication that the estimated VAR is consistent with an aggregate demand and supply framework, in the context of which positive demand shocks are expected to raise prices in the long run while positive supply shocks are expected to lower prices. See, for example, Fidrmuc and Korhonen (2003) and Frenkel and Nickel (2005).

17. An ADF test was performed for real GDP and GDP deflator. The hypothesis of a unit root could be rejected for the real-GDP growth and inflation series.

18. In the case of Denmark, the impulse response function showed a perverse long-run and short-run response of inflation to a supply shock and a perverse short-run response of output growth to a demand shock, and, in the light of this, this country was excluded from the subsequent regressions on shock convergence.

19. Exceptions are the Netherlands, Sweden, Poland and Romania for the case of demand shocks. For the Netherlands, the Jarque-Bera statistic also indicates deviations from normality for supply shocks.

20. In the regressions in Tables 3-5, τ corresponds to the respective shock-correlation period with a four-quarter lead to ensure a causative effect.

21. A major problem in studies examining the impact on output co-movements of trade flows is the possibility of simultaneity and reverse causality between business-cycle correlations and bilateral trade. To deal with this problem, most authors make use of instrumental variable estimation. However, this approach is not an adequate solution because the variables which, from gravity models, are commonly used as instruments for trade intensity (e.g. distance between the capitals of the trading partners, geographical adjacency and use of a common language) may also be reflecting the effects of other omitted variables, such as labour mobility and similarity of economic objectives, in which case the estimates will be seriously biased (see, for example, Grubel *et al.* (2002) and Inklaar *et.al.* (2005)). For this reason, and also to account for factors affecting business-cycle synchrony that are difficult to measure, some authors, including Grubel *et. al.* (2002), include gravity variables directly into their regressions. For the same reason, other authors, including Inklaar *et.al.*(2005), Bergman (2004) and Otto *et.al.* (2001), include policy variables, in addition to trade, in their regressions. Reverse causality is not a problem in this paper to the extent that the upward trend of intra-EU trade that has been observed in recent years cannot be attributed to shocks (Babetskii (2005) also makes the assumption that trade is exogenous to shocks). At the same time, the specifications in Tables 3-5 control for potential simultaneity in so far as policy-convergence variables, which may themselves have affected symmetry of shocks independently of trade flows, are included directly in the regressions. For the same reason, in all the regressions, the period average for the explanatory variables, except *EURO,* has been computed with a four-quarter lead over the corresponding shock-correlation period.

22. A very detailed disaggregation (such as SITC-3) might not be appropriate since with the rise in the level of industry de-composition the share of intra-industry trade falls and the index eventually approaches zero. A very low level of disaggregation (e.g. SITC-1, which involves only 9 sectors) might also be inappropriate since it could give a misleading picture regarding the extent of intra-industry trade.

23. Comparable quarterly intra-industry-trade data at the SITC-2 level of disaggregation are not available prior to 1999q1 for the NM12. Thus, in the case of the NM12, (4) for the first sub-sample period is computed using data for 1999q1-2000q4.

24. See footnote 21.

25. The coefficients of overall bilateral-trade intensity are larger when GDP is used as the scaling variable. However, elasticities are not very different for the two measures of (3) as for all countries *TRADE2* is smaller than *TRADE1* (see Table A.2).

26. In the case of the demand-shock correlations in Table 3.3, introducing GDP differences also renders *INTRA* insignificant. This is because in the context of the pooled EU27 sample, trading partners showing small income differences are also the ones that show relatively high levels of bilateral intra-industry trade.

27. The summary statistics for *TRADE1*, *TRADE2* and *INTRA* in Table A.4 are not directly comparable with those in Table A.2 because of the different country-coverage in the first and second sub-sample period.

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TABLE 3.1 Symmetry of demand shocks, trade flows and policy convergence, pooled sample EU27

Dependent variable: correlations of demand shocks										
Explanatory variables	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**
TRADE1	3.598***	3.774***	3.832***	3.457***	3.223***					
	(0.649)	(0.746)	(0.759)	(0.867)	(0.925)					
TRADE2						6.723***	7.003***	7.317***	6.645***	5.982***
						(1.285)	(1.465)	(1.441)	(1.624)	(1.768)
INTRA		-0.059	-0.112**	-0.144**	-0.096*		-0.055	-0.118**	-0.152***	-0.094*
		(0.048)	(0.051)	(0.051)	(0.058)		(0.048)	(0.051)	(0.051)	(0.057)
EURO			0.069*	0.066*				0.079**	0.075**	
			(0.037)	(0.037)				(0.037)	(0.037)	
BUDGET				0.063**	0.079**				0.064*	0.082**
				(0.033)	(0.036)				(0.033)	(0.036)
RATES					0.0005					0.0005
					(0.004)					(0.004)
No. of observations [a,b]	135	135	135	129 [c]	126 [d]	135	135	135	129 [c]	126 [d]
R-squared (adj)	0.144	0.142	0.157	0.178	0.159	0.141	0.139	0.160	0.182	0.158

Notes: OLS estimation; ***, ** and * indicate significance at 1%, 5% and 10% level respectively (White-heteroskedasticity-robust standard errors in parenthesis); [a]Ireland, Malta, Lithuania and Romania only for 2001q1-2005q4 and Denmark excluded; [b]trade data for Luxemburg not available for the first sub-sample period; [c]Slovakia excluded (frequent revisions in budget-deficit series); [d]comparable interest-rate data for Luxemburg not available

TABLE 3.2 Symmetry of supply shocks, trade flows and policy convergence, pooled sample EU27

Dependent variable: correlations of supply shocks										
Explanatory variables	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**
TRADE1	2.515***	1.688*	1.586*	2.066**	2.310**					
	(0.792)	(0.941)	(0.901)	(0.949)	(1.045)					
TRADE2						4.993***	3.529**	3.061*	3.900**	4.643**
						(1.458)	(1.730)	(1.700)	(1.785)	(1.896)
INTRA		0.159***	0.251***	0.281***	0.220***		0.152***	0.247***	0.278***	0.213***
		(0.058)	(0.070)	(0.074)	(0.78)		(0.058)	(0.071)	(0.075)	(0.078)
EURO			-0.121***	-0.117***				-0.117***	-0.112***	
			(0.041)	(0.044)				(0.042)	(0.044)	
BUDGET				-0.070*	-0.103***				-0.069*	-0.102***
				(0.041)	(0.041)				(0.041)	(0.041)
RATES					-0.004					-0.004
					(0.004)					(0.004)
No. of observations [a,b]	135	135	135	129[c]	126 [d]	135	135	135	129 [c]	126[d]
R-squared (adj)	0.054	0.068	0.115	0.138	0.106	0.060	0.073	0.115	0.138	0.110

Notes: OLS estimation; ***, ** and * indicate significance at 1%, 5% and 10% level respectively (White-heteroskedasticity-robust standard errors in parenthesis); [a]Ireland, Malta, Lithuania and Romania only for 2001q1-2005q4 and Denmark excluded; [b]trade data for Luxemburg not available for the first sub-sample period; [c]Slovakia excluded (frequent revisions in budget-deficit series) ; [d]comparable interest-rate data for Luxemburg not available

TABLE 3.3 Symmetry of structural shocks and income differences, pooled sample EU27

	Dependent variable: Correlations of demand shocks				Dependent variable: Correlations of supply shocks			
Explanatory variables	(i)	(ii)	(iii)	(iv)	(i)	(ii)	(iii)	(iv)
TRADE1	3.453***	3.361***			1.847*	1.834*		
	(0.875)	(0.898)			(1.058)	(1.121)		
TRADE2			6.054***	5.976***			3.477*	3.804*
			(1.778)	(1.774)			(1.952)	(2.026)
INTRA	-0.136	-0.088	-0.109	-0.094	0.309***	0.299***	0.309***	0.288***
	(0.097)	(0.109)	(0.071)	(0.072)	(0.095)	(0.095)	(0.095)	(0.094)
EURO	0.066*		0.085**		-0.110**		-0.105*	
	(0.037)		(0.41)		(0.048)		(0.049)	
BUDGET	0.064*	0.078**	0.061*	0.082**	-0.080*	-0.134***	-0.081*	-0.133***
	(0.034)	(0.036)	(0.030)	(0.042)	(0.049)	(0.046)	(0.049)	(0.046)
RATES		0.0006		0.0005		-0.0003		-0.0002
		(0.004)		(0.004)		(0.005)		(0.005)
DINCD	-0.006	-0.013	-0.020	-0.0006	-0.026	-0.090	-0.029	-0.087
	(0.060)	(0.064)	(0.044)	(0.045)	(0.059)	(0.065)	(0.058)	(0.065)
No. of observations[a,b]	129[c]	126[c,d]	129[c]	126[c,d]	129[c]	126[c,d]	129[c]	126[c,d]
R-squared (adj)	0.171	0.153	0.179	0.151	0.132	0.111	0.133	0.114

Notes: : OLS estimation; ***, ** and * indicate significance at 1%, 5% and 10% level respectively (White-heteroskedasticity-robust standard errors in parenthesis); [a]Ireland, Malta, Lithuania and Romania only for 2001q1-2005q4 and Denmark excluded; [b]trade data for Luxemburg not available for the first sub-sample period; [c]Slovakia excluded (frequent revisions in budget-deficit series); [d]comparable interest-rate data for Luxemburg not available

Table 4 Symmetry of demand shocks, trade flows and policy convergence

Dependent variable: correlations of demand shocks

	4.1 pooled EU15 sample				4.2 EU27 sample, 2001q1-2005q4			
Explanatory variables	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
TRADE1	2.735**	2.344**			3.410***	2.932***		
	(1.129)	(1.079)			(1.207)	(1.392)		
TRADE2			5.505***	4.299**			6.078***	5.241**
			(2.051)	(1.998)			(2.167)	(2.481)
INTRA	-0.062	-0.190*	-0.080	-0.187*	-0.085	-0.121*	-0.084	-0.120*
	(0.086)	(0.101)	(0.086)	(0.097)	(0.058)	(0.070)	(0.057)	(0.068)
EURO	0.126**		0.140**					
	(0.060)		(0.059)					
BUDGET		0.286***		0.288***		0.086*		0.086*
		(0.067)		(0.067)		(0.047)		(0.047)
RATES		-0.042***		-0.041***		0.003		0.003
		(0.010)		(0.010)		(0.003)		(0.003)
No. of observations [a,b]	72	69[d]	72	69[d]	75	69[c,d]	75	69[c,d]
R-squared (adj)	0.121	0.243	0.132	0.242	0.108	0.138	0.110	0.140

Notes: : OLS estimation; ***, ** and * indicate significance at 1%, 5% and 10% level respectively (White-heteroskedasticity-robust standard errors in parenthesis); [a]Ireland, Malta, Lithuania and Romania only for 2001q1-2005q4 and Denmark excluded; [b]trade data for Luxemburg not available for the first sub-sample period; [c]Slovakia excluded (frequent revisions in budget-deficit series); [d]comparable interest-rate data for Luxemburg not available

TABLE 5 Symmetry of supply shocks, trade flows and policy convergence

Dependent variable: correlations of supply shocks								
	5.1 pooled EU15 sample				**5.2 EU27 sample, 2001q1-2005q4**			
Explanatory variables	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**
TRADE1	2.247**	2.543**			2.428**	3.237**		
	(0.955)	(1.074)			(1.189)	(1.364)		
TRADE2			4.169**	5.024**			4.008*	5.329**
			(1.819)	(2.024)			(2.130)	(2.460)
INTRA	0.238***	0.262***	0.235***	0.253***	0.226***	0.256***	0.234***	0.267***
	(0.084)	(0.097)	(0.088)	(0.096)	(0.081)	(0.100)	(0.081)	(0.101)
EURO	-0.167***		-0.156***					
	(0.051)		(0.052)					
BUDGET		-0.143**		-0.140***		-0.109*		-0.106*
		(0.071)		(0.070)		(0.059)		(0.059)
RATES		-0.021*		-0.019*		-0.005		-0.005
		(0.011)		(0.011)		(0.003)		(0.005)
No. of observations[a,b]	72	69[d]	72	69[d]	75	69[c,d]	75	69[c,d]
R-squared (adj)	0.227	0.233	0.227	0.240	0.089	0.120	0.085	0.114

***Notes**: :* OLS estimation; ***, ** and * indicate significance at 1%, 5% and 10% level respectively (White-heteroskedasticity-robust standard errors in parenthesis); [a]Ireland, Malta, Lithuania and Romania only for 2001q1-2005q4 and Denmark excluded; [b]trade data for Luxemburg not available for the first sub-sample period; [c]Slovakia excluded (frequent revisions in budget-deficit series); [d]comparable interest-rate data for Luxemburg not available

APPENDIX

Figure A.1 Accumulated Response of Inflation to Structural One Standard-Deviation Innovations

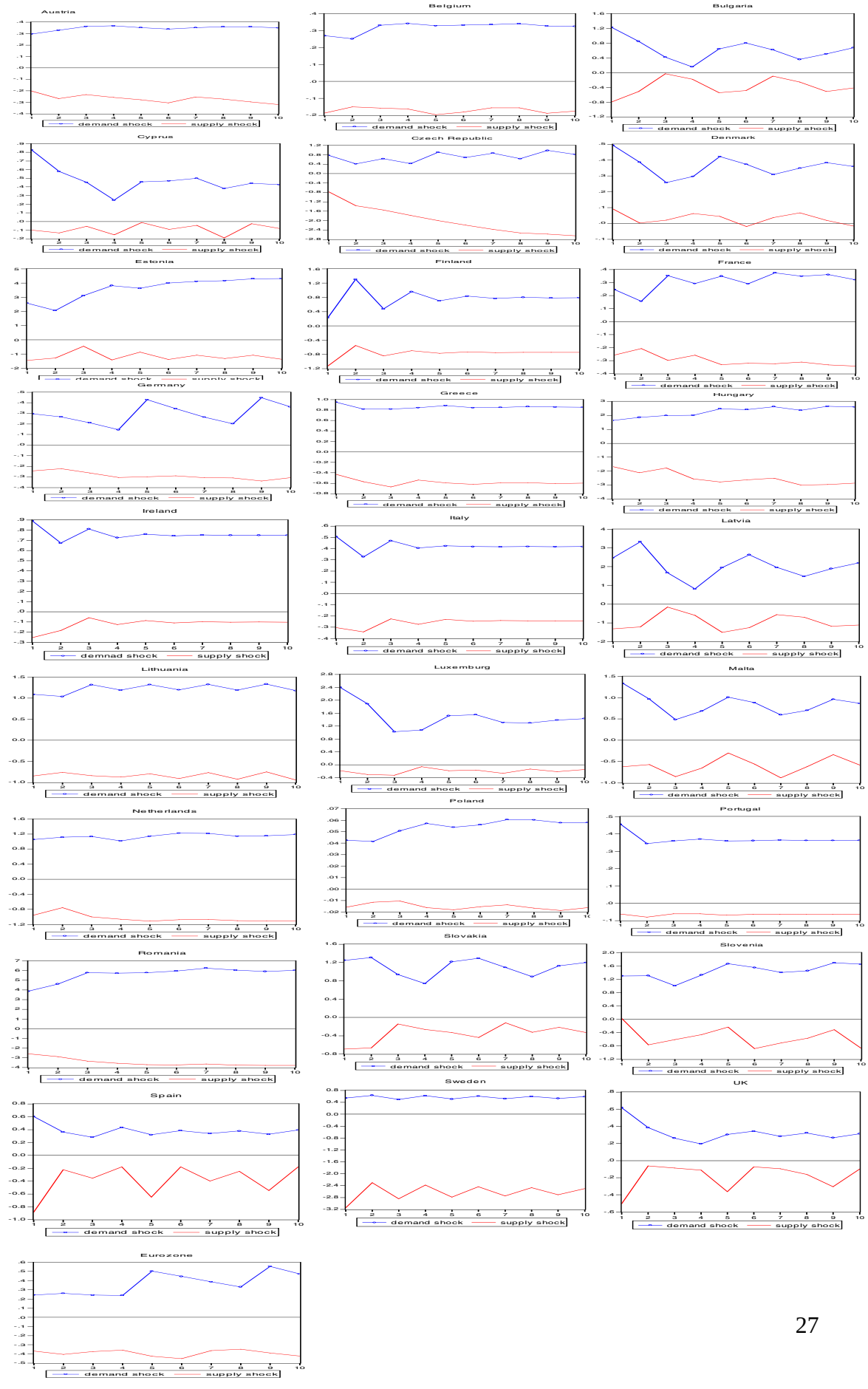

TABLE A.1 Structural shocks, summary statistics

	demand shocks[a]			supply shocks[a]		
Country	*min*	*max*	*Jarque-Bera*[b]	*min*	*max*	*Jarque-Bera*[b]
AU	-2.424	1.379	1.296	-2.592	*min*	1.864
			(0.523)			(0.394)
BE	-1.901	1.546	0.0002	-1.884	-2.592	0.918
			(0.998)			(0.632)
BU	-1.855	1.704	0.667	-2.202	-1.884	2.498
			(0.717)			(0.287)
CY	-1.647	2.260	0.850	-2.549	-2.202	1.057
			(0.654)			(0.589)
CZ	-1.760	1.922	1.149	-2.248	-2.549	0.537
			(0.563)			(0.764)
EST	-1.456	1.476	0.634	-1.826	-2.248	0.054
			(0.728)			(0.974)
FIN	-2.069	1.858	1.728	-2.071	-1.826	1.182
			(0.422)			(0.554)
FR	-1.977	2.532	1.741	-2.035	-2.071	0.461
			(0.419)			(0.794)
GER	-1.469	2.525	2.353	-1.723	-2.035	1.197
			(0.308)			(0.550)
GR	-2.528	1.694	3.652	-1.943	-1.723	0.439
			(0.161)			(0.803)
HU	-2.263	1.883	0.681	-2.884	-1.943	4.028
			(0.711)			(0.133)
IR	-1.307	2.047	1.305	-2.468	-2.884	2.531
			(0.521)			(0.282)
IT	-1.632	1.156	0.308	-1.897	-2.468	0.0155
			(0.857)			(0.992)
LAT	-1.609	1.734	1.428	-1.520	-1.897	0.843
			(0.490)			(0.656)
LITH	-2.116	1.465	0.858	-2.430	-1.520	0.392
			(0.651)			(0.822)
LU	-1.769	1.702	1.545	-1.658	-2.430	1.218
			(0.462)			(0.544)
MA	-2.075	1.465	0.973	-1.638	-1.658	0.640
			(0.615)			(0.727)
NETH	-1.610	3.959	58.185	-3.712	-1.638	44.539
			(0.000)			(0.000)
POL	-1.364	2.720	46.481	-1.504	-1.547	2.601
			(0.000)			(0.272)
POR	-2.393	2.180	1.518	-2.377	-2.066	2.604
			(0.468)			(0.272)
ROM	-1.385	2.796	12.031	-1.889	-2.377	0.219
			(0.002)			(0.896)
SLOV	-1.505	1.931	1.564	-1.594	-1.889	3.476
			(0.457)			(0.176)
SK	-2.130	1.453	1.114	-2.123	-1.594	1.534
			(0.573)			(0.464)
SP	-1.640	2.293	1.134	-1.454	-2.123	3.209
			(0.567)			(0.201)
SWE	-2.691	1.315	8.644	-1.682	-1.454	3.979
			(0.013)			(0.137)
UK	-1.881	1.637	0.636	-1.760	-1.682	0.674
			(0.728)			(0.714)
eurozone	-2.704	1.740	3.843	-1.644	-1.760	0.694
			(0.146)			(0.707)
					-1.644	

Notes: [a]Denmark not reported; [b]*p-values in parenthesis*

TABLE A.2 Summary statistics, pooled EU27 sample

	demand-shock correlations (a)	*Supply-shock correlations (b)*	*TRADE1 (c)*	*TRADE2 (d)*	*INTRA (e)*	*BUDGET (f)*	*RATES (g)*	*DINCD (h)*
pooled EU27 sample[a,b]								
mean	0.0430	0.1193	0.0209	0.0109	0.5481	0.3749	3.2111	0.4605
min	-0.5116	-0.4216	0.0001	0.0001	0.0803	-0.9863	0.0000	0.0091
max	0.6768	0.6979	0.1346	0.0717	0.8590	0.9903	24.320	1.4574
Standard deviation	0.2485	0.2738	0.0268	0.0142	0.2018	0.6278	5.0680	0.4245
Observations	135	135	135	135	135	129[c]	129[d]	135

Notes: [a]Ireland, Malta, Lithuania and Romania only in the second sub-sample period and Denmark excluded; [b]trade data for Luxemburg not available for the first sub-sample period; [c]Slovakia excluded (frequent revisions in budget-deficit series); [d]comparable interest-rate data for Luxemburg not available

TABLE A.3 Summary statistics, pooled EU15 sample

	demand-shock correlations (a)	*supply-shock correlations (b)*	*TRADE1 (c)*	*TRADE2 (d)*	*INTRA (e)*	*BUDGET (f)*	*RATES (g)*	*DINCD (h)*
pooled EU15 sample[a,b]								
mean	0.1189	0.1374	0.0355	0.0185	0.6217	0.7101	0.9536	0.1546
min	-0.4470	-0.4084	0.0038	0.0017	0.2467	-0.5488	0.0000	0.0090
max	0.6767	0.6840	0.1346	0.0717	0.8590	0.9902	8.8000	0.7533
Standard deviation	0.2605	0.2748	0.0294	0.0157	0.1593	0.3735	1.7511	0.1798
Observations	72	72	72	72	72	72	69[c]	72

Notes: [a]Ireland only in the second sub-sample period and Denmark excluded; [b]trade data for Luxemburg not available for the first sub-sample period; [c] comparable interest-rate data for Luxemburg not available

TABLE A.4 Summary statistics, all EU27 2001q1-2005q4

	demand-shock correlations (a)	*supply-shock correlations (b)*	*TRADE1 (c)*	*TRADE2 (d)*	*INTRA (e)*	*BUDGET (f)*	*RATES (g)*	*DINCD (h)*
All EU27[a] **2000q1-2005q4**								
mean	0.0012	0.1718	0.0193	0.0107	0.5450	0.2502	2.3075	0.4586
min	-0.5116	-0.4215	0.0002	0.0001	0.0809	-0.9570	0.0000	0.0114
max	0.6310	0.6979	0.1277	0.0717	0.8449	0.9801	24.320	1.3444
Standard deviation	0.2310	0.2862	0.0253	0.0143	0.1939	0.6443	5.0319	0.4039
Observations	75	75	75	75	75	72[b]	72[c]	75

Notes: [a] Denmark excluded; [b]Slovakia excluded (frequent revisions in budget-deficit series); [c] comparable interest-rate data for Luxemburg not available

TABLE A.5 Time Coverage for GDP series and trade data

Country	*Real GDP quarterly, (1995 prices) and GDP- deflator quarterly (1995=100)*	*total trade quarterly, millions of euro*	*nominal GDP quarterly, millions of euro*	*bilateral trade quarterly, millions of euro*	*Intra-industry trade quarterly millions of euro, SITC-2*
AU	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4
BE	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4
BU	1998q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1999q1-2005q4
CY	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1999q1-2005q4
CZ	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1999q1-2005q4
DEN	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4
EST	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1999q1-2005q4
FIN	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4
FR	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4
GER	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4
GR	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4
HU	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1999q1-2005q4
IR	1999q1-2005q4	1995q1-2005q4	1999q1-2005q4	1995q1-2005q4	1995q1-2005q4
IT	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4
LAT	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1999q1-2005q4
LITH	1999q1-2005q4	1995q1-2005q4	1999q1-2005q4	1995q1-2005q4	1999q1-2005q4
MA	1999q1-2005q4	1995q1-2005q4	1999q1-2005q4	1995q1-2005q4	1999q1-2005q4
LU	1995q1-2005q4	1999q1-2005q4	1995q1-2005q4	1999q1-2005q4	1999q1-2005q4
NETH	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4
POL	1996q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1999q1-2005q4
POR	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4
ROM	1999q1-2005q4	1995q1-2005q4	1999q1-2005q4	1995q1-2005q4	1999q1-2005q4
SLOV	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1999q1-2005q4
SK	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1999q1-2005q4
SP	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4
SWE	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4
UK	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4
eurozone	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4	1995q1-2005q4
Data source	EUROSTAT, *National Accounts*	EUROSTAT, *Comext and External Trade 2008*	EUROSTAT, *National Accounts*	EUROSTAT, *Comext and External Trade 2008*	EUROSTAT, *Comext and External Trade 2008*

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